



Design Partners in  
Architecture and Interiors

# **CITY OF MISSISSAUGA FIRE STATION 123**

3050 The Collegeway, Mississauga

Project Number: 12301  
Specifications Issued for: Tender

## **CONSTRUCTION DOCUMENTS PROJECT MANUAL**

Volume 1

Architectural and Structural

**ISSUED FOR TENDER**

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**Design Partners in Architecture and Interiors**

25 Main Street West Suite 1800  
Hamilton, Ontario L8P 1H1

## **1 Document Responsibility**

- 1.1. *Refer to Project Manual, Section 00 01 10 - Table of Contents, for indication of document responsibility (DR). Abbreviations for entity responsible for document preparation are as follows:*
  - 1.1.1. A - Denotes documents prepared by Architect.
  - 1.1.2. C - Denotes documents prepared by Civil Engineer (Site Servicing).
  - 1.1.3. E - Denotes documents prepared by Electrical Engineer.
  - 1.1.4. M - Denotes documents prepared by Mechanical Engineer.
  - 1.1.5. S - Denotes documents prepared by Structural Engineer.
  - 1.1.6. L - Denotes documents prepared by Landscape Architect
  - 1.1.7. Cx - Denotes documents prepared by Commissioning Agent
- 1.2. *Professional seals if applied next to company names in the project directory (below) govern only those specification sections and schedules identified by the corresponding document responsibility (DR) abbreviation in Section 00 01 10.*
- 1.3. *With regard to Section 00 30 00: The architect's seal governs only Section 00 30 00 proper, and not the documents listed therein.*

## **2 OWNER**

- 2.1. *Owner:*
  - 2.1.1. City of Mississauga
  - 2.1.2. 300 City Centre Drive
  - 2.1.3. Mississauga, ON L5B 3C1
- 2.2. *Primary Contact:*
  - 2.2.1. Title: Project Manager, Capital Design and Construction
  - 2.2.2. Name: Alexis Schneider
  - 2.2.3. Phone: T 905-615-3200 ext. 8246

## **3 CONSULTANTS**

- 3.1. *Architect: Design Professional of Record.*
  - 3.1.1. DPAI Architecture Inc.
  - 3.1.2. 25 Main St W Suite 1800
  - 3.1.3. Hamilton, ON L8P 1H1
  - 3.1.4. Tel: (905) 522-0220
- 3.2. *Primary Contact: All correspondence from the Contractor to the Architect will be through this party.*
  - 3.2.1. Name: Sebastian Lubczynski
  - 3.2.2. Title: Senior Architect
  - 3.2.3. Email: sebastian@dpai.ca
- 3.3. *Structural Engineering Consultant (S):*
  - 3.3.1. LEA Consulting Ltd.
  - 3.3.2. 40 University Avenue, Suite 503
  - 3.3.3. Toronto, Ontario
  - 3.3.4. 416 575 1787
- 3.4. *Mechanical Engineering Consultant (M):*
  - 3.4.1. QUASAR Consulting Group
  - 3.4.2. 250 Rowntree Dairy Road
  - 3.4.3. Woodbridge, Ontario

3.5. ***Electrical Engineering Consultant (E):***

- 3.5.1. QUASAR Consulting Group
- 3.5.2. 250 Rowntree Dairy Road
- 3.5.3. Woodbridge, Ontario

3.6. ***Civil Engineering Consultant (C)***

- 3.6.1. LEA Consulting Ltd.
- 3.6.2. 40 University Avenue, Suite 503
- 3.6.3. Toronto, Ontario
- 3.6.4. 416 575 1787

3.7. ***Landscape Architect (L)***

- 3.7.1. Adesso Design Inc.
- 3.7.2. 69 John Street, Suite 250
- 3.7.3. Hamilton, Ontario
- 3.7.4. 519-616-7076

3.8. ***Commissioning Agent (Cx)***

- 3.8.1. Pradus Group Inc.
- 3.8.2. 213 Sterling Road, Unit 108
- 3.8.3. Toronto, Ontario
- 3.8.4. 416-947-6918

**END OF SECTION**

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**REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR FULL SCOPE OF REQUIREMENTS.**

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**REFER TO CIVIL AND LANDSCAPE DRAWINGS FOR FULL SCOPE OF REQUIREMENTS.**

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**REFER TO CIVIL DRAWINGS FOR FULL SCOPE OF REQUIREMENTS.**

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**END OF SECTION**



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- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

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A08.04	KITCHEN MILLWORK PLANS, ELEVATIONS, & DETAILS
A08.05	MILLWORK PLANS, ELEVATIONS, & DETAILS
A08.06	OFFICE MILLWORK PLANS, ELEVATIONS, & DETAILS
A08.07	MILLWORK DETAILS - GENERAL NOTES, COUNTER TOPS, TYPICAL DETAILS
A08.08	MILLWORK DETAILS
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S-102	TYPICAL DETAILS
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S-104	TYPICAL DETAILS
S-105	TYPICAL DETAILS
S-106	TYPICAL DETAILS
S-107	PROJECT DETAILS
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S-201	FOUNDATION & LEVEL 1 PLAN
S-202	LOW ROOF PLAN
S-203	CLERESTORY ROOF PLAN
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S-300	COLUMN SCHEDULE
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S-400	ELEVATIONS
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S-510	ROOF SECTIONS
S-511	ROOF SECTIONS

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M-101	MECHANICAL SITE PLAN
M-200	FOUNDATION PLAN - PLUMBING AND DRAINAGE
M-201	LEVEL 01 PLAN - PLUMBING AND DRAINAGE
M-202	ROOF PLAN - PLUMBING AND DRAINAGE
M-301	LEVEL 01 PLAN - VENTILATION
M-302	ROOF PLAN - VENTILATION
M-401	LEVEL 01 PLAN - FIRE PROTECTION
M-610	MECHANICAL EQUIPMENT SCHEDULE
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M-642	MECHANICAL DETAILS II
M-643	MECHANICAL DETAILS III
M-644	MECHANICAL DETAILS IV
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M-650	CONTROL SEQUENCES I
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## **ELECTRICAL**

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**CIVIL**

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C-03 CROSS SECTIONS  
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C-05 GENERAL NOTES AND STANDARD DETAILS

**LANDSCAPE**

L100 TREE PROTECTION PLAN  
L101 TREE PROTECTION CHART  
L200 LANDSCAPE PLAN  
L201 DETAILS

## **1 GENERAL**

### **1.1. General requirements**

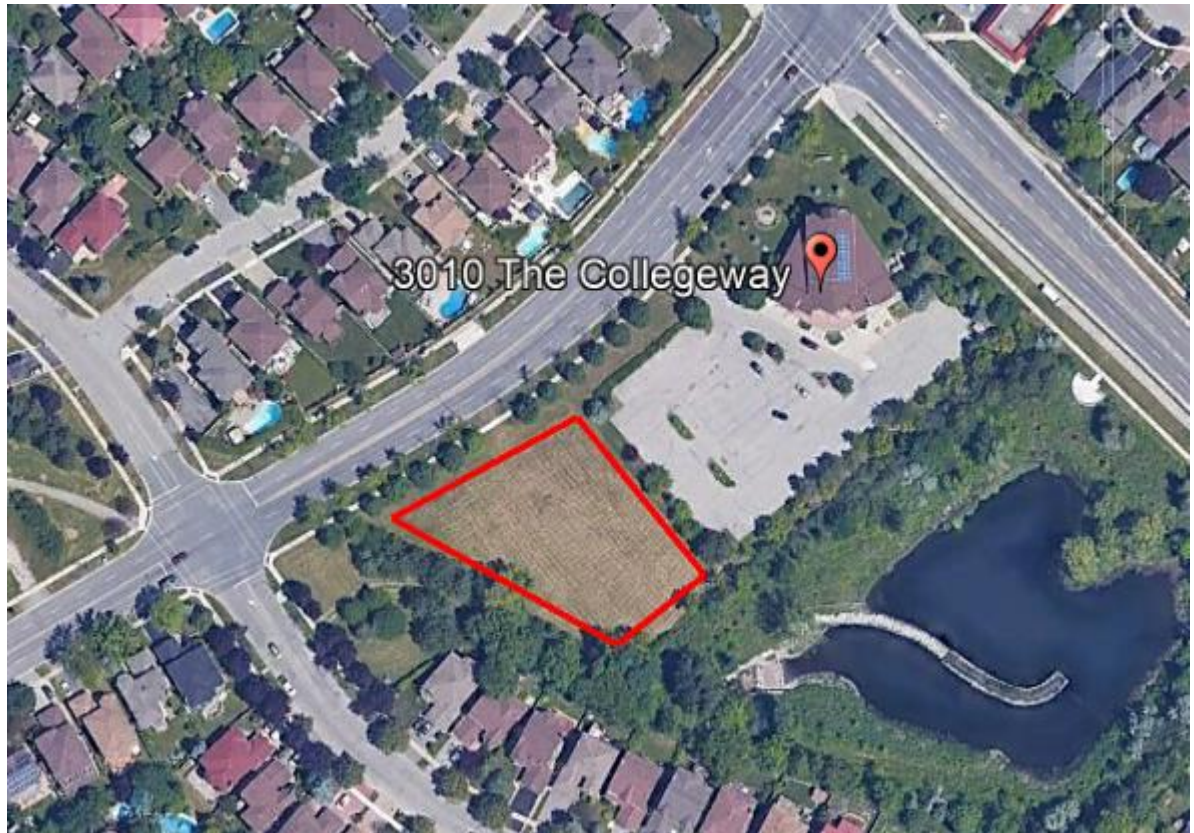
- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. INFORMATION AVAILABLE FOR REVIEW**

- 1.2.1. Be advised the neither the Owner nor the Consultant guarantees the accuracy or completeness of any data contained therein. Bidders must satisfy themselves with regard to all matters relating to conditions that may affect either the methods of construction or the cost of the Work before submitting bids or commencing the Work.
- 1.2.2. The Architect's seal, if applied to the Project Manual, governs only Section 00 30 00 proper, and not the documents listed herein.
- 1.2.3. The following documents have been made available by the Owner for review:
- 1.2.3.1. Geotechnical report:  
(1) "Geotechnical Investigation for the Proposed City of Mississauga Fire Station 123", as prepared by G2S Consulting Inc, dated January 2024.
- 1.2.3.2. Hydrogeological Site Assessment  
(1) "Hydrogeological Site Assessment City of Mississauga Fire Station 123 Vacant Lot West of 3010 The Collegeway Mississauga, Ontario", as prepared by G2S Consulting Inc., dated January 29, 2024
- 1.2.3.3. Soil Characterization Report (SCR)  
(1) "Soil Characterization Report (SCR) City of Mississauga Fire Station 123 3050 The Collegeway Mississauga, Ontario", as prepared by G2S Consulting Inc., dated September 21, 2023
- 1.2.3.4. Environmental *Site* Assessment reports:  
(1) "Phase One Environmental Site Assessment, The Collegeway & Loyalist Drive, Mississauga, Ontario, L5L 4X9, as prepared by Patriot Engineering, dated February 19, 2021
- 1.2.4. *Contractor* must confirm receipt of these documents prior to commencement of construction.

**END OF SECTION**

## Geotechnical Investigation for The Proposed City of Mississauga Fire Station 123



Vacant Lot West of 3010 The Collegeway, Mississauga, ON  
G2S23256A-R1

City of Mississauga  
300 City Centre Drive  
Mississauga, ON L5B 3C1  
c/o Sebastian Lubczynski, DPAI Architecture Inc.

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Grain Size Analysis Graphs & Plasticity Chart

Appendix C: Shear-Wave Velocity Sounding Report

## **1. Introduction**

G2S Consulting Inc. (G2S) was retained by the City of Mississauga (the City) to complete a Geotechnical Investigation for the vacant land parcel located west of 3010 The Collegeway, Mississauga, Ontario, the proposed location of City of Mississauga Fire Station 123, hereinafter referred to as the 'Site'.

The Site is located on the south side of The Collegeway, approximately 110 m west of the intersection of Winston Churchill Boulevard and The Collegeway and covers an approximate plan area of 3,960 m<sup>2</sup> with approximately 65 m of frontage onto The Collegeway.

It is understood that the proposed development will include the construction of a slab on grade, single storey Fire Station building with a fire crew area and an apparatus bay.

The general location of the Site is shown on the Site Key Plan included on Drawing 1 in Appendix A. This Geotechnical Investigation was carried out as outlined in G2S' Proposal No. G2S23256, dated July 07, 2023.



## **2. Site and Project Overview**

### **2.1 Site Description**

The Site is an irregularly shaped property located west of 3010 The Collegeway, comprising an approximate plan area of 3,960 m<sup>2</sup>, and is located on the south side of The Collegeway, approximately 110 m southwest of the intersection of Winston Churchill Boulevard and The Collegeway. The Site is also surrounded by residential and commercial buildings from the east and southwest, water bound from the southeast followed by residential buildings, and the Collegeway from the north side. At the time of the investigation the Site was vacant with ground surface generally covered with small vegetation and mature surrounding the Site area along all property lines.

### **2.2 Proposed Development**

It is understood that consideration is being given to constructing a slab on grade, single storey fire station building with a fire crew area and apparatus bay.

The purpose of this geotechnical investigation was to determine the subsurface conditions at twelve (12) borehole locations and to interpret these findings with respect to the design and construction of the underground services, foundations, and related earthworks for this project from a geotechnical point-of-view.

This report is based on the above summarized project description, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, then this office must be consulted to review the new design with respect to the results of this investigation. The information contained in this report does not reflect upon the environmental aspects of the Site and therefore it has not been addressed in this document.

### **3. Investigation Methodology**

A total of twelve sampled boreholes were advanced at the locations illustrated in the attached Drawing 1, Borehole and Monitoring Well Location Plan, in Appendix A. The borings were put down uncased using solid stem continuous flight auger equipment. The drilling and sampling operations were carried out under the direction and supervision of a G2S staff member. The boreholes were advanced to depths of between approximately 1.7 to 8.2 metres below the existing grade (mbeg). Upon completion of drilling, the boreholes were backfilled in general accordance with Ontario Regulation 903.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split spoon sampling equipment driven in accordance with the requirements of Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the soil laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on the soil samples recovered from the borings.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Borehole (BH) Logs BH101 to BH112, inclusive, included in Appendix B. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact plans of geological change.

Elevations at the ground surface of the borehole locations were Interpolated from the provided topographic survey plan titled "Survey with Topography of Part of Block 124 Registered Plan 43M-745, City of Mississauga, Regional Municipality of Peel, dated April 26, 2023, by Tarasick McMillan Kubicki Limited. Provided to G2S by the Client on January 24, 2024. This topographic survey plan was later utilized to produce the Borehole and Monitoring Well Location Plan.

## **4. Subsurface Conditions**

The subsurface soil conditions have been evaluated in the twelve boreholes investigated by G2S at the Site for the purpose of this report. It should be considered that the subsurface conditions may not be consistent between and beyond the locations investigated at the Site. The soil descriptions outlined in the following stratigraphic summary are based on our interpretation of non-continuous samples of soil obtained from the boreholes.

The subsurface conditions encountered at the borehole locations are summarized as follows:

### **4.1 Topsoil**

A surficial veneer of topsoil and organic material with thicknesses ranging between approximately 25 to 300 millimetres was encountered in all of the investigated boreholes.

It should be noted that the depth of topsoil must be expected to vary across the Site, particularly in the area of mature trees, from the depths encountered at the borehole locations. If required, a more detailed analysis such as test pits can be carried out to accurately quantify the amount of topsoil to be removed for construction purposes. In this report the term “topsoil” has been used from a geotechnical point of view and does not necessarily reflect the suitability of the material to support plant growth. If it is to be used for landscaping or agricultural purposes, its suitability should be confirmed by tests on representative samples for organic and nutrient content and therefore its ability to support plant growth.

### **4.2 Fill**

Fill material was encountered below the topsoil in all of the investigated boreholes. The fill consisted generally of clayey silt/silty clay or sandy silt/silty sand. Organic material was indicated within the fill layer at the locations of BH106 to BH108 and BH111. The fill material extended to depths ranging between 0.8 and 3.0 metres below the existing grade (mbeg). The moisture content for the fill ranged between 11% and 20%, indicating moist conditions.

### **4.3 Clayey Silt**

Clayey silt/silty clay was encountered beneath the fill in BH106 and BH107, this deposit extended to a depth of termination at approximately 2.1 mbeg. The clayey silt was found to contain a trace of gravel and had a reworked appearance at the top portion. With “N” values ranging from 19 to 27 blows per 300 millimetres of penetration indicating the clayey silt deposit was classified as very stiff in consistency. The moisture content for the clayey silt ranged between 10% and 12%, indicating moist conditions.

### **4.4 Clayey Silt/Silty Clay Till**

Clayey silt/silty clay till was encountered beneath the fill in the boreholes BH101 to BH103, BH105, BH108, BH109, BH111, and BH112 and extended to depths ranging between approximately 1.7 and 8.2 mbeg. Borehole BH103, BH111, and BH112 were terminated at this deposit.

The clayey silt/silty clay till was found to contain trace to some sand, trace to some gravel, and had reworked appearance at the top portion. With “N” values ranging from 16 to in excess of 100 blows per 300 millimetres of penetration, the clayey silt/silty clay till deposit was classified as very stiff to hard in consistency.

The moisture content for the clayey silt/silty clay till ranged between 7% and 25%, indicating moist conditions. Based on two grain size analyses, the clayey silt/silty clay till contained between 8% to 13% sand, 46% to 60% silt, and 27% to 46% clay sized particles. Based on the laboratory results for two (2) selected samples of this deposit, the liquid limit ranged between 28% and 35%, and the plastic limit was ranging between 17% and 20%, indicating low to moderate plasticity. Results of the grain size analyses, and the Atterberg Limits are included in Appendix B.

#### 4.5 Silty Sand/Sandy Silt Till

Silty sand/Sandy silt till material was encountered beneath the clayey silt/silty clay till in BH101, BH102, BH105, BH108, and BH109, and beneath the fill in BH104 and BH110, and extended to depths ranging from 2.1 and 8.2 mbeg. BH101, BH102, BH104, BH105, BH108 to BH110 were terminated in this deposit.

The SPT “N” values of this silty sand/sandy silt till deposit was ranging between 34 to in excess of 100 blows per 300 millimetres of penetration, indicating dense to very dense compactness. The moisture content for the silty sand/sandy silt till ranged between 6% and 24%, indicating moist to wet conditions. Based on the grain size analysis for seven (7) representative samples, the silty sand/sandy silt till contained 0% to 13% gravel, 34% to 65% sand, 31% to 50% silt, and 3% to 13% clay sized particles. Results of the grain size analyses are included in Appendix B.

#### 4.6 Groundwater Observations

Groundwater level observations in the open boreholes were recorded during the drilling operation. All boreholes were open upon and dry upon the completion of the drilling operation, with the exception of BH101, where wet cave was noted at 7.3 mbeg. Further, groundwater monitoring wells were installed in boreholes BH103, BH104, and BH109. Results of our groundwater monitoring to date are presented below:

**Table 1: Groundwater Observations**

BH/MW ID	Well Depth (m)	September 1, 2023		September 18, 2023		October 26, 2023	
		Depth (m)	Elevation (m)	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
BH/MW 103	7.6	3.6	167.2	4.0	166.7	5.6	165.1
BH/MW 104	7.6	6.9	163.5	7.0	163.4	7.1	163.3
BH/MW 109	7.6	7.2	163.6	7.3	163.4	7.4	163.3

It is noted that the static groundwater level fluctuates based on seasonal conditions experienced during the wet and dry periods of the year. Therefore, we would recommend that additional monitoring of these wells be conducted prior to construction. Refer to Appendix B for the list of abbreviations and borehole logs.

## 5. Geotechnical Considerations

### 5.1 Site Preparation

At the time of the investigation the grading plan for the Site was not yet available to G2S; however, based on the present ground surface at the Site, and the anticipated Site grading, engineered fill may be utilized. Prior to any earthwork, it will be necessary to remove some or most of the vegetation and topsoil from the Site. All topsoil and any near-surficial soil containing high amounts of topsoil and/or organic material should be removed in areas that are to be developed.

Any engineered fill must be placed and uniformly compacted in maximum lift thicknesses of 300 mm for earth fill and 200 mm for commercially sourced granular material. Each lift of the engineered fill must be uniformly compacted to at least 100 percent of Standard Proctor Maximum Dry Density (SPMDD). The placement water content of the engineered fill material is recommended to be maintained within  $\pm 2$  percent of the laboratory optimum water content in order to achieve an acceptable degree of compaction.

The limits of any engineered fill placed during this operation can best be determined by the geotechnical engineer at the time of construction. If engineered fill is used to support foundations or pavements, it must extend laterally at sufficient distance to develop adequate lateral resistance.

All aspects of engineered fill construction including final excavation, material selection, placement and compaction must be tested by the geotechnical engineer at the time of placement and compaction. *In-situ* density (compaction) testing is required during construction for any and all engineered fill placement.

### 5.2 Foundation Recommendations

#### 5.2.1 Methodology

The shallow foundations are to be designed applying the Limit State Design (LSD) methodology described in Chapter 8 of CFEM (2006). Both Ultimate Limit State (ULS) and Serviceability Limit State (SLS) were considered.

For design purposes to address the ULS, the ultimate (unfactored) bearing capacity of the foundation soil ( $R_n$ ) was calculated. The allowable (factored) bearing capacity ( $\Phi R_n$ ) was computed by multiplying  $R_n$  with a reduction factor  $\Phi=0.5$ , in accordance with NBCC (2015) and CFEM (2006).

The foundation designer needs to ensure that the factored bearing capacity is greater than the factored applied pressure at foundation level ( $\alpha_i S_{ni}$ ). Hence, the following formula applies:

$$\Phi R_n \geq \sum \alpha_i S_{ni}$$

If the foundation is subjected to vertical forces that act eccentric to the centroid of the foundation, the size of the foundation used in the bearing capacity equation is reduced to the following:

$$B' \times L' = (B - 2e_B) \times (L - 2e_L)$$

where:

B, L: actual foundation dimensions

$B'$ ,  $L'$ : reduced dimensions to be used in the bearing capacity equation

$e_B$ ,  $e_L$ : eccentricities due to applied forces (loading) from the centroid in dimensions B and L respectively

Foundations subject to moments  $M_B$  and  $M_L$  in the B and L directions and vertical load V acting through the centroid are equivalent to a loading system with V acting at eccentricities  $e_B=M_B/V$  and  $e_L=M_L/V$ .

CFEM (2006) emphasizes that this equation is an approximate but reasonable approach provided that the eccentricity acts within the middle third of the foundation, i.e., eccentricity,  $e < B/6$ . In addition, in case of inclined loading, appropriate factors need to be considered in accordance with CFEM (2006).

The serviceability limit state (SLS) bearing pressure is considered by calculating the settlements due to foundation load (immediate, consolidation and total). It is expected that the structural team will compare the settlements due to foundation and fill loads against allowable foundation settlement values.

It is noted that the overall settlement and/or heave experienced by the foundations may depend on other factors such as the quality of subgrade preparation and weather conditions at the time of construction, ground freeze and thaw, dynamic loading, among other factors.

### 5.2.2 Strip and Spread Footing

The proposed structure can be supported on conventional spread and strip footings with the maximum width of 2.0 x 2.0 m and 2.0 m, respectively. The footings to be founded on the native clayey silt/silty clay till or silty sand/sandy silt till material, utilizing a design bearing resistance of 250 kPa at SLS and 500 kPa at ULS. The geotechnical resistance of a sustained load at Serviceability Limit State (SLS) should be within the normally tolerated limits of 25 millimetres of settlement. Prior to placement of foundation concrete, all existing fill, organics, and any other deleterious material must be removed down to the undisturbed native soils. The exposed footing base is to be inspected by G2S. The available bearing resistance and the relevant approximate founding elevations are presented in Table 2 below:

**Table 2: Bearing Resistance for Conventional Spread/Strip Footing**

Borehole ID	Material	Bearing Resistance (kPa)	Recommended Founding Depth (m)	Approximate Founding Elevation (m)
BH101	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	1.5	169.1
BH102	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	3.2	167.9
BH103	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	3.2	167.6
BH104	Silty Sand/Sandy Silt Till	250 SLS/500 ULS	1.9	168.5
BH105	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	2.5	168.5

Borehole ID	Material	Bearing Resistance (kPa)	Recommended Founding Depth (m)	Approximate Founding Elevation (m)
BH108	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	1.5	169.1
BH109	Clayey Silt/Silty Clay Till	250 SLS/500 ULS	1.7	169.0

Alternatively, the proposed structure can be supported on engineered fill, to be constructed as detailed in Section 5.1 of this report utilizing a design bearing resistance of 150 kPa at (SLS) and 225 kPa at (ULS).

This office should be contacted to review the field data further and provide relevant recommendations.

### 5.3 Foundation Construction

The footing beds in the clayey silt/silty clay till will be prone to disturbance from construction, foot traffic and precipitation. It would be prudent to consider the placement of a 50-millimetre concrete 'mud' slab over the footing bases once evaluated. This will protect the footing beds from disturbance and provide a clean working surface for the placement of formwork and reinforcing steel.

In areas where it will be necessary to provide adjacent footings at different founding elevations, the lower footing should be constructed before the higher footing, if possible. To limit stress transfer from higher footings to lower footings, the higher footing should be set below a line drawn up from the edge of the lower footing at 10 horizontal to 7 vertical. The footings to be constructed adjacent to existing structures should 'match' the level of the existing foundations.

All footings exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings and foundations should be designed and constructed in accordance with the current Ontario Building Code. We would recommend the placement of a 50 mm thick high-density sheet of Styrofoam insulation against the exterior of the foundation walls, followed by the placement of a 10-mil sheet of 'double' polyethylene ('fold' placed at 'top') to prevent frost heaving/adfreezing action.

With foundations designed as outlined above and as required by the current Ontario Building Code, and with careful attention paid to construction detail, total and differential settlements should be well within normally tolerated limits of 25 and 20 mm, respectively. However, as is typical in most institutional construction, 'cosmetic' cracking of plasterboard, foundation walls, etc., may occur within the first year of construction due to shrinkage, minor settlement, etc. Subsequent to repair, additional cracking should be minimal.



It is imperative that a soil engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with this report's design concepts and recommendations and to allow changes to be made if subsurface conditions differ from the conditions identified at the borehole locations.

#### **5.4 Seismic Design Parameters**

Site-specific Multi-channel Analysis of Surface Waves (MASW) testing was carried out by Geophysics GPR International Inc. to evaluate the shear wave velocity sounding and to confirm or upgrade the site class.

Based on the average Vs30 values (as determined through the MASW method carried out by Geophysics GPR International Inc.) and Table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, the investigated area is site class "C" ( $360 < VS_{30} \leq 760$  m/s). The results of the shear wave velocity sounding tests are provided in Appendix C.

#### **5.5 Floor Slab Considerations**

The floor slab may be constructed using conventional slab-on-grade techniques on a prepared subgrade. The exposed subgrade surface should then be well compacted (proofrolled) in the presence of a representative of G2S. Any soft 'spots' delineated during this work must be sub-excavated and replaced with quality backfill material compacted to 100 percent of its Standard Proctor Maximum Dry Density (SPMDD). Imported granular fill is preferred due to its relative insensitivity to weather conditions, its relative ease in achieving the required degree of compaction, and quick response to applied stresses.

As with all concrete floor slabs, there is a tendency for the floor slabs to crack. The slab thickness, concrete mix design, amount of steel and/or fibre reinforcement and/or wire mesh placed into the concrete slab, if any, will therefore be a function of the owner's tolerance for cracks in, and movements of, the slabs-on-grade, etc. The 'saw-cuts' in the concrete floors, for crack control, should extend a minimum of 1/3 the thickness of the slab.

A moisture barrier will be required under the floor slabs, such as the placement of at least 200 mm of well-compacted 19 mm clear crushed stone. At a minimum, the moisture barrier material should contain no more than 10 percent passing the No. 4 sieve.

The curing of the slab-on-grade must be carefully specified to ensure that slab curl is minimized. This is especially critical during the hot summer months of the year when the surface of the slab tends to dry out quickly while high moisture conditions in the moisture barrier or water trapped on top of any 'poly' sheet at the saw cut joints and cracks, and at the edges of the slabs, maintains the underside of the slab in moist conditions.

It is also essential that excess free water is not added to the concrete during its placement as this could increase the potential for shrinkage cracking and curling of the slab. Based on the conditions encountered in the boreholes, backfill recommendations, and the floor slab considerations, a modulus of sub-grade reaction,  $k_{v1}$ , of 25 MPa/m (based on a loaded area of 300 mm x 300 mm) can be used for the design of the slab-on-grade floor slab.



## 5.6 Perimeter Drainage

We would recommend that the perimeter drainage system extend in all areas where the floor slab level is less than 0.3 metres above the final exterior grade. As a minimum, it is recommended that the perimeter weeping tile consist of a 150 mm diameter perforated pipe with a geofabric 'sock', surrounded with 200 mm of 20 mm clear stone, with the stone in turn encased by a heavy geotextile filter fabric. The suppliers of the geotextile filter fabric should be consulted as to the type best suited for this project. The perimeter drainage system should outlet to a gravity drainage connection, fitted with a suitable back-flow prevention valve.

This office should examine the installation of the perimeter drains. Even a small break in the filtering materials could result in loss of 'fines' into the drains with attendant performance difficulties, including settlements of the ground surface. The exterior grade around the structure should be sloped away from the structure to prevent the ponding of water against the foundation walls.

Additional well graded granular material should be placed and compacted in exterior sidewalk and accessibility ramp areas to reduce the effects of frost heaving. Alternatively, insulation could be placed in these areas, or a structural 'frost' slab should be constructed at the doorways.

## 5.7 Excavations and Groundwater Control

It is anticipated that the excavations for the proposed foundations, sewers and other underground services may extend to depths of up to 3.0 m below ground through the fill and into the very stiff to hard clayey silt/silty clay till or dense to very dense silty sand/sandy silt till. All excavations must comply with the current Occupations Health and Safety Act and Regulations for Construction Projects. For guidance, the fill material, the stiff clayey silt/silty clay till, and the loose silty sand/sandy silt till are classified as Type 3 soil. The very stiff to hard clayey silt/silty clay till, and the dense to very dense silty sand/sandy silt till above the groundwater table may be classified as Type 2 soil. All soils below the groundwater table can be classified as Type 4 soil. In accordance with the OHSA regulations, if the excavation contains more than one type of soil, the soil shall be classified as the type with the highest number. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior Geotechnical Engineer from this office should supervise the work. The till is a non-sorted sediment. Therefore, cobbles and boulder size materials, that may hinder the progress of the excavation, should be anticipated. In addition, the rate of excavation may be slowed when existing buried services and foundations and floor slabs of former structures are encountered by the contractor. In this regard it is recommended that a number of test excavations be conducted to allow tendering contractors to observe the groundwater conditions firsthand to assess how they will affect their operations.

Temporary shoring may be required along the side of the excavation adjacent to the existing structure. We would recommend an active earth pressure coefficient  $K_a = 0.33$  and using a unit weight of retained soil of  $22 \text{ kN/m}^3$ . The shoring system must be designed by a professional engineer experienced in shoring design and the shoring system constructed by an experienced contractor. Any surcharge loads must be incorporated into the shoring design. The structural member stiffness and stability is the responsibility of the shoring design engineer and the shoring contractor. We would recommend that a detailed condition survey for the nearby structures and roadways be conducted prior to the commencement of the excavation operation. In addition, the shoring system must be monitored for any vertical or horizontal movements during the course of construction.

The excavation must provide 'space' for the construction of the footings and foundation walls, with an allowance for access by workers. In the event that a shoring system is required for this project we would recommend that this office be retained to review the selected design and provide monitoring during installation.

Groundwater infiltration through the upper fill layer and the more permeable seams within the native soils should be anticipated during the excavation for the footing, engineered fill construction, and the underground utility installation. Any water that may seep into the excavations could be removed using conventional construction 'dewatering' techniques, such as pumping from sumps and ditches. It should be noted that a hydrogeological investigation should be completed for the Site to provide recommendations pertinent to the type and extent of the groundwater control for in-construction and post-construction dewatering needs.

The base of the excavations in the native clayey silt/silty clay till or silty sand/sandy silt till encountered in the boreholes should remain firm and stable. Therefore, standard pipe bedding, as typically specified by the City of Mississauga, should suffice. The bedding material should be uniformly compacted to at least 95 percent SPMDD, with special attention paid to compaction under the pipe haunches. Greater difficulty with base instability will likely occur in excavations below a depth of about 3.0 metres, as such there may be a need for the placement of a stabilizing ballast material or additional bedding material.

## **5.8 Backfill Considerations**

The majority of the excavated material will consist of the native clayey silt/silty clay till or silty sand/sandy silt till, which is considered to be suitable for use as service trench backfill and as engineered fill provided that the moisture content can be controlled to within 3 percent of the standard Proctor optimum value. Some moisture content conditioning of the excavated material may be required, depending upon the weather conditions experienced at the time of construction to achieve acceptable compaction densities and minimize long-term settlements. Dusting could be a problem in the 'dry' summer months.

We note that where backfill material is placed near or slightly above its optimum content, the potential for long-term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of 'wet' backfill material is also lowered, thereby reducing its ability to support construction traffic, and therefore impacting roadway construction. If the soil is well 'dry' of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. The soil may require high compaction energy to achieve acceptable densities if the moisture content is not close to their standard Proctor optimum value. It is therefore very important that the placement moisture content of the backfill soils be within 3 percent of its standard Proctor optimum moisture content during placement and compaction.

The backfilling and compaction operations should be monitored by a representative of G2S to monitor uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs', and around the foundation walls. Any engineered fill should be compacted to 100 percent SPMDD. A method should be developed to assess compaction efficiency employing the on-Site compaction equipment and backfill materials during construction.

## **5.9 Pavement Considerations**

### **5.9.1 Subgrade Preparation**

The pavement areas should be stripped of all topsoil, organic and other unsuitable materials. The exposed subgrade should be proofrolled with 3 to 4 passes of a loaded tandem truck with the presence of a representative of G2S immediately prior to the placement of the sub-base material. Any areas of distress revealed by this, or any other means, must be sub-excavated and replaced with suitable backfill material. Alternatively, the soft areas may be repaired by placing coarse aggregate, such as 50 mm clear crushed stone. The need for sub-excavations of a softened subgrade will be reduced if construction is undertaken during periods of dry weather and careful attention is paid to the compaction operations. The fill placed over shallow utilities that cut into or across the paved areas must also be compacted to 100 percent of its SPMDD.

Good drainage provisions will optimize the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and to prevent softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved area.

The most severe loading conditions on the subgrade typically occur during the course of construction, therefore, precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. These measures would include minimizing the amount of heavy traffic travelling over the subgrade, such as during the placement of granular base layers.

If construction is conducted under adverse weather conditions, additional subgrade preparation may be required. During wet weather conditions, such as typically experienced during the fall and spring months, additional subgrade preparation, such as the provision of an additional depth of Granular B sub-base coarse material would be required. It is also important that the sub-base and base coarse granular layers of the pavement structure be placed as soon after exposure and preparation of the subgrade level as practical.

### **5.9.2 Flexible Pavement Structure**

The suggested pavement structures, for the pavement areas, outlined in Table 3 below are based on subgrade parameters estimated on the basis of visual and tactile examinations of the on-Site soils and past experience. The outlined pavement structures may be expected to have an approximate ten-year life, assuming that regular maintenance is performed. Should a more detailed pavement structure design be required, Site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

**Table 3: Suggested Pavement Structure**

Layer Description	Compaction Requirements	Light Duty Sections	Heavy Duty (Truck route)
Asphaltic Concrete Wearing course OPSS HL 3 or HL 3A	Min 92.0 % *MRD	65 millimetres	40 millimetres
Binder Course OPSS HL 8	Min 92.0 % *MRD	--	65 millimetres
Base Course OPSS Granular A	100% **SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% **SPMDD	200 millimetres	350 millimetres

Notes: \* MRD denotes maximum relative density, MTO LS-264

\*\* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

Depending on the arrangement of light duty and heavy-duty pavement sections, the transition between sections may present some difficulty for contractors. In this regard, consideration might be given to a slightly increased light duty pavement structure consisting of 50 mm of HL8 binder course and 40 mm of HL3 surface course asphaltic concrete. This structure will provide for a continuous depth of surface course asphalt allowing for ease of construction.

As well, such a structure would have an improved performance over an increased design life. Such an arrangement of asphalt layers would also allow for future rehabilitation with a 'mill and pave' type operation.

### **5.9.3 Concrete Pavement Structure**

The suggested design is based on our estimate of the subgrade soil properties determined from visual and tactile examinations of the on-site soil samples, practical experience, as well as the traffic requirements. As such, the recommended concrete pavement structure should be considered for preliminary design purposes only. Should a more detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

**Table 4: Suggested Minimum Pavement Structure**

Layer Description	Compaction Requirements	Light Duty Sections	Heavy Duty Sections
Jointed Plain Concrete (JPC)	-	200 millimetres	200 millimetres
Base Course OPSS Granular "A" Crusher Run Limestone	100% **SPMDD	150 millimetres	200 millimetres

Note: \* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

#### **5.9.4 Concrete Pavement Construction Material**

The pavement construction materials are summarized as follows:

- Jointed Plain Concrete with a minimum 28-day strength of 32 MPa in compliance with the CAN/CSA A23.1 Class C-2, with a maximum water/cement ratio of 0.45
- Entrained air ranged between 5-8% for concrete with nominal aggregate size of 14-20 mm, and between 4-7% for concrete with nominal aggregate size of 28-40 mm. Acceptable range for concrete slump less than 80 mm should be within  $\pm 20$  mm, and for slump between 80 to 180 mm should be within  $\pm 30$  mm.
- Dowel bars, smooth, round steel bars placed across transverse joints to provide load transfer while permitting a joint to open and close. Dowels shall be in accordance with CSA G40.219 and OPSS 1441.
- Tie bars, epoxy coated deformed bars placed in longitudinal joints to prevent slabs from separating and shall be in accordance with OPSS 1442.
- Expansion joint filler shall be in accordance with OPSS 1308. Joint sealant material shall be in accordance with OPSS 369.

#### **5.9.5 Concrete Pavement Construction**

- The construction should be carried out as per the OPSS 350, OPSD 552.051, 552.010, 551.031 and 551.010.
- The concrete placement temperature should be between 10°C and 27°C (OPSS1350)
- Transverse joints should be reinforced with 32 mm (diameter) x 450 mm (length) bars, at 300 mm on centre. Dowel bars shall be coated with a de-bonding agent and inserted at mid-depth of the slab.
- Longitudinal joint should be reinforced with 15 mm (diameter) x 600 mm (length), bars, at 600 mm on centre.
- To prevent joint lock-up at transverse joints, tie-bars should not be placed within 600 mm of a transverse joint.

- Curing shall be according to OPSS 904. Curing shall be applied to all exposed surfaces as soon after the texturizing operation as can be achieved without damaging the surface.
- For fixed-form placements, where the formwork is removed in less than 96 hours, the side of the exposed concrete faces shall be sprayed with white pigmented curing compound at the specified rate of application.
- Curing compound shall not be applied to joint faces receiving sealant or to concrete surface to which concrete, or mortar is to be bonded.

#### ***5.9.6 Construction Review and Testing***

Site review should be carried out during construction to confirm that the conditions exposed are consistent with the conditions encountered during the borehole investigation. In-situ testing should be carried out to verify compliance with the relevant local and provincial specification, as well as the project contract documents.

## 6. General Comments

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are only intended to describe conditions at the borehole locations. Contractors placing bids for undertaking this project should carry out due diligence to verify the results of this investigation and to determine how the subsurface conditions will affect their operations. The action of stripping topsoil and unsuitable near-surficial soils as well as the selection and placement of engineered fill should be tested by the geotechnical engineer at the time of construction. *In-situ* density testing should be carried out on any engineered fill placed at the Site.

All foundations should be reviewed on-Site by the geotechnical engineer as they are constructed, as required by Section 4.2.2.2 of the Ontario Building Code (2012). If G2S is not retained to review the foundation bearing conditions or the construction of the foundations in the field, then G2S assumes no responsibility for the performance of the foundations as constructed.

The long-term performance of slabs on grade is dependent on the subgrade support conditions. Subgrades to support slabs on grade should be inspected by the geotechnical engineer prior to final construction. It is important that any engineered fill constructed beneath slabs on grade is carried out as outlined in this report.



## 7. Limitations

The geotechnical engineering advice and recommendations provided in this report are considered preliminary and were based on the factual information obtained during this investigation.

It may be possible that the subsurface conditions vary between and beyond the investigated borehole locations. For the purpose of this report, it is assumed that the conditions outside of and between the exact borehole locations are similar to the conditions observed in the boreholes. The change in subsurface stratigraphy reported on the borehole logs has also been interpreted based on non-continuous sampling, therefore, changes in stratigraphy as shown on the borehole logs and as discussed in this report should not be regarded as exact lines of geological change. The subsurface conditions at the Site may change with the passage of time and/or by human intervention.

The findings along with the geotechnical engineering advice and recommendations provided in this report are limited to the conditions at the Site at the time of this investigation as described herein. Conclusions presented in this report should not be construed as legal advice. If Site conditions or applicable standards change or if any additional information becomes available at a future date, changes to the findings, conclusions and recommendations in this report may be necessary.

Through any subsurface investigation by boreholes, it may not be possible to identify all aspects of the subsurface conditions at the Site that could affect construction costs, techniques, equipment, and scheduling. Contractors bidding on or undertaking work on the project must be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their interpretation of the subsurface conditions and/or their own investigations.

This report has been prepared for the sole benefit of the Client (City of Mississauga) and is intended to provide geotechnical engineering advice and recommendations based on the subsurface conditions investigated at the subject Site. This report is the copyright of G2S Consulting Inc. (G2S) and may not be used by any other person or entity without the expressed written consent of the Client and G2S. Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. G2S accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report. It is recognized that The City of Mississauga, in its capacity as the planning and building authority under Provincial statutes, may make use of and rely upon this report cognizant of the limitations thereof, both as expressed and implied.

A secondary review of this report was completed for general QA/QC and adherence to company standards and does not include a technical review of engineering conclusions and recommendations. This report does not address any environmental conditions such as soil and groundwater chemical quality and the suitability of excess soil for off-site re-use.

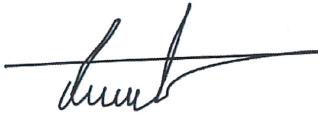


## 8. Closing Remarks

We trust this report is satisfactory for your present purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

**G2S Consulting Inc.**

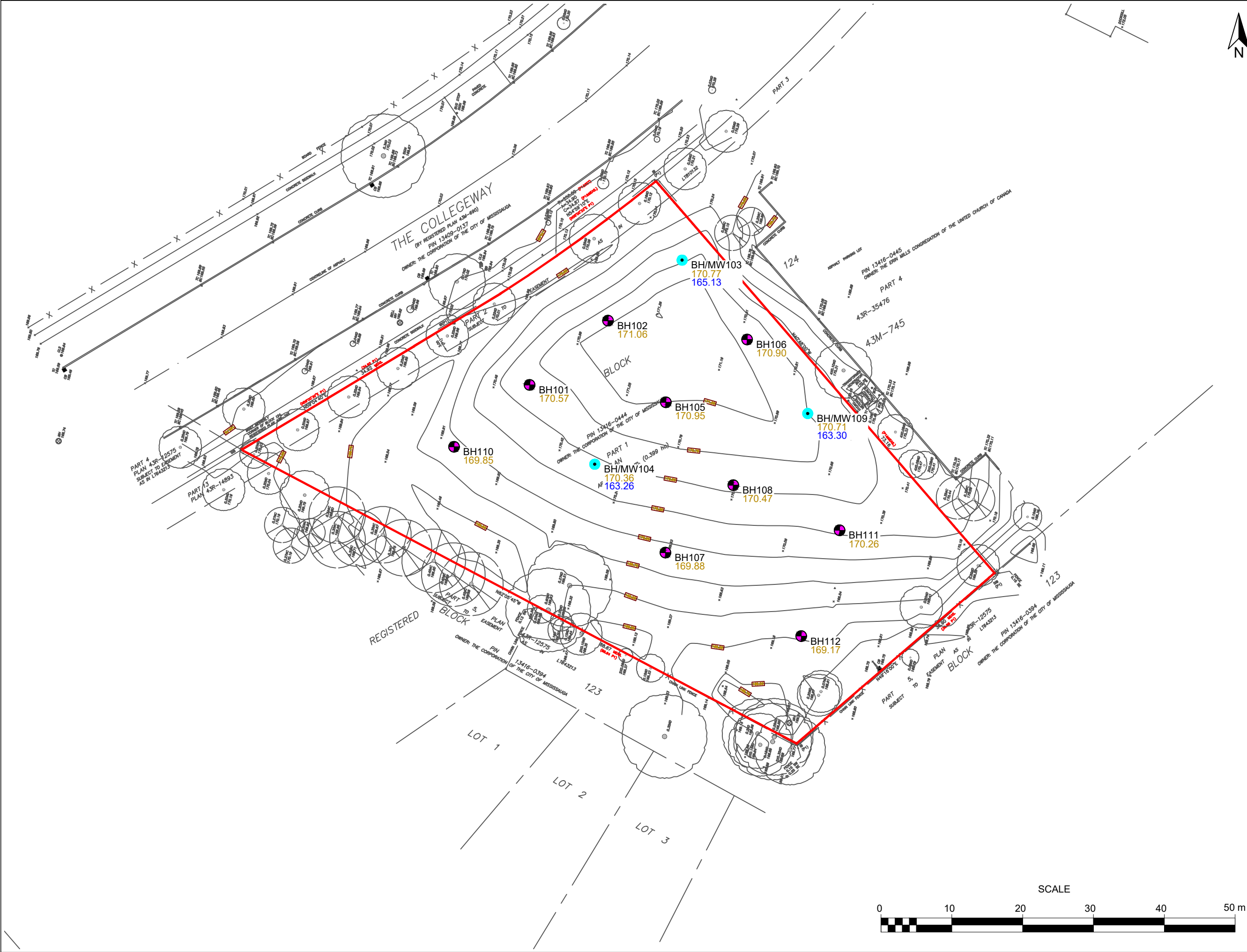


Almustafa Al-Doori, EIT  
Engineer in Training  
Geotechnical Services



Ashraf Abass, P. Eng.  
Senior Project Engineer

## **Appendix A: Drawings**



**LEGEND**

- SITE BOUNDARY
- BOREHOLE LOCATION
- BOREHOLE/MONITORING WELL LOCATION
- 170.77 GROUND ELEVATION (m)
- 165.13 GROUNDWATER ELEVATION (m) (OCTOBER 26, 2023)

**REFERENCE:**

DRAWING REPRODUCED FROM TARASICK  
McMILLAN KUBICKI LTD SURVEY 9764-SRPR-T  
DATED 2023/04/26, PROVIDED BY CLIENT

**TITLE:**

BOREHOLE AND MONITORING WELL LOCATION  
PLAN

**CLIENT:**

CITY OF MISSISSAUGA

**LOCATION:**

VACANT LAND PARCEL WEST OF 3010 THE  
COLLEGEWAY  
MISSISSAUGA, ONTARIO

**PROJECT NO.:** G2S23256

**DRAWING:**

1

**SCALE:**

AS SHOWN

**DATE:**

JANUARY 2024

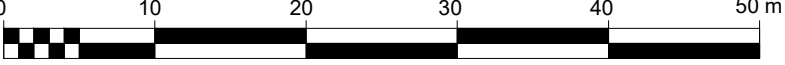
**DRAWN BY:**

DB

**FILE NAME:**

G2S23256.dwg

**SCALE**



**Appendix B:  
Borehole Logs and  
Grain Size Analysis Graphs  
Plasticity Chart**

## LIST OF ABBREVIATIONS

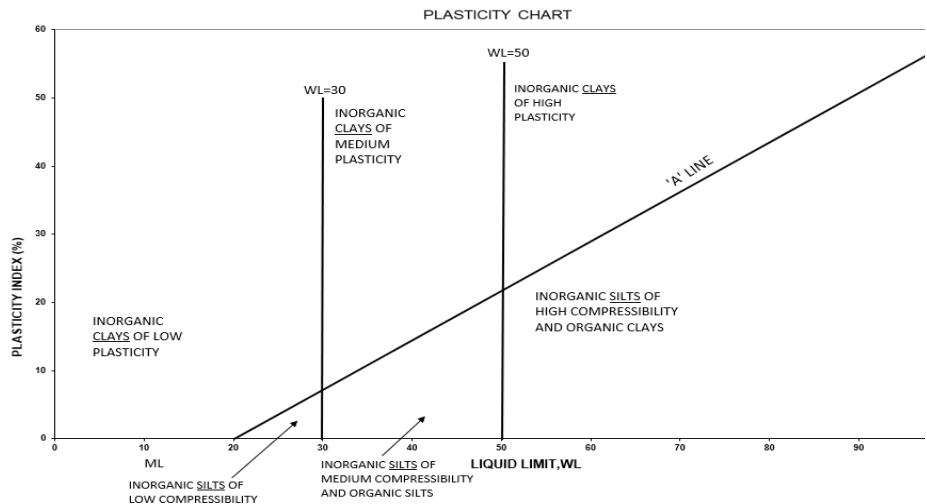
### Description of Soil

The consistency of cohesive soils and the relative density or compactness of cohesionless soils are described in the following terms:

COHESIVE SOIL			COHESIONLESS SOIL	
CONSISTENCY	N (blows/0.3 m)	C (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 – 2	0 – 12	Very Loose	0 – 4
Soft	2 – 4	12 – 25	Loose	4 – 10
Firm	4 – 8	25 – 50	Compact	10 – 30
Stiff	8 – 15	50 – 100	Dense	30 – 50
Very Stiff	15 – 30	100 – 200	Very Dense	>50
Hard	>30	>200		
<b>Moisture conditions</b>				
<b>Moist:</b> dark or greyish color, may feel cool upon				
<b>Wet:</b> same as moist with free water seepage when handled				

### Abbreviations

SS	Split Spoon Sample
AS	Auger Sample
GS	Grab Sample
DP	Direct Push
S	Sample
RC	Rock Core
FV/VA	Shear Vane (Field)
SPT	Standard Penetration Test
N	Blow counts per 300mm of penetration. (ASTMD1586)
MC	Moisture Content
PL	Plastic Limits
LL	Liquid Limits
PI	Plasticity Index



### Penetration Resistance

**Standard Penetration Resistance N:** The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m. The values reported are as noted in the field without corrections.

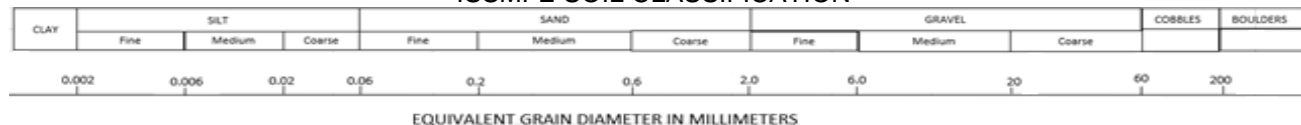
**Soil Classification Dynamic Penetration Resistance:** The number of blows required to advance a 51 mm, 60-degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow. Soils descriptions are made in accordance with the Canadian Foundations Engineering Manual (CFEM), following the International Society for Soil Mechanics and Foundation Engineering. (ISSMFE)

### Notes

Soil samples will be discarded after three months unless directed otherwise by the Client.

Unless the grain size analysis is performed in our lab, soil samples are classified based on visual, tactile, and olfactory examinations, which may not be sufficient for accurate classification or precise grain sizing.

### ISSMFE SOIL CLASSIFICATION



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.57 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30 40				
									PL MC LL			
									10 20 30			
0.20	TOPSOIL: ~200 mm	170.37		S1A	SS	8						
0.80	FILL: Clayey silt, brown, some sand to sandy, trace to some gravel, moist	169.77		S1B	SS							
2	CLAYEY SILT TILL: Brown, some sand, trace gravel, reworked appearance at top portion, moist, very stiff to hard			S2	SS	25						
2.3		168.27		S3	SS	31						
3	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist to wet, dense to very dense			S4	SS	50						
4				S5	SS	69						
4.6		165.97		S6	SS	50						
5	becoming grey			S7	SS	63						
6				S8	SS	34						
8		162.37		S9	SS	37						

Borehole terminated at 8.2 m.

Upon completion of drilling  
Wet cave at 7.3 m  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 171.06 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	171.04		S1	SS	17	▲	△	PL MC LL	0/0		
0.80	FILL: Clayey silt, dark brown and brown, some sand, some gravel, moist occasional sandy silt layers	170.26		S2	SS	15	▲	△		0/0		
				S3	SS	10	▲	△		0/0		
				S4	SS	41	▲	△		0/0		
3.0	CLAYEY SILT/SILTY CLAY TILL: Brown, trace sand to sandy, trace gravel, moist, hard	168.06		S5	SS	31	▲	△		0/0		0 8 46 46
				S6	SS	71	▲	△		0/0		
				S7	SS	57	▲	△		0/0		0 13 60 27
				S8	SS	39	▲	△		0/0		
7.6		163.46										
8.2	SILTY SAND/SANDY SILT: Grey, moist, dense	162.86		S9	SS	50	▲	△		0/0		0 54 43 3

Borehole terminated at 8.2 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.77 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer X					
							Vane +					
							40	80	120	160		
									PL	MC	LL	
									10	20	30	
0.30	TOPSOIL: ~300 mm	170.47		S1A	SS	6	▲					Stickup protective casing set in concrete
	FILL: Sandy silt, brown to dark brown, trace gravel, moist			S1B								
1				S2	SS	8	▲					
1.5		169.27		S3	SS	7	▲					
2	becoming clayey silt, brown, trace sand, moist			S4	SS	18	▲					Bentonite seal
3		167.77		S5	SS	63			>>▲			
4	CLAYEY SILT TO SILTY CLAY TILL: Greyish brown to grey, trace sand, trace gravel, rust-stained, moist to very moist, hard			S6	SS	51			>>▲			Filter sand
5				S7	SS	53			>>▲			
6		164.67		S8	SS	69			>>▲			Slotted screen
6.1	occasional wet sand seams			S9	SS	38	▲					
8		162.57										
8.2												

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	3.62	167.15
2023-09-18	4.04	166.73
2023-10-26	5.64	165.13



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.36 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30 40	PL MC LL			
0.13	TOPSOIL: ~125 mm	170.24		S1	SS	12	▲		●	0/0		Stickup protective casing set in concrete
1	FILL: Silty clay, dark brown and brown, trace sand, trace gravel, moist			S2	SS	48		▲	●	0/0		
1.7		168.66		S3A	SS	50		▲	●	0/0		
2	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist, very dense			S3B	SS	50		▲	●	0/0		
3				S4	SS	50		▲	●	0/0		Bentonite seal
4				S5	SS	50		▲	●	0/0		3 51 40 6
5				S6	SS	74		▲	●	0/0		
4.6		165.76		S7	SS	51		▲	●	0/0		Filter sand
5	becoming greyish brown, very moist			S8	SS	51		▲	●	0/0		
6				S9	SS	56		▲	●	0/0		Slotted screen
8.2		162.16								0/0		

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	6.85	163.51
2023-09-18	6.99	163.37
2023-10-26	7.10	163.26


**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.95 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	170.80		S1A	SS	12	▲	△		0/0		
1	FILL: Sandy silt, brown, some gravel, trace clay, moist			S1B	SS					0/0		
1.5		169.45		S2	SS	8	▲			0/0		
2	becoming clayey silt, dark brown and brown, trace sand, trace gravel, moist			S3	SS	16	▲			0/0		
2.3		168.65		S4	SS	33				0/0		
3	CLAYEY SILT TILL: Brown, trace to some sand, trace to some gravel, moist, hard			S5	SS	50				0/0		
3.8		167.15		S6	SS	50				0/0		
4	becoming grey			S7	SS	50				0/0		
4.6		166.35		S8	SS	46				0/0		
5	SILTY SAND TO SANDY SILT TILL: Grey, trace to some gravel, moist to wet, dense to very dense			S9	SS	50				0/0		13 34 40 13
6												
7												
7.8		163.15								0/0		4 46 44 6

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.90 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
0.18	TOPSOIL: ~175 mm	170.73		S1	SS	5	▲		●	0/0		
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist			S2	SS	15		▲	●	0/0		
1.5		169.40										
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	168.80		S3	SS	19		▲	●	0/0		
2.1												

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.88 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA   SI & CL	
							10    20    30    40						
							Undrained Shear Strength (kPa)						
							Pocket Penetrometer 40    80    120    160	Vane 160	PL    MC    LL 10    20    30				
0.05	TOPSOIL: ~50 mm	169.83		S1	SS	10	▲			●	0/0		
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist			S2	SS	12	▲			●	0/0		
1.5		168.38											
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	167.78		S3	SS	27		▲		●	0/0		
2.1													
												Upon completion of drilling	

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.47 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	170.45		S1	SS	7	▲		●	0/0		
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, trace clay, moist	169.67		S2	SS	16	▲		●	0/0		
2	CLAYEY SILT TILL: Brown, trace sand, some gravel, reworked appearance at top portion, moist, very stiff			S3	SS	25	▲		●	0/0		
2.4		168.05		S4A S4B	SS	52		>>▲	●	0/0		
3	SANDY SILT / SILTY SAND TILL: Brown, trace gravel, moist to wet, dense to very dense			S5	SS	59		>>▲	●	0/0		1 45 50 4
4				S6	SS	49		▲	●	0/0		
4.6		165.87		S7	SS	53		>>▲	●	0/0		
5	becoming grey											
6				S8	SS	54		>>▲	●	0/0		
7												
7.8		162.67		S9	SS	50		50/150 mm	●	0/0		

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.71 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_




DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	170.56		S1A	SS	12	▲	△	PL MC LL	0/0	Stickup protective casing set in concrete	
1	FILL: Sandy silt, dark brown and brown, trace clay, trace gravel, moist			S1B	SS					0/0		
1.5		169.21		S2	SS	24	▲	△		0/0		
2	CLAYEY SILT TILL: Brown, trace to some sand, trace gravel, moist, very stiff to hard			S3	SS	21	▲	△		0/0		
3				S4	SS	45		△		0/0		
3.8		166.91		S5	SS	71		>>▲		0/0		
4	SILTY SAND/SANDY SILT TILL: Brown, moist to wet, dense to very dense			S6	SS	63		>>▲		0/0		
4.6	becoming grey	166.11		S7	SS	46		▲		0/0		
5										0/0		
6				S8	SS	77		>>▲		0/0		
7										0/0		
7.8		162.91		S9	SS	50		50/150 mm		0/0		

Borehole terminated at 7.8 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	7.16	163.55
2023-09-18	7.29	163.42
2023-10-26	7.41	163.30

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.85 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values CPT values	MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							10 20 30 40				
							Undrained Shear Strength (kPa) Pocket Penetrometer Vane				
							40 80 120 160	PL MC LL 10 20 30			
0.18	TOPSOIL: ~175 mm	169.68		S1A	SS	10	▲	●	0/0		
1	FILL: Clayey silt, brown to dark brown, trace to some sand, trace gravel, moist			S1B							
1.5		168.35		S2	SS	36	▲	●	0/0		
2	SILTY SAND TILL: Light brown to brown, trace gravel, reworked	167.75		S3	SS	49	▲	●	0/0		
2.1											

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.26 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_




DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values CPT values	MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							10 20 30 40				
							Undrained Shear Strength (kPa) Pocket Penetrometer Vane				
							40 80 120 160	PL MC LL 10 20 30			
0.05	TOPSOIL: ~50 mm	170.21		S1	SS	8	▲	●	0/0		
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, moist	169.46									
	CLAYEY SILT TILL: Brown, trace sand, trace gravel, moist, very stiff to hard			S2	SS	27	▲	●	0/0		
1.7		168.56		S3	SS	50	▲	●	0/0		

Borehole terminated at 1.7 m.

Upon completion of drilling  
No cave  
No free water



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.17 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA    SI & CL	
							▲	△					
							Undrained Shear Strength (kPa)						
							Pocket Penetrometer ✕	Vane +	PL    MC    LL				
							40    80    120    160		10    20    30				
0.13	TOPSOIL: ~125 mm	169.05		S1A	SS	8	▲				0/0		
1	FILL: Clayey silt, brown, some sand, trace gravel, moist			S1B									
				S2	SS	50							
1.5		167.67									0/0		
2	CLAYEY SILT TILL: Brown, trace sand, trace gravel, moist, very stiff to hard	167.07		S3	SS	36	▲				0/0		
	2.1												

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**Project No.:** G2S23256 A

**Lab No.:** 23057A

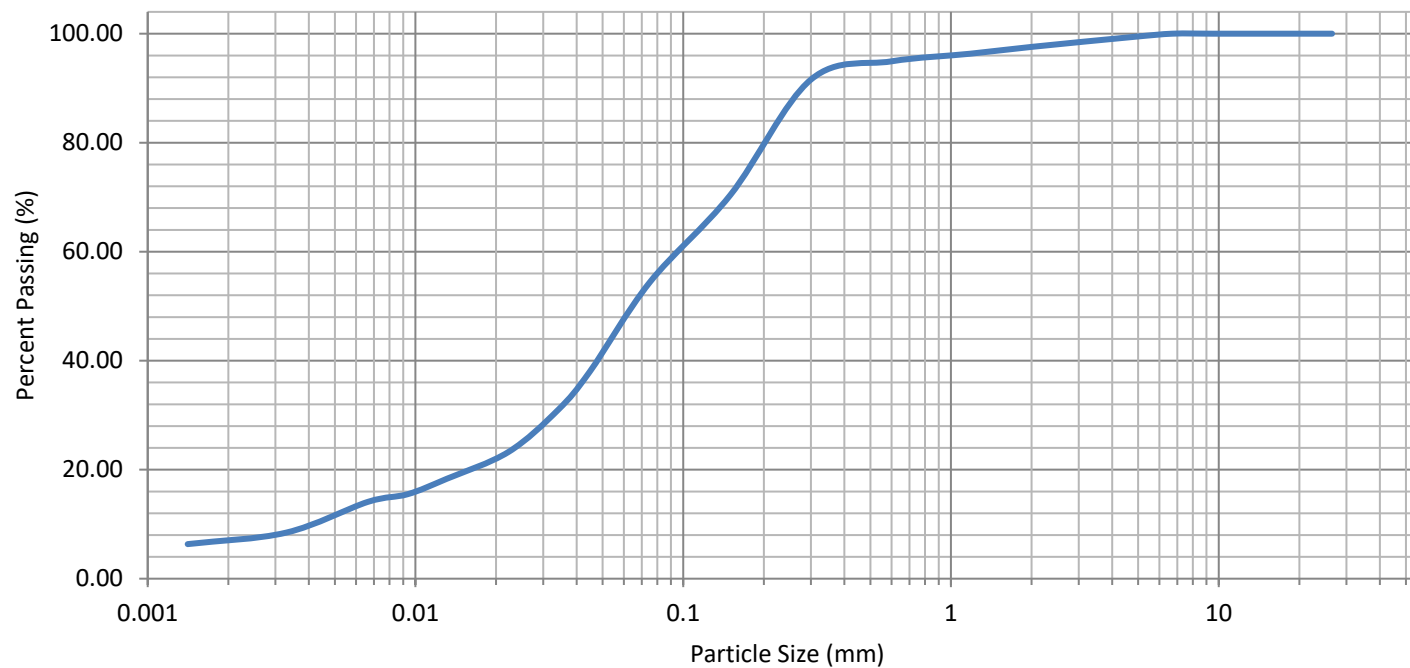
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH101-S8

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057B

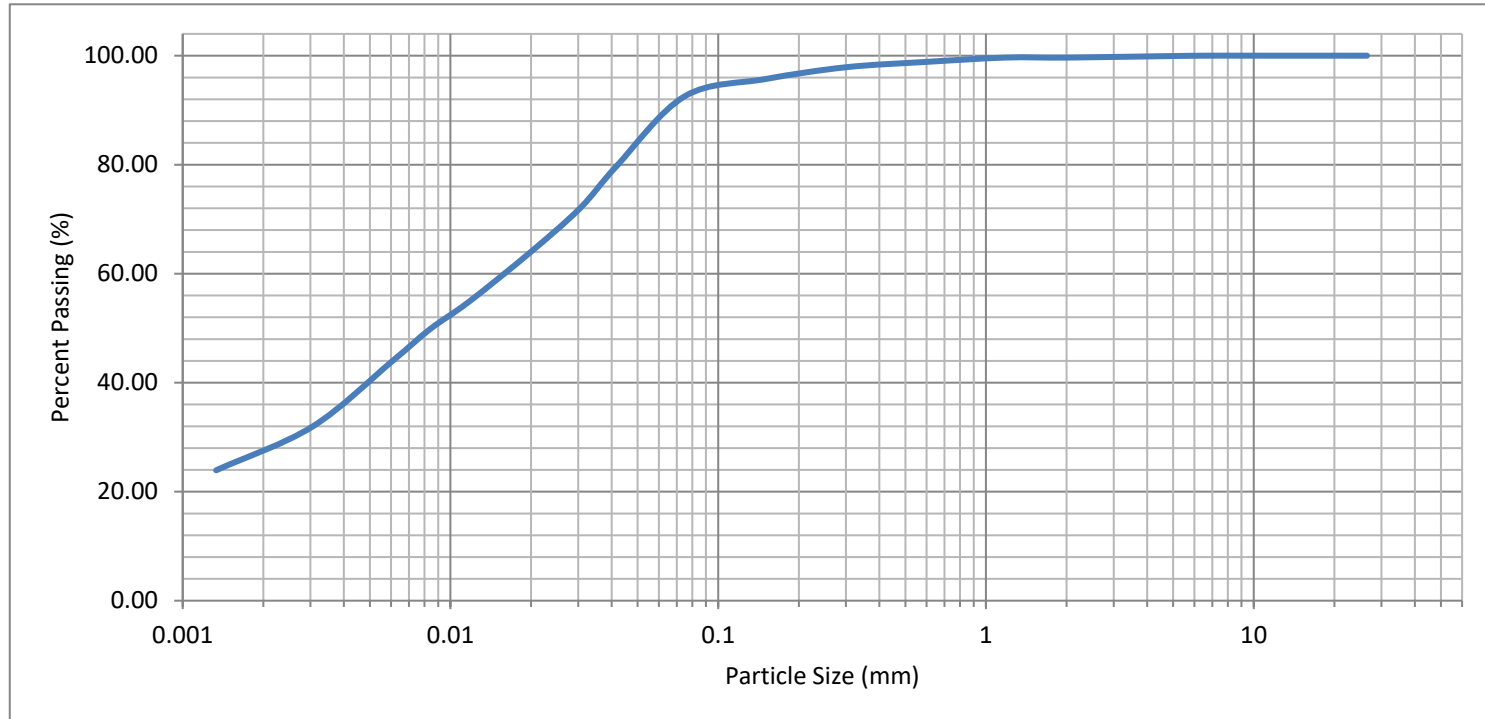
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH102-S7

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057J

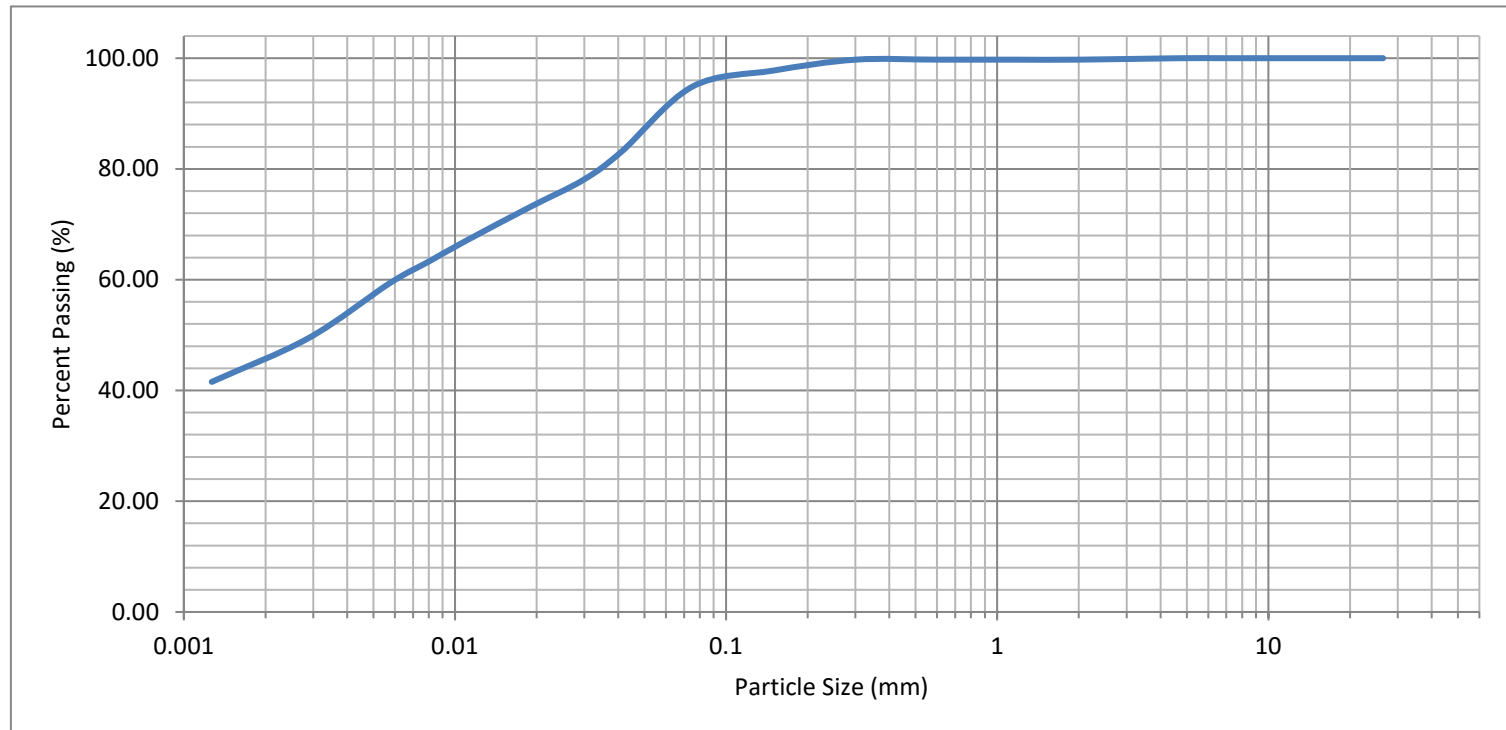
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH102-S5

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057B

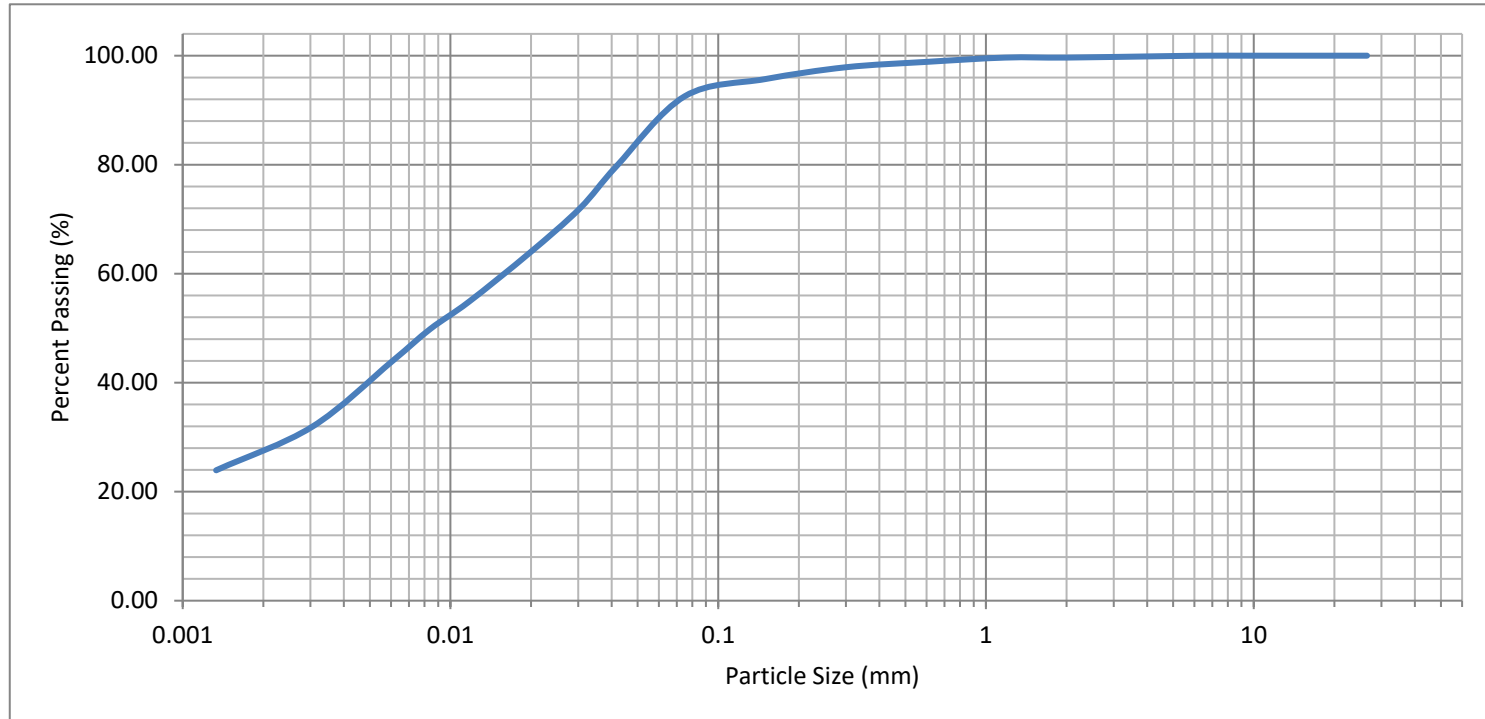
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH102-S7

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057C

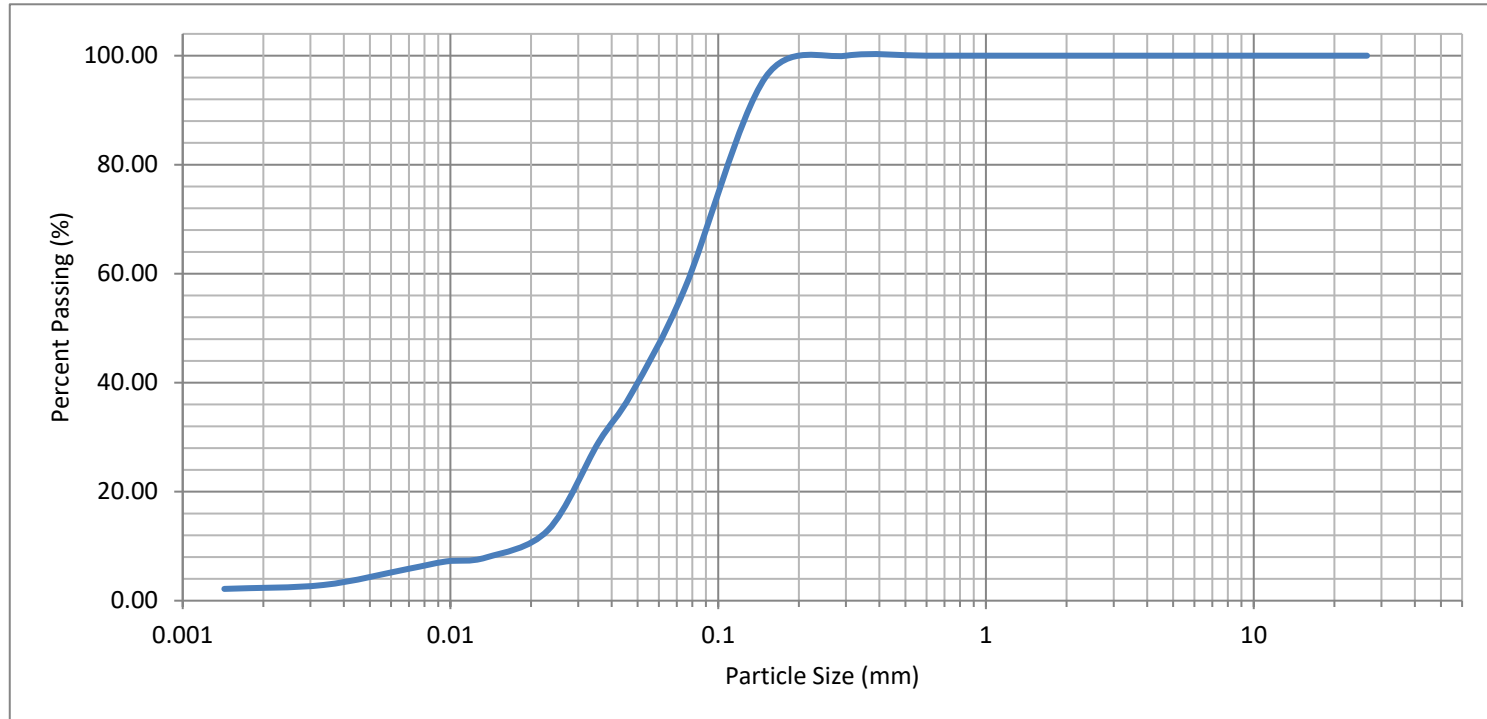
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH102-S9

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057E

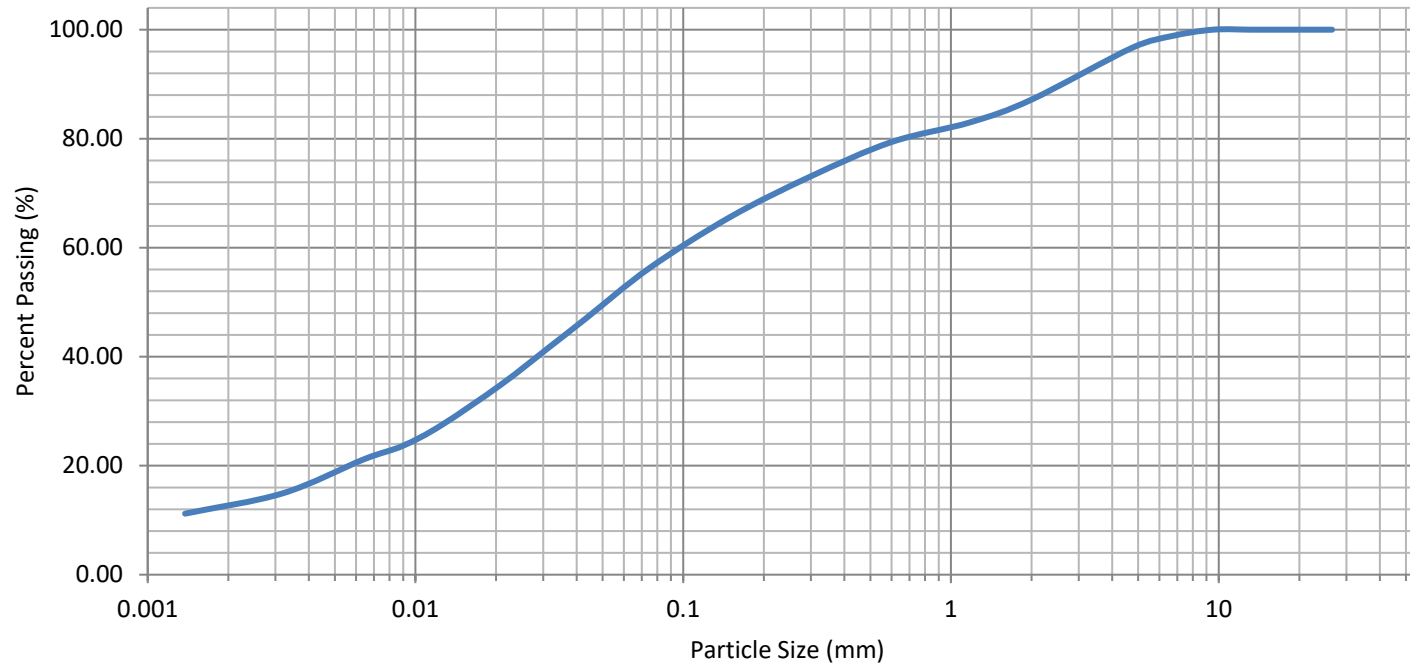
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH105-S7

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057F

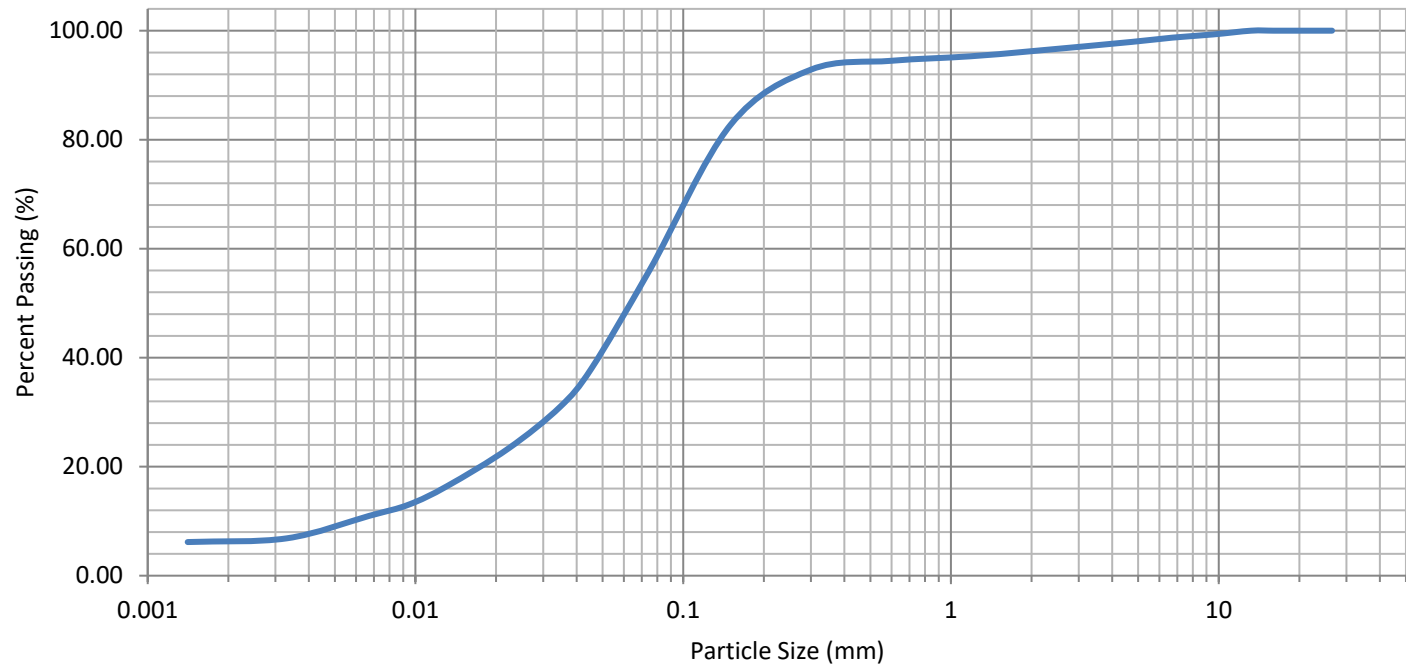
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH105-S9

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"





**Project No.:** G2S23256A

**Lab No.:** 23057G

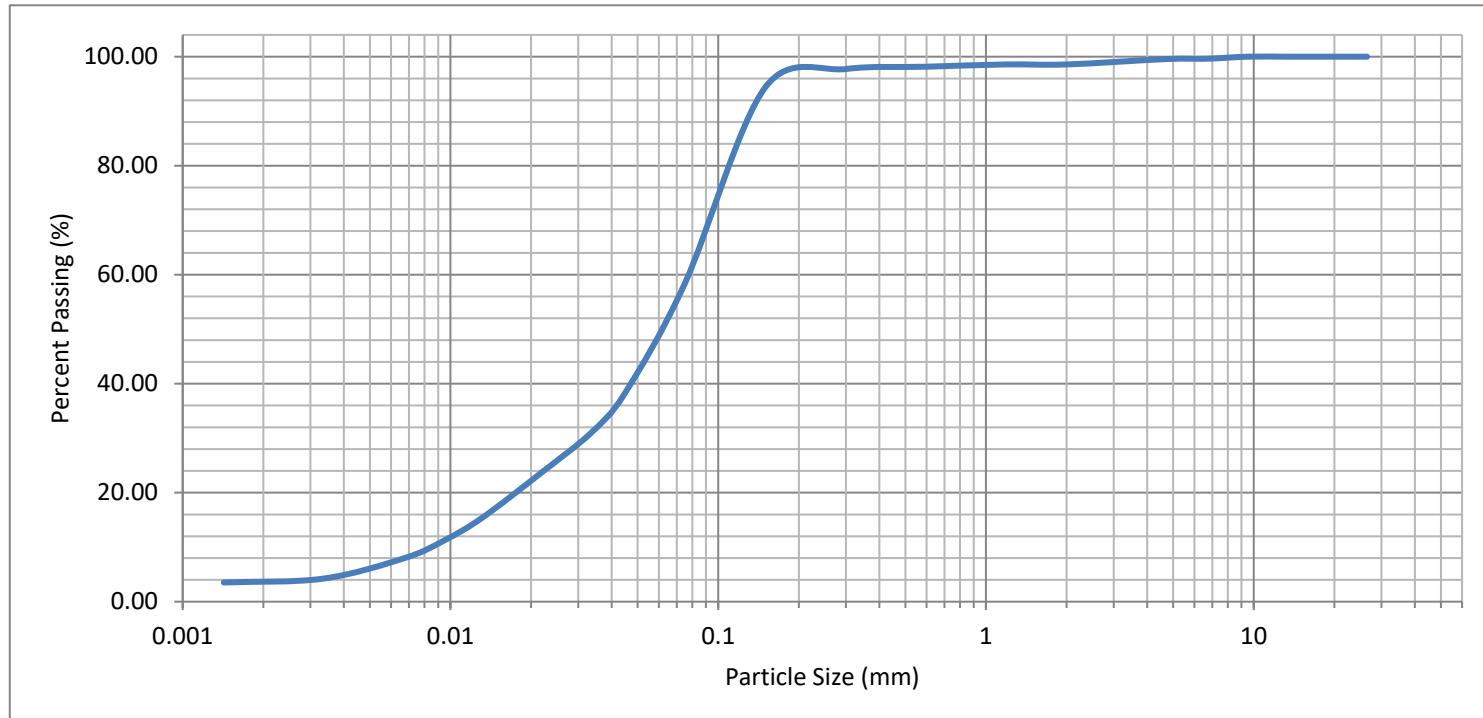
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH108-S5

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



**Project No.:** G2S23256A

**Lab No.:** 23057H

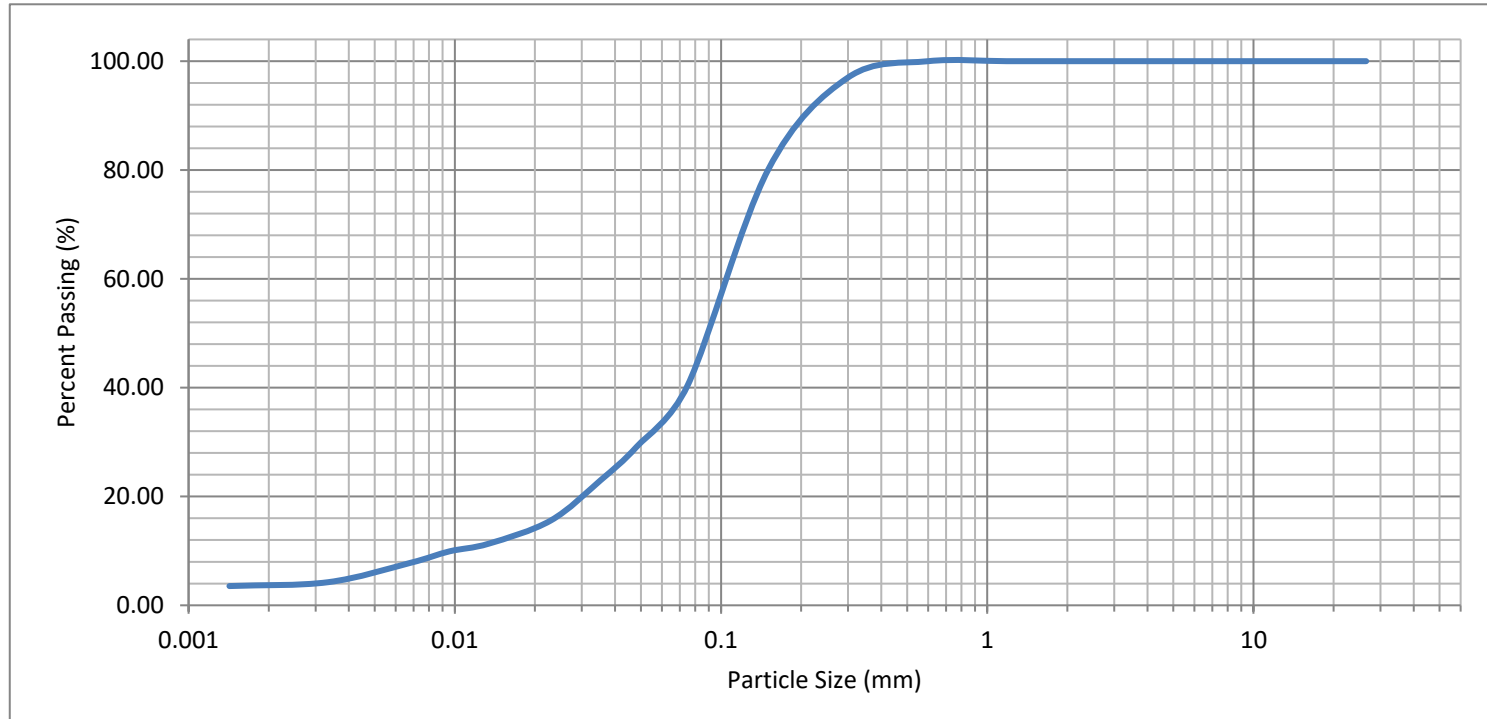
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** BH109-S6

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



Project No.: G2S23256A

Lab No.: 23057-B&J

Project Name: The Proposed City of Mississauga Fire Station 123

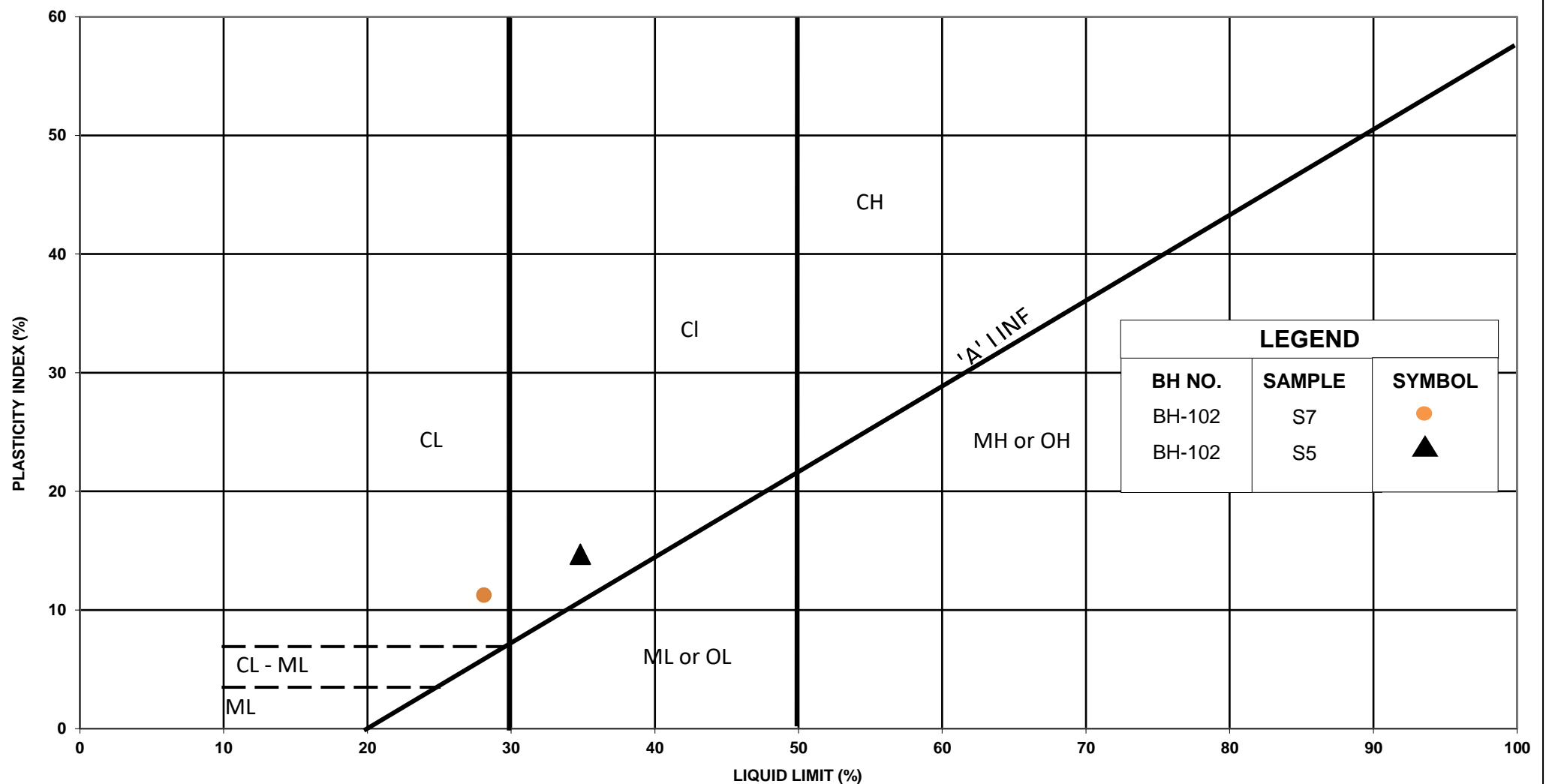


4361 Harvester Rd., Unit 12, Burlington, ON L7L 5M4

P 905.331.3735 F 905.642.5999

G2Sconsulting.com

## PLASTICITY CHART



**Appendix C:**  
**Shear-Wave Velocity Sounding Report**

September 29, 2023

Reference No.: G2S23256A

City of Mississauga  
300 City Centre Drive  
Mississauga, ON L5B 3C1  
c/o Sebastian Lubczynski, Senior Architect  
DPAI Architecture Inc.

**Reference: Seismic Site Classification – Shear Wave Velocity Sounding  
Mississauga Fire Station - 3010 The Collegeway, Mississauga, Ontario**

G2S Consulting Inc. (G2S) was retained by the City of Mississauga to complete shear-wave velocity sounding to provide a seismic site classification for the property located at 3010 The Collegeway, Mississauga, Ontario, hereinafter referred to as the 'Site'. Authorization to proceed with the investigation was provided by Mr. Sebastian Lubczynski of the DPAI Architecture Inc. on behalf of the City of Mississauga.

G2S initially carried out a geotechnical investigation of the site based on twelve (12) boreholes advanced to depths ranging from 2.1 to 8.2 metres below the existing grades. The results of the geotechnical investigation are published in G2S Report No. G2S23256A, titled "*Geotechnical Investigation - 3010 The Collegeway, Mississauga, Ontario*", dated September 2023.

Based on the subsurface soil conditions encountered in this investigation, Seismic Site Class "D" was given to the site based on the average soil characteristics for the Site (Stiff Soil over Soft Rock).

Shear-wave velocity sounding was carried out by Geophysics GPR International Inc. on September 13, 2023, and based on the subsoil information and the results of the shear-wave velocity testing, Site Class "C" as per Table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, was assigned to the Site. Details of the shear wave velocity analysis are enclosed in the attached report.

Should you have any questions regarding the information contained in this report, please do not hesitate to contact this office.

Yours truly,

**G2S Consulting Inc.**



Almustafa Al-Doori, EIT  
Geotechnical Services



Ashraf Abass, P. Eng.  
Senior Geotechnical Engineer



**GEOPHYSICS GPR INTERNATIONAL INC.**

6741 Columbus Road  
Unit 14  
Mississauga, Ontario  
Canada, L5T 2G9

Tel.: 905-696-0656  
Fax: 905-696-0570  
info@geophysicsgpr.com  
www.geophysicsgpr.com

Transmitted by Email: [almustafa@g2sconsulting.com](mailto:almustafa@g2sconsulting.com)

GPR file: T234894

September 25<sup>th</sup>, 2023

Almustafa Al-Doori, EIT  
Geotechnical Engineer in Training  
**G2S Consulting Inc.**  
4361 Harvester Road, Unit 12  
Burlington, Ontario  
L7L M4

**RE: Shear-wave velocity sounding at 3010 The Collegeway, Mississauga, Ontario**

Dear Mr. Al-Doori:

Geophysics GPR International Inc. has been requested by G2S Consulting Inc. to carry out a shear-wave velocity sounding at the above site in Mississauga.

The investigation included the multi-channel analysis of surface waves (MASW), the micro-tremor array measurements (MAM), the Spatial AutoCorrelation (SPAC), and the refraction methods to generate a shear-wave velocity model.

The survey was performed on September 13<sup>th</sup>, 2023. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic spread. Both figures are presented at the end of this report.

The following paragraphs describe the survey design, the principles of the test method, the methodology for interpreting the data, and provide a culmination of the results in table format.



## MASW and MAM Surveys

### *Basic Theory*

The Multi-channel Analysis of Surface Waves (MASW), the Micro-tremor Array Measurements (MAM) and the Spatial AutoCorrelation (SPAC) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves (“ground roll”). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave ( $V_s$ ) velocity depth profile (sounding). The SPAC is considered a “passive” method, using the low frequency “signals” produced far away. The method can also be used with “active” seismic source records. This method generally allows deeper  $V_s$  soundings. The dispersion curve can then be merged with the one of higher frequency from the MASW to calculate a more complete inversion. Figure 3 outlines the basic operating procedure for the MASW method. Figure 4 is an example image of a typical MASW record and resulting 1D  $V_s$  model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves*, Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808.

### *Survey Design*

The geometry of an MASW survey is similar to that of a seismic refraction investigation. A seismic spread usually consists of 12 to 24 vibration-monitoring devices (geophones) in a linear array, connected to a seismograph (Abem Terraloc Pro/Mark 6). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an “active source” method. A sledgehammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 25 to 30 m off both ends, and in the middle of the spread. Data were collected with a geophone spacing of 3 m and 1m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5 m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a “passive source” method in that there is no time break and the motions recorded are from



ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background “noise.” The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

### ***Interpretation Method and Accuracy of Results***

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package and MASwAI from Geophysics GPR. The data inversions is done using the neural networks based algorithm MASwAI.

In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

The results of the MASW/MAM tests are presented in chart format as Figure 5. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The  $V_{s30}$  value for the sounding is presented in Table 1. The  $V_{s30}$  values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The  $V_{s30}$  value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth.

$$\bar{V}_{s30} = \frac{\sum_{i=1}^N H_i}{\sum_{i=1}^N H_i / V_i} \quad | \quad \sum_{i=1}^N H_i = 30 \text{ m}$$

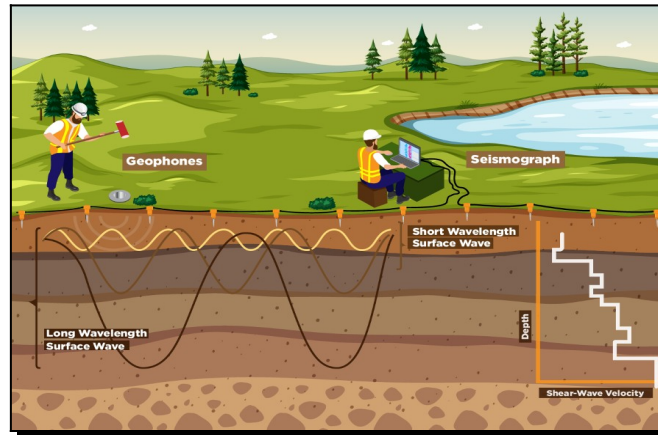
(N: number of layers;  $H_i$ : thickness of layer "i" ;  $V_i$ :  $V_s$  of layer "i")

This harmonic mean value reflects the equivalent single layer response. Table 2 at the end of the report displays the  $V_{s30}$  calculations at various depths up to 30 meters.

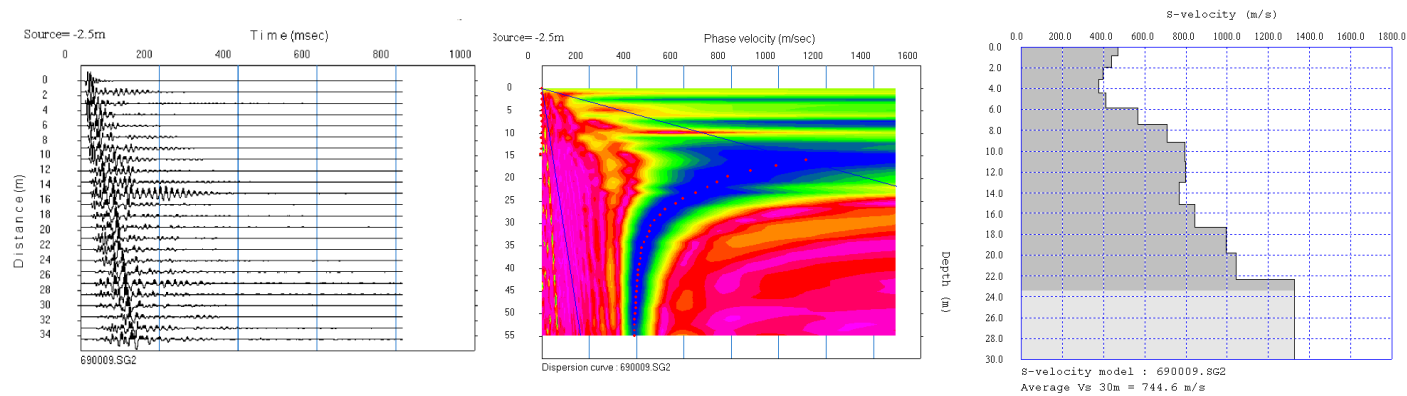
The estimated error in the average  $V_{s30}$  value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.







**Figure 3: MASW Operating Principle**



Raw Seismic Shot Record

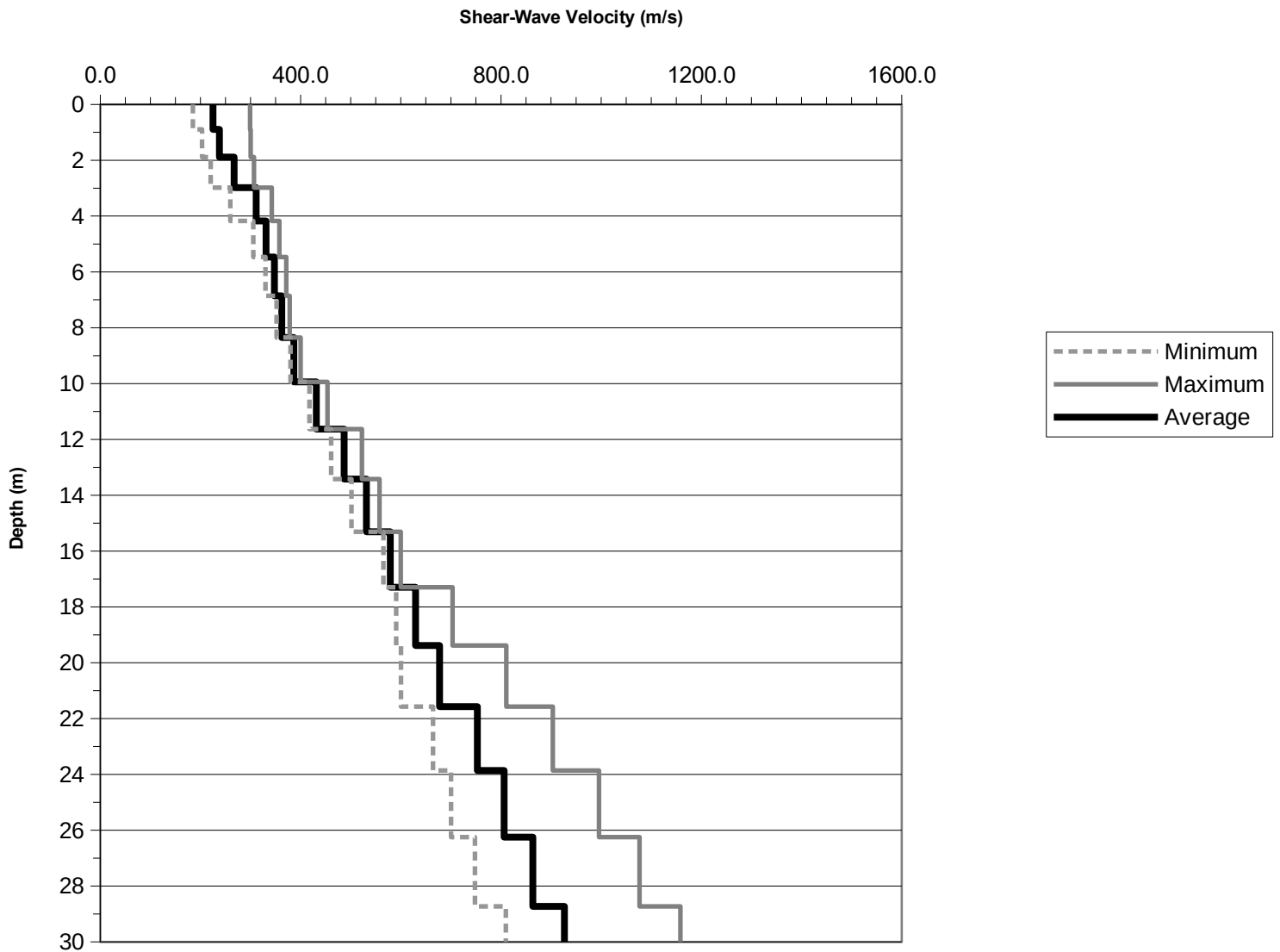
Phase Velocity-Frequency Transformation  
indicating Dispersion Curve

1D Shear-Wave Velocity Profile  
from Inversion of Dispersion Curve

**Figure 4: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model.**



**MASW Shear-Wave Velocity  
Sounding#1  
3010 The Collegeway  
Mississauga, Ontario**



**Figure 5: MASW Shear-wave Velocity Sounding**



## CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 2.

The MASW shear-wave models are presented in Figure 5. The results are summarized in Table 1. The background seismic noise levels at this site were moderate. The quality of the seismic records and the resulting dispersion curves was good.

Simple critical distance calculations from refracted P-waves show that the water table could be at 3 m deep. The Shale bedrock could be approximately at 17 m deep.

The available limited boreholes confirmed the relatively stiff to dense overburden at this site.

**Table 1:** Calculated  $V_{s30}$  values (m/s) from the MASW data (0 to 30 m)

Sounding	Minimum	Average	Maximum	Site Class
1	427	472	531	C

The calculated average  $V_{s30}$  value (m/s) from the 1D MASW collected sounding was 472 m/s +/-10 to 15%.

The  $V_{s30}$  values calculated for the minimum and the maximum envelopes ranged from 427 to 531 m/s.

Based on the average  $V_{s30}$  values (as determined through the MASW method) and table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, the investigated area is site class "C" ( $360 < V_{s30} \leq 760$  m/s).

It must be noted that the site classification provided in this report is based solely on the  $V_{s30}$  value as derived from the MASW method and that it can be superseded by other geotechnical information. This geotechnical information includes, but is not limited to, the presence of sensitive and/or liquefiable soils, more than 3 m of soft clays, high moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2015 Edition for more information on the requirements for site classification.

This report has been written by Lhoucin Taghya, P.Geo.



Lhoucin Taghya, P.Geo.  
Geophysicist







**Figure 1: Regional location of the Site**  
(Source: GoogleMaps™)



**Figure 2: Location of the seismic spread**  
(Source: Google Earth™)



**Table 2:**  $V_{s30}$  Calculation for the Site Class

Depth	Vs			Thickness	Cumulative Thickness	Delay for Med. Vs	Cumulative Delay	Vs at given Depth Min.
	Min.	Mean	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(m)	(m/s)
0.0	185	225	299	Grade Level				
0.9	203	238	300	0.9	0.9	0.003979	0.003979	225
1.9	221	267	307	1.0	1.9	0.004181	0.008160	231
3.0	260	311	342	1.1	3.0	0.004093	0.012253	243
4.2	306	331	358	1.2	4.2	0.003833	0.016086	260
5.5	330	348	371	1.3	5.5	0.003907	0.019993	273
6.9	352	362	378	1.4	6.9	0.004004	0.023997	286
8.4	380	386	400	1.5	8.4	0.004114	0.028111	297
9.9	418	431	454	1.6	9.9	0.004117	0.032228	308
11.6	461	487	522	1.7	11.6	0.003918	0.036146	322
13.4	502	531	558	1.8	13.4	0.003675	0.039821	337
15.3	565	579	600	1.9	15.3	0.003555	0.043376	353
17.3	591	630	703	2.0	17.3	0.003434	0.046811	370
19.4	600	677	811	2.1	19.4	0.003316	0.050127	387
21.6	664	753	904	2.2	21.6	0.003228	0.053355	404
23.9	700	806	996	2.3	23.9	0.003038	0.056393	423
26.2	748	864	1077	2.4	26.2	0.002959	0.059352	442
28.7	810	927	1158	2.5	28.7	0.002878	0.062230	462
30.0				1.3	30.0	0.001369	0.063600	472

$V_{s30}$ (m/s)	472
Site Class	C



January 29, 2024

Reference No. G2S23256B-R2

City of Mississauga  
300 City Centre Drive  
Mississauga, ON L5B 3C1  
c/o Sebastian Lubczynski, Senior Architect  
DPAI Architecture Inc.

**Hydrogeological Site Assessment  
City of Mississauga Fire Station 123  
Vacant Lot West of 3010 The Collegeway  
Mississauga, Ontario**

G2S Consulting Inc. (G2S) is pleased to provide the results of our Hydrogeological Site Assessment for the vacant property located west adjacent to 3010 The Collegeway in Mississauga, Ontario (referred to herein as the 'Site'), which is the proposed location of City of Mississauga Fire Station 123.

## **1. Introduction**

The Site is located on the south side of The Collegeway, approximately 110 m southwest of the intersection of Winston Churchill Boulevard and The Collegeway, and covers an approximate plan area of 3,960 square metres with 65 m of frontage onto The Collegeway. The Site is undeveloped and has historically been vacant undeveloped land since at least 2004.

The proposed development plan includes the construction of a single-storey, slab on grade fire station building (no basement) with a fire crew area and apparatus bay. Additionally, an infiltration gallery will be installed on-Site for the purpose of Low Impact Development (LID) design.

## **2. Terms of Reference**

The purpose of the Hydrogeological Site Assessment was to assess the stratigraphic and hydrogeological conditions of the Site for the purpose of assessing groundwater elevation and infiltration rates.

G2S completed a concurrent geotechnical investigation, which included the completion of boreholes and the installation of monitoring wells. The data from the geotechnical investigation was used as part of this Hydrogeological Site Assessment.

The requirements of this project and scope of work are discussed in the following sections.



### **3. Scope of Work**

The objectives of the study were accomplished by completing the following tasks:

1. The installation of three monitoring wells in the boreholes advanced as part of the concurrent Geotechnical Investigation (issued under separate cover).
2. Completion of an elevation survey for the boreholes and monitoring wells installed as part of the Hydrogeological Site Assessment and concurrent Geotechnical Investigation.
3. Completion of three groundwater level monitoring events over the course of three months.
4. Completion of grain size analyses on two samples to assess soil type.
5. Completion of infiltration testing at two locations.
6. Completion of a water well search for properties located within 250 m of the Site.
7. Preparation of this report.

The following sections provide the findings of each task.

### **4. Site Setting**

The Site is located in an urban setting and is bound by The Collegeway to the north, Erin Mills United Church to the east and a city park to the west and south. The Site is undeveloped and has historically been vacant undeveloped land since at least 2004.

Refer to Drawing 1 in Appendix A for the Ontario Base Map showing the Site location.

#### **4.1 Site Topography and Drainage**

The Site is generally flat and surface water is inferred to percolate through the ground surface and overland flow is likely southeast toward a pond that is located directly southeast of the Site. Adjacent land uses include residential to the north, institutional to the east, and recreational to the west and south. According to the Ministry of Natural Resources Natural Heritage Map, there are no natural heritage areas or protected regions within the 'Study Area', which is defined as being the lands located within 250 m of the Site.

#### **4.2 Site Physiographic, Geologic and Hydrogeologic Setting**

Subsurface investigations completed at the Site by G2S indicated a soil stratigraphy consisting of topsoil overlying clayey silt/silty clay or sandy silt/silty sand fill materials, underlain by clayey silt to silty clay till, and silty sand to sandy silt till. Bedrock was not encountered during drilling. Refer to the borehole logs in Appendix B for a detailed description of the subsurface conditions encountered.

The Ministry of Northern Development and Mines Map 2556 Quaternary Geology of Ontario, Southern Sheet, issued 1991, indicates the Site is part of the Halton Till, consisting of predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor. Based on the Ministry of Northern Development and Mines Map 2544 the Bedrock Geology of Ontario

Southern Sheet, the bedrock in the vicinity of the consists of shale, limestone, dolostone, and siltstone of the Queenston Formation from the Upper Ordovician.

## **5. Water Well Search**

The Site and properties within an approximate 250 m radius were searched within the current MECP Water Well Information System (WWIS) database. A total of 11 water well records were located within the search radius. Based on water well information obtained from the MECP, there are no wells reported to be located on the Site. A summary of the water well records is included in Appendix C.

The use of the water wells within the 250 m radius included monitoring (MO), monitoring test hole (MT) and test hole (TH).

The Site is located in Peel Region, which obtains its municipal water supply from a drinking water system that draws water from Lake Ontario, regionally owned wells, or privately owned wells. Some water well records did not identify their use; however, since the Site is located within a developed urban area, it is unlikely any of the wells within the search radius are for drinking water purposes.

## **6. Borehole Drilling and Monitoring Well Installation**

As part of the concurrent Geotechnical Investigation, twelve boreholes were advanced in August 2023, three of which were completed as groundwater monitoring wells. The monitoring wells installed by G2S and utilized for this Hydrogeological Site Assessment are identified as BH/MW103, BH/MW104 and BH/MW109, as shown on Drawing 2 in Appendix A.

Elevations at the ground surface of the borehole locations were interpolated from the topographic map provided by the Client on January 24, 2024, entitled, Plan of Survey with Topography of Part of Block 124 Registered Plan 43M-745, City of Mississauga, Regional Municipality of Peel, dated on April 26, 2023 by Tarasick McMillan Kubicki Limited.

## **7. Groundwater Monitoring and Conditions**

Groundwater was encountered during the drilling of BH/MW101, where free water was observed at 7.3 m bgs. The remainder of the boreholes were dry upon completion.

Three groundwater monitoring events were completed between September 1, 2023 and October 26, 2023. Groundwater levels were measured using a Solinst™ groundwater level reader, which was cleaned between uses at each monitoring well location.

Groundwater levels are subject to seasonal fluctuations and variations in precipitation. A summary of groundwater data is included in the following table.



**Table 1: Summary of Groundwater Levels**

Monitoring Well ID	Well Depth and Ground Surface (m, geodetic)	Groundwater Depth (m bgs) (Elevation, m ASL)		
		September 1, 2023	September 18, 2023	October 26, 2023
BH/MW103	7.45 (170.77)	3.62 (167.15)	4.04 (166.73)	5.64 (165.13)
BH/MW104	7.82 (170.36)	6.85 (163.51)	6.99 (163.37)	7.10 (163.26)
BH/MW109	7.53 (170.71)	7.16 (163.55)	7.29 (163.42)	7.41 (163.30)

Since the proposed development is a slab on grade building, with water levels found at depths between 3.6 and 7.4 m bgs, construction dewatering should not be required. Any water that may seep into the excavations could be removed using conventional construction 'dewatering' techniques, such as pumping from sumps and ditches.

## 8. Grain Size Analysis

Typical rates of hydraulic conductivity for the soils encountered on-Site are as follows (Freeze and Cherry, 1979):

- Silty Sand/Sandy Silt -  $10^{-3}$  m/s to  $10^{-7}$  m/s
- Clayey Silt/Silty Clay -  $10^{-6}$  m/s to  $10^{-12}$  m/s

## 9. Infiltrometer Testing

Infiltration testing was required to support the design and installation of an infiltration gallery on-Site for LID design. To estimate the infiltration rate of existing soil, field tests were undertaken, in conjunction with grain size analysis (sieve and hydrometer).

Hydrogeology Consulting Services Inc. (HCS) was retained by G2S to assess the soil infiltration capacity using a double ring infiltrometer (DRI). On October 11, 2023, a DRI from AMS Samplers was used to assess the surficial soil infiltration rate at two locations, DRI 01-23 and DRI 02-23, as shown on Drawing 2 in Appendix A. Both test pits were excavated to an approximate depth of 1.5 m bgs using an excavator retained by G2S to allow for the DRI to seat into the native soil. Calculated estimated soil infiltration rates and t-times based on the DRI test results are provided in Table 1 of the HCS report and depict a soil with a moderately-low to low infiltration rate.

A soil sample was collected from the bottom of each DRI test pit (TP1/DRI-01-23 and TP2/DRI-02-23) and submitted to the G2S laboratory for analysis of particle size distribution (grain size). The grain size analysis curves confirming the soil classifications and hydraulic conductivity ranges are presented in Appendix D. These results were then used by HCS to estimate the soil's hydraulic conductivity and the related on-Site infiltration potential. Estimated soil infiltration rates from grain size analysis hydraulic conductivity values are provided in Table 3 of the HCS report and depict a soil with a very low infiltration rate.

Refer to Appendix E for the HCS Infiltration Report and corresponding recommendations regarding infiltration rates.

## **10. Assessment of Findings and Conclusions**

The purpose of this study was to prepare a Hydrogeological Site Assessment to assess the stratigraphic and hydrogeological conditions of the Site for the purpose of assessing groundwater elevation and infiltration rates.

Based on the findings of this evaluation, G2S's summarized comments are provided below.

1. Soil stratigraphy encountered on-Site comprised topsoil overlying clayey silt/silty clay or sandy silt/silty sand fill materials, underlain by clayey silt to silty clay till, and silty sand to sandy silt till.
2. A water well search of wells within 250 m of the Site identified eleven records within the Study Area, none of which are located on the Site. The well uses of the well records included monitoring (MO), monitoring test hole (MT) and test hole (TH). Since the Site is located within a developed urban area, it is unlikely any of the wells within the search radius are for drinking water purposes.
3. The highest recorded water level at the Site was 3.62 m bgs (elevation 167.15 m) in monitoring well BH/MW103, measured on September 1, 2023.
4. Based on observations made during drilling, as well as grain size analysis testing, the dominant soil types in the area of the proposed infiltration galleries are silty sand and clayey silt.
5. The infiltration rates estimated for soils at DRI 01-23 and DRI 02-23 were moderately low to very low. Factored and unfactored rates are provided by HCS in Table 1 and 3 of the Infiltration report included in Appendix E.

## **11. Limitations**

Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. G2S accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report. It is recognized that the City of Mississauga in their capacity as the planning and building authority under Provincial statutes, may make use of and rely upon this report cognizant of the limitations thereof, both as are expressed and implied. The findings in this report are limited to the conditions within the Site at the time of this investigation as described herein. Conclusions presented in this report should not be construed as legal advice. If the Site conditions or applicable standards change or if any additional information becomes available at a future date, changes to the findings, conclusions and recommendations in this report may be necessary.

## 12. Closing Remarks

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

**G2S Consulting Inc.**



Jacob Pinter, M.Sc.  
Environmental Technician (G.I.T)



Melissa King, P.Geo., QP<sub>ESA</sub>  
Head of Environmental Services



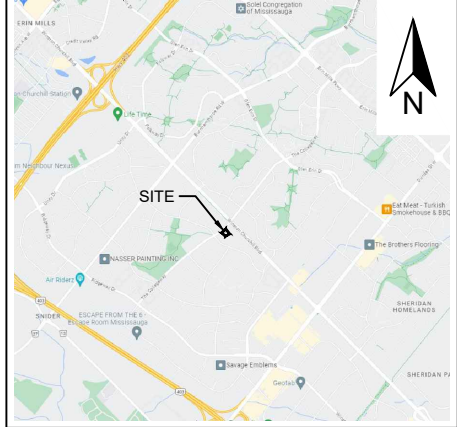
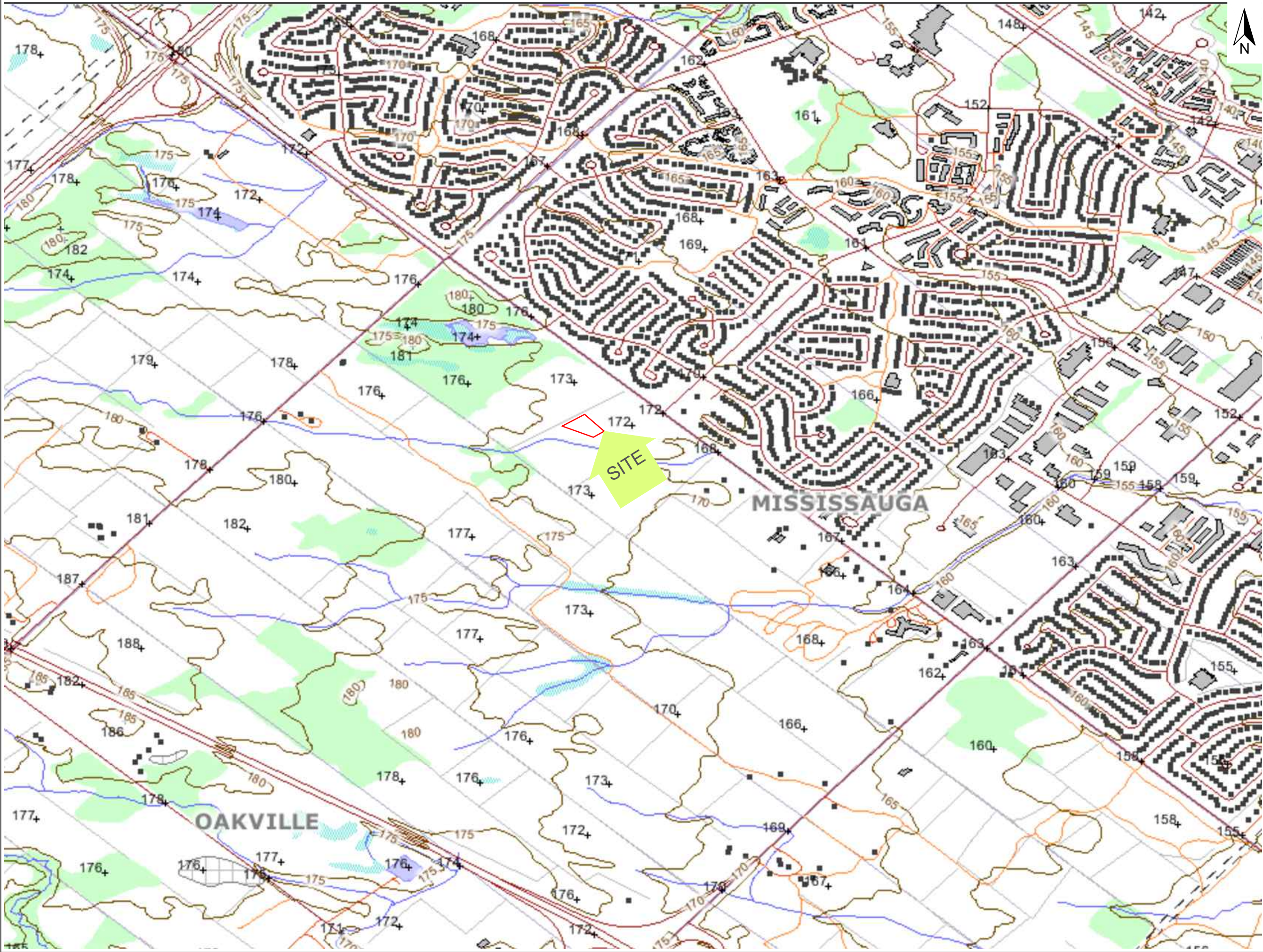
Dana Haslett, B.A.  
Senior Project Manager

### Enclosures

Appendix A: Drawings  
Appendix B: Borehole Logs  
Appendix C: Well Records  
Appendix D: Grain Size Analysis  
Appendix E: Infiltration Report

## **Appendix A: Drawings**





**LEGEND**

APPROXIMATE SITE BOUNDARY

**REFERENCE:**  
DRAWING REPRODUCED FROM ONTARIO BASIC MAPPING

**TITLE:**  
ONTARIO BASE MAP

**CLIENT:**  
CITY OF MISSISSAUGA

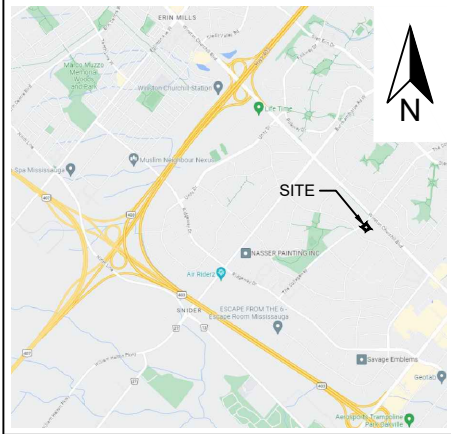
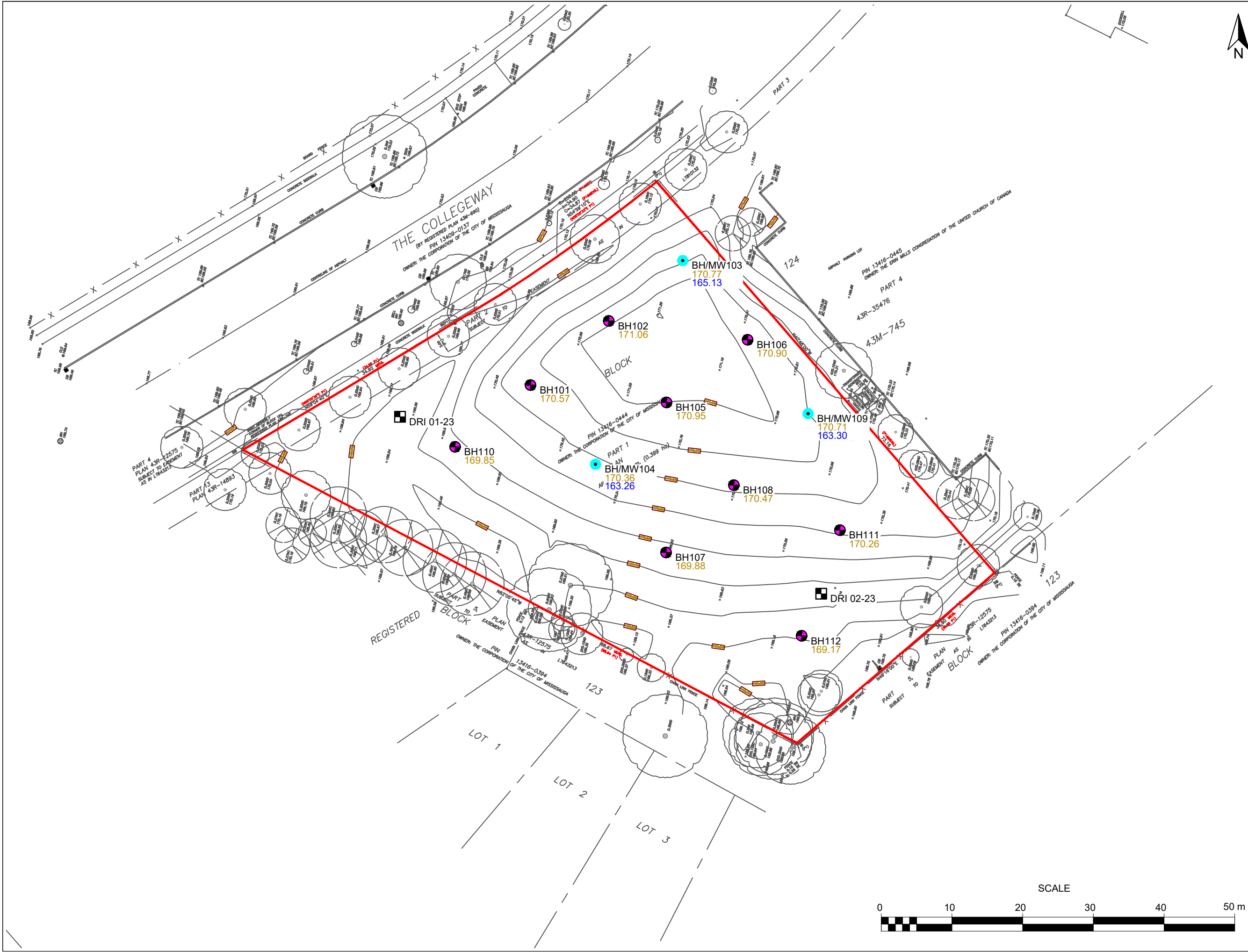
**LOCATION:**  
VACANT LAND PARCEL WEST OF 3010 THE COLLEGEWAY  
MISSISSAUGA, ONTARIO

**PROJECT NO.:** G2S23256B

**DRAWING:** 1  
**SCALE:** N.T.S  
**DATE:** JANUARY 2024  
**DRAWN BY:** DB/JP  
**FILE NAME:** G2S23256B.dwg







- LEGEND**
- SITE BOUNDARY
  - BOREHOLE ADVANCED BY G2S (AUGUST 2023)
  - BOREHOLE/MONITORING WELL ADVANCED BY G2S (AUGUST 2023)
  - APPROXIMATE DOUBLE RING INFILTRMETER TEST PIT LOCATIONS (OCTOBER 2023)
  - 101.11 GROUND ELEVATION (m)
  - 93.70 GROUNDWATER ELEVATION (OCTOBER 26, 2023) (m)

**REFERENCE:**  
DRAWING REPRODUCED FROM GOOGLE MAPS AERIAL IMAGERY

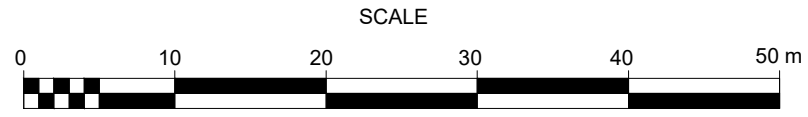
**TITLE:**  
BOREHOLE AND MONITORING WELL LOCATION PLAN

**CLIENT:**  
CITY OF MISSISSAUGA

**LOCATION:**  
VACANT LAND PARCEL WEST OF 3010 THE COLLEGEWAY  
MISSISSAUGA, ONTARIO

**PROJECT NO.:** G2S23256B

<b>DRAWING:</b>	2
<b>SCALE:</b>	AS SHOWN
<b>DATE:</b>	JANUARY 2024
<b>DRAWN BY:</b>	DB/JP
<b>FILE NAME:</b>	G2S23256B.dwg



## **Appendix B: Borehole Logs**

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.57 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.20	TOPSOIL: ~200 mm	170.37		S1A	SS	8	▲					
0.80	FILL: Clayey silt, brown, some sand to sandy, trace to some gravel, moist	169.77		S1B	SS							
2	CLAYEY SILT TILL: Brown, some sand, trace gravel, reworked appearance at top portion, moist, very stiff to hard			S2	SS	25	▲					
2.3		168.27		S3	SS	31	▲					
3	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist to wet, dense to very dense			S4	SS	50						
4				S5	SS	69						
4.6		165.97		S6	SS	50						
5	becoming grey			S7	SS	63						
6				S8	SS	34	▲					
8		162.37		S9	SS	37	▲					

Borehole terminated at 8.2 m.

Upon completion of drilling  
Wet cave at 7.3 m  
No free water



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 171.06 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	171.04		S1	SS	17	▲		●	0/0		
0.80	FILL: Clayey silt, dark brown and brown, some sand, some gravel, moist occasional sandy silt layers	170.26		S2	SS	15	▲		●	0/0		
				S3	SS	10	▲		●	0/0		
				S4	SS	41		▲	●	0/0		
3.0	CLAYEY SILT/SILTY CLAY TILL: Brown, trace sand to sandy, trace gravel, moist, hard	168.06		S5	SS	31		▲	●	0/0		0 8 46 46
				S6	SS	71		>>▲	●	0/0		
				S7	SS	57		>>▲	●	0/0		0 13 60 27
				S8	SS	39		▲	●	0/0		
7.6		163.46										
8.2	SILTY SAND/SANDY SILT: Grey, moist, dense	162.86		S9	SS	50		▲	●	0/0		0 54 43 3

Borehole terminated at 8.2 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.77 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30				
0.30	TOPSOIL: ~300 mm	170.47		S1A	SS	6	▲			0/0		Stickup protective casing set in concrete
1	FILL: Sandy silt, brown to dark brown, trace gravel, moist			S1B					●	0/0		
1.5		169.27		S2	SS	8	▲		●	0/0		
2	becoming clayey silt, brown, trace sand, moist			S3	SS	7	▲		●	0/0		Bentonite seal
3		167.77		S4	SS	18	▲		●	0/0		
4	CLAYEY SILT TO SILTY CLAY TILL: Greyish brown to grey, trace sand, trace gravel, rust-stained, moist to very moist, hard			S5	SS	63		>>▲	●	0/0		
5				S6	SS	51		>>▲	●	0/0		Filter sand
6				S7	SS	53		>>▲	●	0/0		
6.1	occasional wet sand seams	164.67		S8	SS	69		>>▲	●	0/0		Slotted screen
8				S9	SS	38	▲		●	0/0		
8.2		162.57										

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	3.62	167.15
2023-09-18	4.04	166.73
2023-10-26	5.64	165.13

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.36 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30 40	PL MC LL			
0.13	TOPSOIL: ~125 mm	170.24		S1	SS	12	▲		●	0/0		Stickup protective casing set in concrete
1	FILL: Silty clay, dark brown and brown, trace sand, trace gravel, moist			S2	SS	48		▲	●	0/0		
1.7		168.66		S3A	SS	50		▲	●	0/0		
2	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist, very dense			S3B	SS	50		▲	●	0/0		
3				S4	SS	50		▲	●	0/0		Bentonite seal
4				S5	SS	50		▲	●	0/0		3 51 40 6
5				S6	SS	74		▲	●	0/0		
4.6		165.76		S7	SS	51		▲	●	0/0		Filter sand
6	becoming greyish brown, very moist			S8	SS	51		▲	●	0/0		Slotted screen
8				S9	SS	56		▲	●	0/0		
8.2		162.16										

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	6.85	163.51
2023-09-18	6.99	163.37
2023-10-26	7.10	163.26



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 170.95 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	170.80		S1A	SS	12	▲	△		0/0		
1	FILL: Sandy silt, brown, some gravel, trace clay, moist			S1B	SS					0/0		
1.5		169.45		S2	SS	8	▲			0/0		
2	becoming clayey silt, dark brown and brown, trace sand, trace gravel, moist			S3	SS	16	▲			0/0		
2.3		168.65		S4	SS	33				0/0		
3	CLAYEY SILT TILL: Brown, trace to some sand, trace to some gravel, moist, hard			S5	SS	50				0/0		
3.8		167.15		S6	SS	50				0/0		
4	becoming grey			S7	SS	50				0/0		
4.6		166.35		S8	SS	46				0/0		
5	SILTY SAND TO SANDY SILT TILL: Grey, trace to some gravel, moist to wet, dense to very dense			S9	SS	50				0/0		13 34 40 13
6												
7												
7.8		163.15								0/0		4 46 44 6

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.90 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL	
							N values	CPT values					
							10	20					30
							Undrained Shear Strength (kPa)						
							Pocket Penetrometer	Vane					
							40	80	120	160			
									PL	MC	LL		
									10	20	30		
0.18	TOPSOIL: ~175 mm	170.73		S1	SS	5	▲			●	0/0		
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist			S2	SS	15		▲		●	0/0		
1.5		169.40											
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	168.80		S3	SS	19		▲		●	0/0		
2.1													
Upon completion of drilling													

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.88 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values CPT values 10 20 30 40	MOISTURE / PLASTICITY Undrained Shear Strength (kPa) Pocket Penetrometer Vane 40 80 120 160	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							PL MC LL				
0.05	TOPSOIL: ~50 mm	169.83		S1	SS	10	▲	●	0/0		
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist			S2	SS	12	▲	●	0/0		
1.5		168.38									
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	167.78		S3	SS	27	▲	●	0/0		
2.1											

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.47 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES**

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	170.45		S1	SS	7	▲	△	PL MC LL	0/0		
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, trace clay, moist	169.67		S2	SS	16	▲	△		0/0		
2	CLAYEY SILT TILL: Brown, trace sand, some gravel, reworked appearance at top portion, moist, very stiff			S3	SS	25	▲	△		0/0		
2.4		168.05		S4A S4B	SS	52	>>▲	△		0/0		
3	SANDY SILT / SILTY SAND TILL: Brown, trace gravel, moist to wet, dense to very dense			S5	SS	59	>>▲	△		0/0		1 45 50 4
4				S6	SS	49	▲	△		0/0		
4.6		165.87		S7	SS	53	>>▲	△		0/0		
5	becoming grey											
6				S8	SS	54	>>▲	△		0/0		
7												
7.8		162.67		S9	SS	50	50/150 mm ▲	△		0/0		

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.71 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	170.56		S1A	SS	12	▲	△	PL MC LL	0/0	Stickup protective casing set in concrete	
1	FILL: Sandy silt, dark brown and brown, trace clay, trace gravel, moist			S1B	SS					0/0		
1.5		169.21		S2	SS	24	▲	△		0/0		
2	CLAYEY SILT TILL: Brown, trace to some sand, trace gravel, moist, very stiff to hard			S3	SS	21	▲	△		0/0		
3				S4	SS	45		△		0/0		
3.8		166.91		S5	SS	71		>>▲		0/0		
4	SILTY SAND/SANDY SILT TILL: Brown, moist to wet, dense to very dense			S6	SS	63		>>▲		0/0		
4.6	becoming grey	166.11		S7	SS	46		▲		0/0		
5										0/0		
6				S8	SS	77		>>▲		0/0		
7										0/0		
7.8		162.91		S9	SS	50		50/150 mm		0/0		




Borehole terminated at 7.8 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	7.16	163.55
2023-09-18	7.29	163.42
2023-10-26	7.41	163.30



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.85 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES	MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL			
							N values					CPT values		
							10					20	30	40
							Undrained Shear Strength (kPa)							
							Pocket Penetrometer	Vane	PL MC LL					
							40	80	120	160	10	20	30	
0.18	TOPSOIL: ~175 mm	169.68		S1A	SS	10	▲		●	0/0				
1	FILL: Clayey silt, brown to dark brown, trace to some sand, trace gravel, moist			S1B										
1.5		168.35		S2	SS	36		▲	●	0/0				
2	SILTY SAND TILL: Light brown to brown, trace gravel, reworked	167.75		S3	SS	49			▲	●	0/0			
2.1														

Upon completion of drilling  
No cave  
No free water



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 170.26 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values CPT values	MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							10 20 30 40				
							Undrained Shear Strength (kPa) Pocket Penetrometer Vane				
							40 80 120 160	PL MC LL 10 20 30			
0.05	TOPSOIL: ~50 mm	170.21		S1	SS	8	▲	●	0/0		
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, moist	169.46									
	CLAYEY SILT TILL: Brown, trace sand, trace gravel, moist, very stiff to hard			S2	SS	27	▲	●	0/0		
1.7		168.56		S3	SS	50	▲	●	0/0		

Borehole terminated at 1.7 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** Vacant land parcel west of 3010 The Collegeway, Mississauga  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 169.17 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA    SI & CL		
							▲	△						
							Undrained Shear Strength (kPa)							
							Pocket Penetrometer	Vane						
							40	80    120    160	PL    MC    LL	10    20    30				
0.13	TOPSOIL: ~125 mm	169.05		S1A	SS	8	▲			●	0/0			
	FILL: Clayey silt, brown, some sand, trace gravel, moist			S1B										
1														
1.5		167.67		S2	SS	50			50/50 mm	▲	●	0/0		
2														
2.1	CLAYEY SILT TILL: Brown, trace sand, trace gravel, moist, very stiff to hard	167.07		S3	SS	36	▲			●	0/0			

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

## **Appendix C: Well Records**

# Water Well Records

November 6, 2023

9:11:13 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
MISSISSAUGA CITY	17 605601 4820680 W	2020-03 7644	2		///:	MT	0010 10	7355803 (Z329404) A171458	BRWN SAND TILL 0020
MISSISSAUGA CITY	17 605597 4820671 W	2020-03 7644	2		///:	MT	0005 10	7355802 (Z329405) A171461	BRWN SAND TILL 0015
MISSISSAUGA CITY	17 605604 4820653 W	2020-03 7644	2		///:	MT	0005 10	7355800 (Z329407) A291648	BRWN SAND TILL 0015
MISSISSAUGA CITY	17 605627 4820665 W	2020-03 7644	2		///:	MT	0005 10	7355799 (Z334446) A261649	BRWN SAND TILL 0015
MISSISSAUGA CITY	17 605687 4820470 W	2009-11 6988	2.00			TH	0015 5	7136494 (M04129) A087089	BRWN SAND SILT 0020
MISSISSAUGA CITY (TR	17 605597 4820620 W	2020-03 7644	2	UT 0015	///:	MT	0007 10	7360071 (Z334476) A291661	BRWN FILL 0003 BRWN SAND SILT 0007 GREY SAND SILT 0017
MISSISSAUGA CITY (TR	17 605610 4820584 W	2018-02 7472						7312086 (Z277243) A	
MISSISSAUGA CITY (TR	17 605610 4820584 W	2017-04 7472	2			MO	0010 10	7287391 (Z259497) A222943	BLCK STNS HARD 0001 BRWN STNS SAND HARD 0006 GREY SHLE CLAY HARD 0020
MISSISSAUGA CITY (TR	17 605661 4820398 W	2017-03 6926						7286585 (C37034) A201273 P	
MISSISSAUGA CITY (TR	17 605637 4820439 W	2016-09 6926						7278341 (C35866) A201273 P	
MISSISSAUGA CITY (TR	17 605575 4820484 W	2013-10 7464						7225159 (C23326) A154567 P	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
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Notes:  
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid  
DATE CNTR: Date Work Completedand Well Contractor Licence Number  
CASING DIA: .Casing diameter in inches  
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes  
WELL USE: See Table 3 for Meaning of Code  
SCREEN: Screen Depth and Length in feet  
WELL: WEL ( AUDIT # ) Well Tag . A: Abandonment; P: Partial Data Entry Only  
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYP SUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDY OAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

## **Appendix D: Grain Size Analysis**

**Project No.:** G2S23256A

**Lab No.:** 23072A

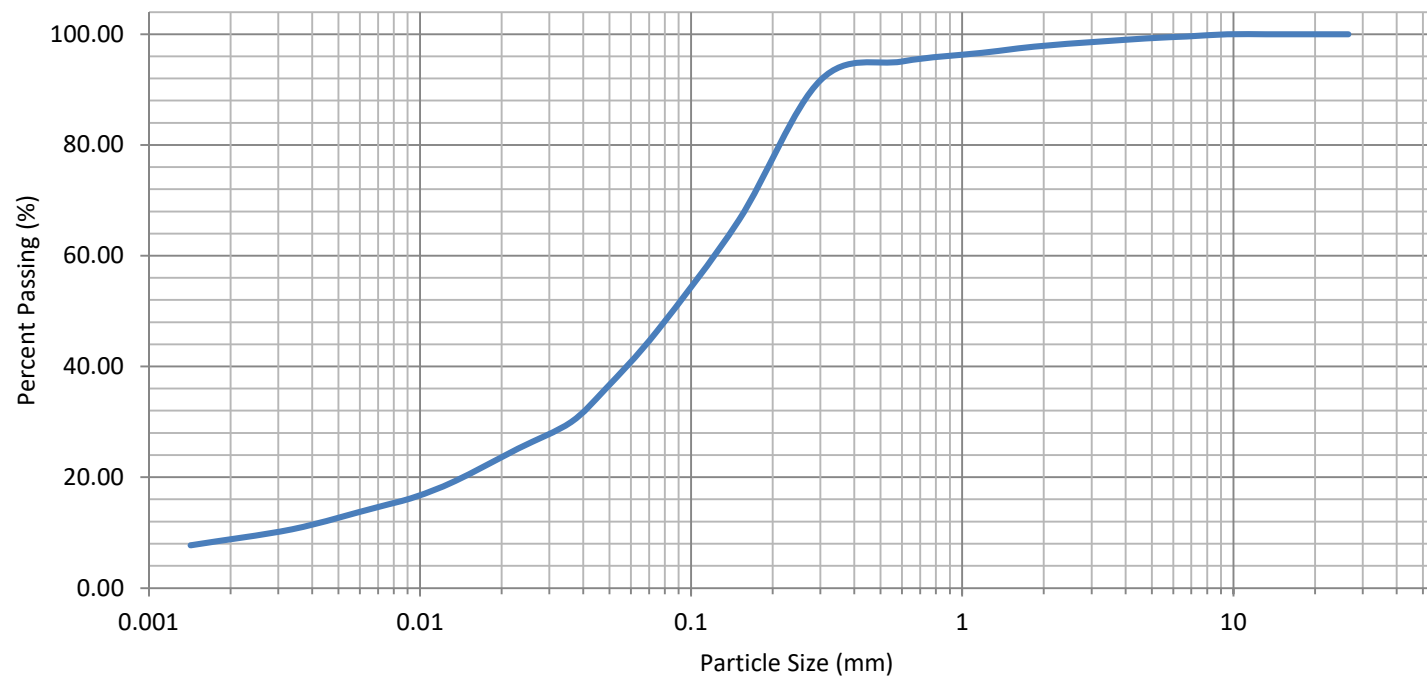
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** TP1-GS1

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"





**Project No.:** G2S23256A

**Lab No.:** 23072B

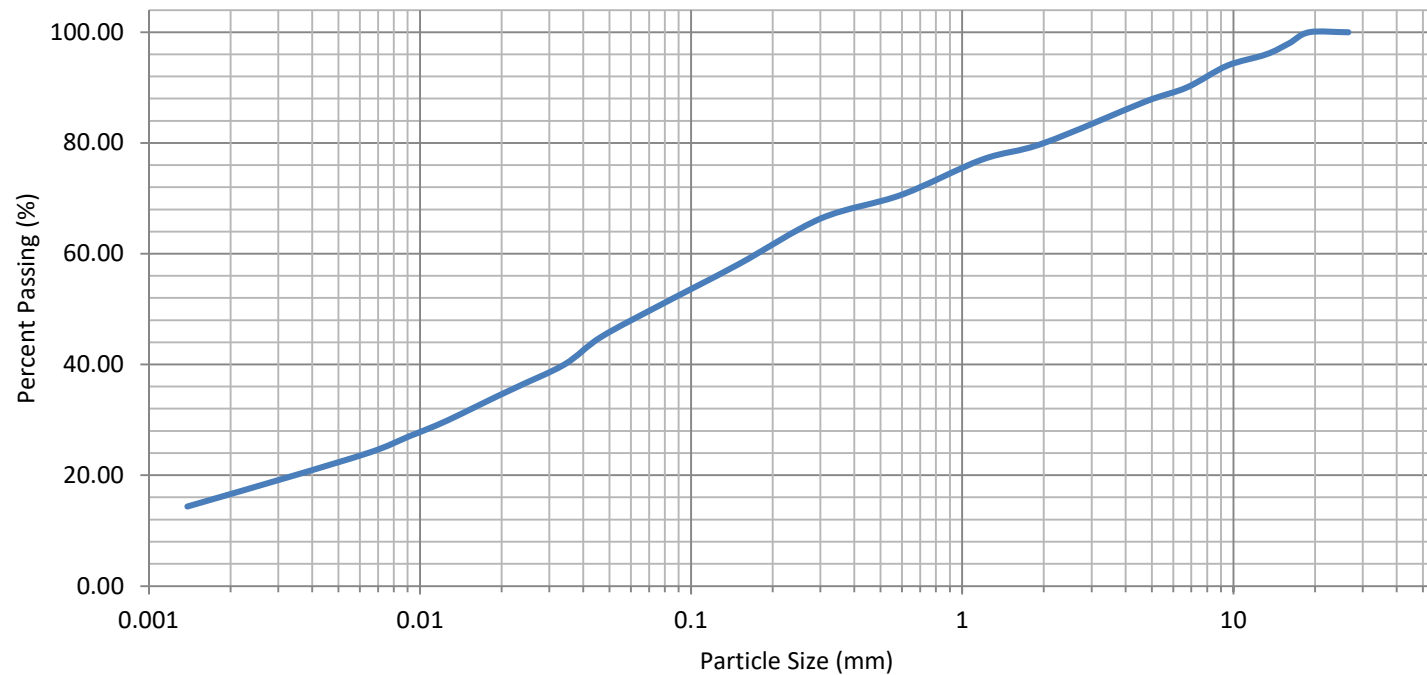
**Project Name:** The City of Mississauga Fire Station 123

**Borehole/Sample No.:** TP2-GS1

ISSMGE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL		
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE

SIEVE SIZE: 1 2 6 20 60#200 #100 #50 #16 #8 #4 3/8" 3/4" 2-1/2"



## **Appendix E: Infiltration Report**



November 13, 2023

G2S Environmental Consulting Inc.  
4361 Harvester Road, Unit 12  
Burlington, ON  
L7L 5M4  
ATTN: Melissa King

Re: 3010 The Collegeway  
Mississauga, ON  
Soil Infiltration Assessment  
Project 10272  
REVISION 1

Hydrogeology Consulting Services Inc. (HCS) was retained by G2S Environmental Consulting Inc. to assess the near-surface soil infiltration capacity at the above-referenced property.

### **Double Ring Infiltrometer Results**

A double ring infiltrometer (DRI) from AMS Samplers was used to assess the surficial soil infiltration rate at the two locations shown on the attached Drawing 1 on October 11, 2023. At the time of testing the ground was not frozen. Surface vegetation, topsoil, and overburden material were excavated at the test locations to a depth of approximately 0.91 mBGS using an excavator to allow the DRI to seat into the native soils. It is important to consider that factors such as roots and wormholes (which create preferential pathways for infiltrating water), and rocks and debris (which can prevent a proper seal of the infiltrometer rings into the soil and cause escape of water under the bottom of the ring) can result in erroneously high measured infiltration rates.

Water was added to the outer ring of the DRI during the test to maintain a vertical "curtain" of saturated soil around the inner ring. This curtain of saturated soil ensured that the DRI test only measured vertical percolation of water through the soil matrix beneath the inner ring. The water level of the outer ring was monitored to ensure it remained similar to the water level in the inner ring during the test. Water was added to the inner ring and the rate of infiltration timed with a stopwatch at regular intervals by measuring the drop in water level inside the inner ring. When the rate of change of water level reached an equilibrium, the test was considered complete.

The Toronto Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) provide a method of assessing soil infiltration rate in the Low Impact Development (LID) Stormwater Management (SWM) Planning and Design Guide (TRCA and CVC, 2010). Following the methodology outlined in Appendix C of the Guide the measured infiltration rates from the DRI tests were factored. Additionally, an estimated soil "T-Time" value based on the Ontario Building Code (OBC) classifications for major soil types is provided.

The measured and estimated factored soil infiltration rates, plus OBC T-Time values, are included in Table 1 below.

Table 1: Calculated Estimated Soil Infiltration Rates and T-Times

DRI Test Location	Measured Soil Infiltration Rate – <u>Unfactored</u> (mm/hr)	Estimated Soil T-Time (mins/cm) (OBC)	Estimated Soil Infiltration Rate – Factored * (mm/hr)
DRI-01-23 (silt and sand)	52.4	17-25	21.0
DRI 02-23 (silt and sand, some gravel)	11.5	20-30	4.6

\* - Factor of 2.5 applied

As shown in Table 1 it is important to consider that the LID SWM Planning and Design Guide requires implementation a Safety Correction factor to calculate “Design Infiltration Rates” (e.g. for subdivision soakaway pits and infiltration galleries). The measured unfactored rates listed in the table are considered reasonable for comparative purposes and for design of sewage effluent leaching beds, while the factored rates would be applicable for design of high volume infiltration facilities.

The factored infiltration values show the near-surface native silt and sand deposits underlying topsoil beneath the subject property have a moderate to low infiltration rate, varying quite significantly between the two tested areas.

## Grain Size Analysis Results

A sample of soil from each DRI test pit collected during excavation was submitted for analysis of particle size distribution (grain size). As shown on the appended grain size analysis graph, the near-surface soil consists of sandy silt. The grain size analysis results were used to estimate soil hydraulic conductivity (K) values by applying the Kaubisch, Breyer, Hazen, and Kozeny-Carman formulae where appropriate based on the limitations of each formula. The hydraulic conductivity estimates are summarized in Table 2 below:

Table 2: Calculated soil hydraulic conductivity values

Location	Sample Depth (mBGS)	Analysis Method	Hydraulic Conductivity (m/sec)
DRI-01-23	0.91	Kaubisch	$2.1 \times 10^{-8}$
DRI 02-23	0.91	Kaubisch	$6.3 \times 10^{-9}$

The hydraulic conductivity values of  $2.8 \times 10^{-11}$  to  $6.0 \times 10^{-10}$  m/sec indicates a low permeability.

The hydraulic conductivity estimates from the grain size analysis correlate relatively well with published ranges for major soil types (Freeze and Cherry, 1979); however, it is noted the grain size analyses suggest a significantly lower permeability than the DRI test results.

As discussed previously, there are many factors which can influence DRI tests and cause anomalously higher percolation rates to be measured. It is suggested the test results from DRI 02-23 and from the grain size analyses should be considered more accurate for the purposes of assessing on-site infiltration potential.

### Soil Infiltration Rate and T-Time Calculations – Grain Size Analysis Results

The Toronto Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) provide a method of assessing soil infiltration rate in the Low Impact Development (LID) Stormwater Management (SWM) Planning and Design Guide (TRCA and CVC, 2010). Following the methodology outlined in Appendix C of the Guide the highest and lowest estimated soil hydraulic conductivity values from Table 2 above were converted into the infiltration rate listed in Table 3 below. Additionally, an estimated soil “T-Time” value based on the Ontario Building Code (OBC) classifications for major soil types is provided.

Table 3: Estimated Soil Infiltration Rates from Grain Size Analysis Hydraulic Conductivity Values

Borehole Location and Sample Depth (m)	Estimated Soil Infiltration Rate – <u>Unfactored</u> (mm/hr)	Estimated Soil T-Time (mins/cm) (OBC)	Estimated Soil Infiltration Rate – Factored * (mm/hr)
DRI-02-23 (lowest)	10	17-25	<5
DRI 01-23 (highest)	17	20-30	6.8

\* - Factor of 2.5 applied

As discussed previously it is important to consider the LID SWM Planning and Design Guide requires implementation of a Safety Correction factor to calculate “Design Infiltration Rates” (e.g. for subdivision soakaway pits and infiltration galleries). The measured unfactored rates listed in the table are considered reasonable for comparative purposes and for design of sewage effluent leaching beds, while the factored rates would be applicable for design of high volume infiltration facilities.

The factored infiltration value shows the near-surface native soil deposits underlying topsoil beneath the subject property have a very low infiltration rate, with three of the four calculated rates notably lower than the DRI-estimated infiltration rate for DRI-01-23. The rates listed in Table 3 can be considered more conservative for the purposes of infiltration facility design as the empirical test data from grain size analyses is not subject to the potential issues that can occur with DRI testing.



I trust this information is sufficient for your present requirements. If any further questions or comments arise, please feel free to contact me directly.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Chris Helmer', is written over the 'Respectfully submitted,' text.



Chris Helmer, B.Sc., P.Geo.  
Senior Hydrogeologist  
MECP Licensed Well Contractor and Class 5 Well Technician  
[www.hydrog.ca](http://www.hydrog.ca)

encl. Drawing 1 – Location Plan  
encl. Grain Size Analysis Graphs

September 21, 2023

Reference No. G2S23256C

City of Mississauga  
300 City Centre Drive  
Mississauga, ON L5B 3C1  
c/o Sebastian Lubczynski, Senior Architect  
DPAI Architecture Inc.

**Soil Characterization Report (SCR)  
City of Mississauga Fire Station 123  
3050 The Collegeway  
Mississauga, Ontario**

G2S Consulting Inc. (G2S) was retained by the City of Mississauga (the Client) to complete a Soil Characterization Report (SCR) for the proposed location of City of Mississauga Fire Station 123 at 3050 The Collegeway in Mississauga, Ontario, hereinafter referred to as the 'Project Area'. Authorization to proceed with this SCR was given by Sebastian Lubczynski of DPAI Architecture Inc. on behalf of City of Mississauga.

It is noted that the SCR was prepared in general accordance with the City's standard due diligence requirements for soil characterization.

## **1. Introduction**

The Project Area comprises a near rectangular shaped parcel that covers an approximate plan area of 0.39 ha (0.97 ac). The proposed development of the Project Area includes the construction of a single-storey fire station building with a fire crew area and an apparatus bay. Preliminary analysis conducted by the Client indicated that the estimated in-place volume of excess soil to be generated is approximately **1,800 to 2,500 m<sup>3</sup>**. Refer to Drawing 1 in Appendix A for the Excess Soil Location Plan.

The purpose of the current assignment was to check the chemical quality of excess soil compared to the O. Reg. 406/19, as amended Excess Soil Quality Standards (ESQS) for various property uses and O. Reg. 153/04 standards for the Project Area. Based on the results, comments regarding reuse and/or disposal options of the excess soils are provided. It is noted that G2S did not assess the ESQS to the applicable to the Reuse Site (Receiving Site), which is unknown at this time.

## **2. Excess Soil**

The Ministry of the Environment, Conservation and Parks (MECP) introduced a new On-Site and Excess Soil Management Regulation (O. Reg. 406/19, as amended) and Rules for Soil Management and Excess Soil Quality Standards, December 8, 2020. The regulation changes the definition of soil as a waste unless it is being transported for beneficial reuse. Soil quality must meet the new ESQS and the quantity of soil must be consistent with the beneficial reuse specified for a Reuse Site (Receiving Site).

### 3. Background Information

The following report was completed by others for the Project Area:

- Phase One Environmental Site Assessment, The Collegeway and Loyalist Drive, Mississauga, Ontario, prepared by Patriot Engineering Ltd. for the City of Mississauga, Project Ref.: 41108, dated February 19, 2021.

At the time of the Phase One Environmental Site Assessment (ESA), the Project Area was vacant, undeveloped land. The Phase One ESA identified two Potentially Contaminating Activities (PCAs) within the Project Area and several PCAs within the Study Area, which were assessed based on observations of the operations, their location relative to the Project Area with respect to the inferred groundwater flow direction, their tenure, expected chemical storage amounts, and proposed excavation depth of the excess soil. Based on review and evaluation of the information gathered, the following Areas of Potential Environmental Concern (APECs) were identified for the Project Area:

APEC 1: Western edge of Project Area – Hydraulic oil spill of 50 litres in 2015.

APEC 2: Entire Project Area – Historical use of pesticides associated with farming on-Site.

APEC 3: Northwestern and northeastern portions of Project Area – Storage and handling of hazardous materials at off-Site properties (2686 The Collegeway and 3521 Loyalist Drive).

APEC 4: Northeastern portion of Project Area – Underground storage tanks (USTs) located at 3425 Winston Churchill Boulevard; gasoline spills of 30 and 140 litres at the property in 1995 and 1996, respectively.

APEC 6: Entire Project Area – Historical use of adjacent properties for agricultural use associated with pesticides.

Based on our review of the above report and as requested in the RFP, the following parameters were recommended to be investigated:

- Metals including hydride-forming metals including arsenic (As), selenium (Se) and antimony (Sb)
- Petroleum hydrocarbon (PHC) fractions F1 to F4
- Benzene, toluene, ethylbenzene and xylenes (BTEX)
- Electrical conductivity (EC) and sodium adsorption ratio (SAR)
- Organochlorine (OC) pesticides
- Semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs)
- Toxicity characteristic leaching procedure (TCLP)

It is noted that per the City's SOP, modified synthetic precipitation leaching procedure (mSPLP) analysis was not required.



## 4. Scope of Work

The drilling for this investigation was conducted on August 17 and August 18, 2023. Twelve boreholes were advanced at the Project Area and labelled as BH101 to BH112.

The drilling was completed by Pontil Drilling Services Inc. (Pontil), a licensed well contractor, working under the supervision of G2S staff. The boreholes were sampled at regular depth intervals and were advanced with a CME 75 track-mounted drill rig to depths between 1.7 and 8.2 m below ground surface (bgs). The borehole locations were chosen by G2S based on the locations provided in the Request for Proposal (RFP), coverage of the area to be excavated, and the locations of buried utility services.

Reference is made to the appended Drawing 2 in Appendix A for a visual depiction of the borehole locations, and Appendix B for the borehole logs.

Disposable nitrile gloves (one per sample) were used during sample collection. New laboratory-supplied glass jars with Teflon-lined lids were filled with a portion of each soil sample. The jars and vials were then sealed and placed in a cooler with ice packs for storage and transportation. Sample cores for analysis of volatiles were collected using a 5-gram Eze-Core soil sampler. The soil cores were immediately placed into a methanol vial (pre-filled and weighed with 10 mL purge & trap grade methanol). The remaining soil sample was placed in a sealable plastic bag and allowed to reach ambient temperature prior to field screening for the presence of organic vapours.

As part of the environmental procedural protocol, soil samples at each borehole location were examined for visual and olfactory evidence of potential contamination. Organic vapours were measured in the bagged soil samples, using an RKI Eagle 2 gas detector, equipped with a catalytic combustible gas sensor, calibrated to hexane, and a Photo Ionization Detector (PID) sensor, calibrated to isobutylene (IBL).

## 5. Selection of Assessment Criteria

### 5.1 Applicable Site Condition Standard for Reuse (Within the Project Area)

The assessment criteria applicable to a given site in Ontario are provided in the MECP document entitled "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", dated April 15, 2011. Standards are provided in Tables 1 to 9 in the document. These standards are based on site sensitivity, groundwater use, property use, soil type and restoration depth.

For the Project Area, G2S selected the Full Depth Background Table 3 Site Condition Standards (SCS) for Residential/Parkland/Institutional (RPI) Property Use, with coarse textured soils. The selection of this category is based on the following factors:

- There is no intention to carry out stratified restoration at the Site.
- The more stringent coarse textured soil was utilized since the beneficial reuse site is unknown.
- The Project Area is not located within 30 metres of a permanent water body.
- The Project Area is not considered Environmentally Sensitive based on:

- Areas of Natural Significance are not located within the Project Area or within the Study Area.
- The potable groundwater condition does not apply to the Project Area based on:
  - The Project Area and properties within 250 m of the Site are serviced by a municipal supply.
- Based on the findings of this investigation, the following can be confirmed within respect to Sections 41 and 43.1 of O. Reg. 153/04, as amended:
  - The Project Area is not a shallow soil property, as defined in Section 43.1 of O. Reg. 153/04, as amended, since bedrock was not encountered within 2 m bgs.
  - The Project Area is not Environmentally Sensitive as defined in Section 41 of O. Reg. 153/04, as amended.

## **5.2 Excess Soil Quality Standards (ESQS) for Reuse Outside the Project Area (Potential Reuse Sites)**

The MECP has developed Generic ESQS for use with the Rules for Soil Management and Excess Soil Quality Standards (December 2020) under O. Reg. 406/19, as amended. The ESQS consist of nine tables (Table 1 through Table 9.1) that provide criteria for maximum concentrations of various contaminants. In general, the applicable Table and ESQS depend on the Reuse Site (Receiving Site) location, land use, soil texture, bedrock depth, soil pH, and source of potable water at the Reuse Site (Receiving Site).

For reuse with minimal environmental restrictions, the O. Reg. 406/19, as amended, Full Depth Background Table 1 ESQS for residential/parkland/institutional/industrial/commercial/community (RPI/ICC) property uses were considered applicable.

For the option of reusing the excess soil at a Reuse Site (Receiving Site) with a non-potable groundwater condition, the O. Reg. 406/19, Table 3.1 Full Depth Generic ESQS were considered applicable for RPI and ICC property uses.

It is noted that a comparison to other tables within O. Reg. 406/19, as amended, was outside of G2S's scope for this assignment. If the potential Reuse Site (Receiving Site) for excess soil falls within another category, additional evaluation by G2S will be required to confirm conformance.

## **6. Chemical Testing Protocol**

In accordance with the proposal, soil samples were submitted under Chain of Custody protocols to Paracel Laboratories (Paracel) in Hamilton, Ontario. Paracel is accredited by the Standards Council of Canada/Canadian Association of Environmental Analytical Laboratories in accordance with ISO/IEC 17025:1999 – "General Requirements for the Competence of Testing and Calibration Laboratories".

The soil samples were submitted for chemical testing for the parameters outlined in O. Reg. 406/19 and included metals, EC, SAR, PHCs F1 to F4, including BTEX, VOCs, SVOCs, and OC pesticides. As well, one sample was submitted for testing in accordance with O. Reg. 347, Schedule 4, as amended, for TCLP (metals and inorganics, ignitability, VOCs, SVOCs,

including polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs). TCLP testing classifies a material for landfill disposal purposes.

The following table is a summary of the samples submitted:

**Table 1: Soil Samples Submitted for Laboratory Analysis**

Sample ID	Approx. Depth (m bgs)	Material Description	Sample Identification					
			Metals	PHCs F1-F4 + BTEX	EC/SAR	VOCs and SVOCs	OCPs	TCLP
BH101 S2	0.8 – 1.4	Clayey silt till	✓	✓	✓		✓	
BH103 S5	3.0 – 3.6	Clayey silt to silty clay till	✓	✓	✓	✓	✓	
BH104 S1	0.1 – 0.6	Fill	✓	✓	✓	✓	✓	
BH105 S2	0.8 – 1.4	Fill	✓	✓	✓		✓	
BH108 S1	0.03 – 0.8	Fill	✓	✓	✓	✓	✓	
BH109 S4	2.3 – 2.9	Clayey silt till	✓	✓	✓		✓	
TCLP-1	Composite sample	Clayey silt, sandy silt, silty sand						✓

## 7. Subsurface Findings

### Topsoil

A surficial veneer of topsoil and organic material with thicknesses ranging between approximately 25 to 300 millimetres was encountered in each of the boreholes (BH101 to BH112).

### Fill

Fill material was encountered below the topsoil in each of the boreholes. The fill consisted generally of clayey silt/silty clay or sandy silt/silty sand. Organic material was indicated within the fill layer at the locations of BH106 to BH108 and BH111. The fill material extended to depths ranging between 0.8 and 3.0 m bgs.

### Clayey Silt

Clayey silt/silty clay was encountered beneath the fill in BH106 and BH107. This deposit extended to a depth of termination at approximately 2.1 m bgs. The clayey silt was found to contain a trace of gravel and had a reworked appearance at the top portion.

### Clayey Silt/Silty Clay Till

Clayey silt/silty clay till was encountered beneath the fill in boreholes BH101 to BH103, BH105, BH108, BH109, BH111, and BH112, and extended to depths ranging between approximately 1.7 and 8.2 m bgs. Boreholes BH103, BH111, and BH112 were terminated in this deposit. The clayey silt/silty clay till was found to contain trace to some sand, trace to some gravel, and had reworked appearance at the top portion.

### Silty Sand/Sandy Silt Till

Silty sand/sandy silt till material was encountered beneath the clayey silt/silty clay till in boreholes BH101, BH102, BH105, BH108, and BH109, and beneath the fill in BH104 and BH110, and extended to depths ranging from 2.1 and 8.2 m bgs. Boreholes BH101, BH102, BH104, BH105, BH108 to BH110 were terminated in this deposit.

### Vapour Screening

Organic vapour concentrations were measured in the headspace of the recovered soil samples using an RKI Eagle Portable Gas Detector and PID, which detects a combination of combustible gases in parts per million (ppm). There are no regulatory criteria for soil vapours; however, soil vapours are often used as a screening tool to identify VOC and/or PHC impacted soils. The correlation between combustible vapour concentrations and PHCs in soil is highly dependent on the soil type, moisture content and characteristics of the contaminants of potential concern.

The results of screening are used as a tool in establishing relative organic vapours among samples and sampling locations. PID and gas detector values were 0 ppm, which is not considered significant.

## **8. Analytical Findings**

The laboratory certificate of analysis compared to the Table 3 RPI SCS, Table 1 RPI/ICC ESQS, and the Table 3.1 RPI and ICC ESQS for coarse textured soil are included in Appendix C. The measured values and corresponding values (labelled as Criteria) are shown on the certificates of analysis. In the event of an exceedance of the SCS or the ESQS, the level is shown in highlighted text, where applicable.

When compared to Table 3 RPI SCS, the measured concentrations of the tested parameters in the submitted samples met the criteria.

When compared to the Table 1 RPI/ICC ESQS, the measured concentrations of the tested parameters in the submitted samples met the criteria, except for the following:

- Sample BH108 S1 – PHC Fraction F4 value of 121 µg/g exceeds the ESQS of 120 µg/g.

When compared to the Table 3.1 RPI and ICC ESQS for reuse outside the Project Area, the measured concentrations of the tested parameters in the submitted samples met the criteria.

### Waste Characterization

The measured concentrations of the tested metals and inorganic parameters met the Schedule 4 leachate quality criteria, VOCs, SVOCs and PCBs were not detected, and the material was not ignitable. Therefore, the material can be classified as nonhazardous.

## **9. Assessment of Analytical Findings and Conclusions**

The purpose of the current assignment was to check the chemical quality of excess soil to provide comments regarding reuse and/or disposal options.

### Reuse within the Project Area

The soil tested met the O. Reg. 153/04, as amended, Table 3 RPI SCS for the parameters tested.

Reuse of the excavated soil within the Project Area is acceptable, subject to acceptance by the geotechnical consultant at the time of construction based on geotechnical considerations.

### Reuse outside of the Project Area

The soil tested did not meet the O. Reg 406/19, as amended, Table 1 RPI/ICC ESQS, therefore certain handling restrictions will apply.

The soil tested met the O. Reg 406/19, as amended, Table 3.1 RPI and ICC ESQS for off-site use.

### Guidelines for Off-Site Reuse

If the excess soil is to be removed from the Project Area for reuse, the following conditions must be met:

- i. The excess soil is not taken to a property that is environmentally sensitive as defined in O. Reg. 153/04, as amended.
- ii. The work must be completed in accordance with local by-laws and Regulations governing soil movement and/or placement at the Reuse Site (Receiving Site).
- iii. All analytical results and environmental assessment reports must be fully disclosed to the Reuse Site (Receiving Site) owners/authorities/Qualified Person (QP), and they have agreed in writing to receive the material. The chemical testing requirements for various Reuse Site (Receiving Site) is site-specific and additional testing may be required, beyond that provided in this report.
- iv. Transportation and placement of the excess soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site.
- v. The excavation work, for any amount of excess soil, must be completed in accordance with O. Reg. 406/19, as amended to ensure that all excess excavated material is tested

and managed appropriately, and that imported fill material is of suitable quality and meets the ESQS applicable to the Project Area. Reuse of excess excavated soil within the Project Area or at a reuse site is also subject to acceptance for reuse by the geotechnical consultant at the time of construction based on geotechnical considerations.

It is noted that despite any chemical testing program, ultimate acceptance of excess soil lies with the Reuse Site (Receiving Site) and their written approval to receive the material, based on review of the reports provided.

## **10. Limitations**

Any use which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. G2S accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report. The findings in this report are limited to the conditions within the Project Area at the time of this investigation as described herein. Conclusions presented in this report should not be construed as legal advice. If the Project Area conditions or applicable standards change or if any additional information becomes available at a future date, changes to the findings, conclusions and recommendations in this report may be necessary.

It should be noted that the soil conditions between and beyond the sampled locations may differ from those encountered during this assignment.

## **11. Closing Remarks**

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

**G2S Consulting Inc.**

**DRAFT**

Hailey Perras, B.Sc.  
Environmental Technician

**DRAFT**

Melissa King, P.Geo., QP<sub>ESA</sub>  
Head of Environmental Services

**DRAFT**

Dana Haslett, B.A.  
Senior Project Manager

### Enclosures

Appendix A: Drawings  
Appendix B: Borehole Logs  
Appendix C: Certificate of Analysis

## **Appendix A: Drawings**





Scale: AS SHOWN  
 Project No.: G2S23256C  
 Date: SEPTEMBER 2023  
 Drawn by: HP/DH  
 File name: G2S23256C

# EXCESS SOIL LOCATION PLAN 3010 THE COLLEGEWAY

MISSISSAUGA

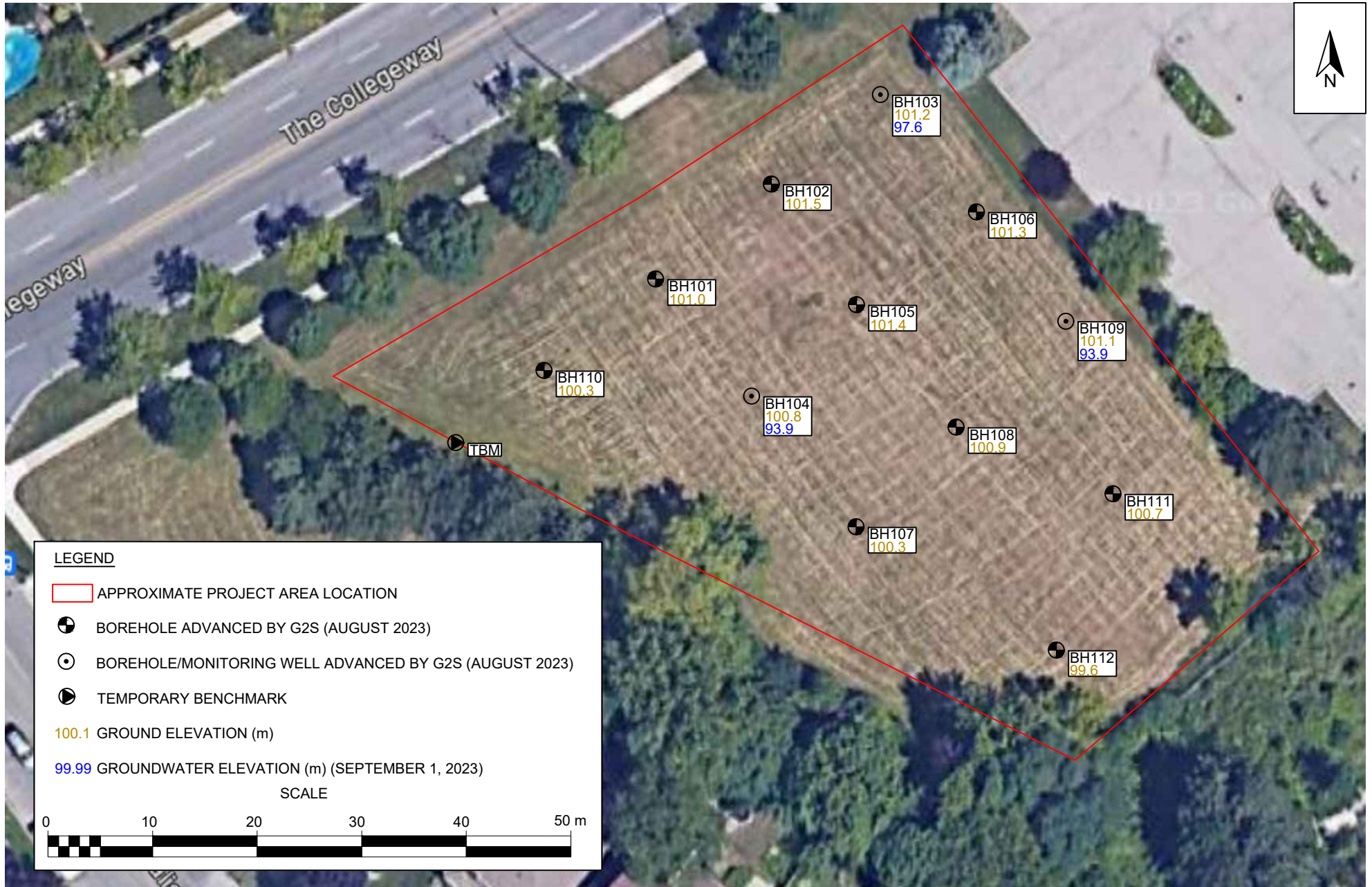
ONTARIO



Drawing No.

1





Scale: AS SHOWN  
 Project No.: G2S23256C  
 Date: SEPTEMBER 2023  
 Drawn by: HP/DH  
 File name: G2S23256C

## BOREHOLE AND MONITORING WELL LOCATION PLAN 3010 THE COLLEGEWAY

MISSISSAUGA

ONTARIO



Drawing No.

2

## **Appendix B: Borehole Logs**

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 101 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30				
									PL MC LL			
									10 20 30			
0.20	TOPSOIL: ~200 mm	100.80		S1A	SS	8						
0.80	FILL: Clayey silt, brown, some sand to sandy, trace to some gravel, moist	100.20		S1B	SS							
2	CLAYEY SILT TILL: Brown, some sand, trace gravel, reworked appearance at top portion, moist, very stiff to hard			S2	SS	25						
				S3	SS	31						
2.3		98.70		S4	SS	50						
3	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist to wet, dense to very dense			S5	SS	69						
4				S6	SS	50						
4.6		96.40		S7	SS	63						
5	becoming grey			S8	SS	34						
8		92.80		S9	SS	37						

Borehole terminated at 8.2 m.

Upon completion of drilling  
Wet cave at 7.3 m  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 101.5 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	101.48		S1	SS	17	▲	△	●	0/0		
0.80	FILL: Clayey silt, dark brown and brown, some sand, some gravel, moist occasional sandy silt layers	100.70		S2	SS	15	▲	△	●	0/0		
				S3	SS	10	▲	△	●	0/0		
				S4	SS	41	▲	△	●	0/0		
3.0		98.50		S5	SS	31	▲	△	●	0/0		0 8 46 46
	CLAYEY SILT/SILTY CLAY TILL: Brown, trace sand to sandy, trace gravel, moist, hard			S6	SS	71	>>▲	△	●	0/0		
				S7	SS	57	>>▲	△	●	0/0		0 13 60 27
				S8	SS	39	▲	△	●	0/0		
7.6		93.90										
8.2	SILTY SAND/SANDY SILT: Grey, moist, dense	93.30		S9	SS	50	▲	△	●	0/0		0 54 43 3

Borehole terminated at 8.2 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 101.2 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer X					
							Vane +					
							40	80	120	160		
									PL	MC	LL	
									10	20	30	
0.30	TOPSOIL: ~300 mm	100.90		S1A	SS	6	▲					Stickup protective casing set in concrete
1	FILL: Sandy silt, brown to dark brown, trace gravel, moist			S1B					●	0/0		
1.5		99.70		S2	SS	8	▲		●	0/0		
2	becoming clayey silt, brown, trace sand, moist			S3	SS	7	▲		●	0/0		Bentonite seal
3		98.20		S4	SS	18	▲		●	0/0		
4	CLAYEY SILT TO SILTY CLAY TILL: Greyish brown to grey, trace sand, trace gravel, rust-stained, moist to very moist, hard			S5	SS	63		>>▲	●	0/0		
5				S6	SS	51		>>▲	●	0/0		Filter sand
6				S7	SS	53		>>▲	●	0/0		
6.1		95.10										
7	occasional wet sand seams			S8	SS	69		>>▲	●	0/0		Slotted screen
8												
8.2		93.00		S9	SS	38	▲		●	0/0		

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	3.60	97.60

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 100.8 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.13	TOPSOIL: ~125 mm	100.68		S1	SS	12	▲	△	PL MC LL	0/0		Stickup protective casing set in concrete
1	FILL: Silty clay, dark brown and brown, trace sand, trace gravel, moist			S2	SS	48				0/0		
1.7		99.10		S3A	SS	50				0/0		
2	SILTY SAND TO SANDY SILT TILL: Light brown to brown, trace gravel, moist, very dense			S3B	SS	50				0/0		
3				S4	SS	50				0/0		Bentonite seal
4				S5	SS	50				0/0		3 51 40 6
4.6		96.20		S6	SS	74				0/0		
5	becoming greyish brown, very moist			S7	SS	51				0/0		Filter sand
6				S8	SS	51				0/0		Slotted screen
8.2		92.60		S9	SS	56				0/0		

Borehole terminated at 8.2 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	6.90	93.90



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-17 **COMPLETED** 23-8-17 **GROUND ELEVATION** 101.4 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	101.25		S1A	SS	12	▲	△		0/0		
1	FILL: Sandy silt, brown, some gravel, trace clay, moist			S1B	SS					0/0		
1.5		99.90		S2	SS	8	▲			0/0		
2	becoming clayey silt, dark brown and brown, trace sand, trace gravel, moist			S3	SS	16	▲			0/0		
2.3		99.10		S4	SS	33				0/0		
3	CLAYEY SILT TILL: Brown, trace to some sand, trace to some gravel, moist, hard			S5	SS	50				0/0		
3.8		97.60		S6	SS	50				0/0		
4.6	becoming grey	96.80		S7	SS	50				0/0		
5	SILTY SAND TO SANDY SILT TILL: Grey, trace to some gravel, moist to wet, dense to very dense			S8	SS	46				0/0		13 34 40 13
6												
7												
7.8		93.60		S9	SS	50				0/0		4 46 44 6

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 101.3 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values	CPT values				
							10 20 30 40	10 20 30 40				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer Vane					
							40 80 120 160	10 20 30				
0.18	TOPSOIL: ~175 mm	101.13		S1	SS	5	▲		●	0/0		
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist			S2	SS	15	▲		●	0/0		
1.5		99.80										
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	99.20		S3	SS	19	▲		●	0/0		
2.1												

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water



**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 100.3 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA   SI & CL
							10    20    30    40					
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer 40    80    120    160	Vane				
									PL    MC    LL 10    20    30			
0.05	TOPSOIL: ~50 mm	100.25		S1	SS	10						
1	FILL: Sandy silt, dark brown and brown, some gravel, trace clay, trace organics, moist											
				S2	SS	12						
1.5		98.80										
2	CLAYEY SILT: Brown, trace gravel, reworked appearance at top portion, moist, very stiff	98.20		S3	SS	27						
2.1												
Upon completion of drilling												

Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 100.9 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.03	TOPSOIL: ~25 mm	100.88		S1	SS	7	▲		●	0/0		
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, trace clay, moist	100.10		S2	SS	16	▲		●	0/0		
	CLAYEY SILT TILL: Brown, trace sand, some gravel, reworked appearance at top portion, moist, very stiff			S3	SS	25	▲		●	0/0		
2.4		98.48		S4A S4B	SS	52		>>▲	●	0/0 0/0		
	SANDY SILT / SILTY SAND TILL: Brown, trace gravel, moist to wet, dense to very dense			S5	SS	59		>>▲	●	0/0		1 45 50 4
				S6	SS	49		▲	●	0/0		
4.6		96.30		S7	SS	53		>>▲	●	0/0		
	becoming grey			S8	SS	54		>>▲	●	0/0		
7.8		93.10		S9	SS	50		50/150 mm ▲	●	0/0		

Borehole terminated at 7.8 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 101.1 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_



DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							N values ▲	CPT values △				
0.15	TOPSOIL: ~150 mm	100.95		S1A	SS	12	▲			0/0		Stickup protective casing set in concrete
1	FILL: Sandy silt, dark brown and brown, trace clay, trace gravel, moist			S1B	SS					0/0		
1.5		99.60		S2	SS	24	▲			0/0		
2	CLAYEY SILT TILL: Brown, trace to some sand, trace gravel, moist, very stiff to hard			S3	SS	21	▲			0/0		Bentonite seal
3				S4	SS	45				0/0		
3.8		97.30		S5	SS	71		>>▲		0/0		
4	SILTY SAND/SANDY SILT TILL: Brown, moist to wet, dense to very dense			S6	SS	63		>>▲		0/0		0 65 31 4 Filter sand
4.6	becoming grey	96.50		S7	SS	46				0/0		
5										0/0		
6				S8	SS	77		>>▲		0/0		Slotted screen
7										0/0		
7.8		93.30		S9	SS	50				0/0		

Borehole terminated at 7.8 m.

Water Level Readings:

Date	Depth (m)	Elev. (m)
2023-09-01	7.20	93.90

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 100.3 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL
							▲	△				
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer    Vane		PL    MC    LL			
							40    80    120    160		10    20    30			
0.18	TOPSOIL: ~175 mm	100.13		S1A	SS	10	▲		●	0/0		
1	FILL: Clayey silt, brown to dark brown, trace to some sand, trace gravel, moist			S1B								
				S2	SS	36		▲	●	0/0		
1.5		98.80										
2	SILTY SAND TILL: Light brown to brown, trace gravel, reworked	98.20		S3	SS	49		▲	●	0/0		
2.1												

Upon completion of drilling  
 No cave  
 No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 100.7 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES N values    CPT values		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA   SI & CL
							10    20    30    40					
							Undrained Shear Strength (kPa)					
							Pocket Penetrometer 40    80    120    160	Vane	PL    MC    LL 10    20    30			
0.05	TOPSOIL: ~50 mm	100.65		S1	SS	8						
0.80	FILL: Sandy silt, dark brown and brown, some gravel, some organics, moist	99.90								0/0		
	CLAYEY SILT TILL: Brown, trace sand, trace gravel, moist, very stiff to hard			S2	SS	27				0/0		
1.7		99.00		S3	SS	50				0/0		

Borehole terminated at 1.7 m.

Upon completion of drilling  
No cave  
No free water

**CLIENT** City of Mississauga **PROJECT NAME** City of Mississauga Fire Station 123  
**PROJECT NUMBER** G2S23256A **PROJECT LOCATION** 3010 The Collegeway, Mississauga, ON  
**DATE STARTED** 23-8-18 **COMPLETED** 23-8-18 **GROUND ELEVATION** 99.6 m  
**DRILLING CONTRACTOR** Pontil Drilling **LOGGED BY** DB **CHECKED BY** AA/DH  
**DRILLING METHOD** Continuous Flight Solid Stem Auger **NOTES** \_\_\_\_\_

DEPTH (m)	MATERIAL DESCRIPTION	ELEVATION (m)	GRAPHIC LOG	NUMBER	TYPE	N VALUE	SPT N VALUES		MOISTURE / PLASTICITY	SOIL GAS READINGS HEX/IBL (ppm)	WELL CONSTRUCTION	GRAIN SIZE DISTRIBUTION % GR SA SI & CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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Borehole terminated at 2.1 m.

Upon completion of drilling  
No cave  
No free water

## **Appendix C: Certificates of Analysis**

## Certificate of Analysis

**G2S Environmental Consulting Inc. (Burlington)**

4361 Harvester Road, Unit 12

Burlington, ON L7L 5M4

Attn: Dana Haslett

Client PO:

Project: G2S23256

Custody:

Report Date: 18-Sep-2023

Order Date: 24-Aug-2023

Revised Report

**Order #: 2334448**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2334448-01	BH101 S2
2334448-02	BH103 S5
2334448-03	BH104 S1
2334448-04	BH105 S2
2334448-05	BH108 S1
2334448-06	BH109 S4

Approved By:



Milan Ralitsch, PhD

Senior Technical Manager



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
Conductivity	MOE E3138 - probe @25 °C, water ext	30-Aug-23	30-Aug-23
PHC F1	CWS Tier 1 - P&T GC-FID	25-Aug-23	28-Aug-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Aug-23	30-Aug-23
REG 153: ABNs + PAHs	based on SW-846 8270	8-Sep-23	12-Sep-23
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	31-Aug-23	31-Aug-23
REG 153: Pesticides, OC	EPA 8081B - GC-ECD	25-Aug-23	28-Aug-23
REG 153: VOCs by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
SAR	Calculated	30-Aug-23	30-Aug-23
Solids, %	CWS Tier 1 - Gravimetric	28-Aug-23	28-Aug-23

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

**Regulatory Comparison:**

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Reg 153/04 -T3 Res/Park, coarse	-
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Physical Characteristics

% Solids	0.1 % by Wt.	89.7	89.8	90.7	87.7	-	-
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#### General Inorganics

SAR	0.01 N/A	0.31	0.15	0.31	0.68	5 N/A	-
Conductivity	0.005 mS/cm	0.119	0.131	0.220	0.184	0.7 mS/cm	-

#### Metals

Antimony	1 ug/g	<1.0	<1.0	<1.0	<1.0	7.5 ug/g	-
Arsenic	1 ug/g	4.6	3.3	5.1	4.0	18 ug/g	-
Barium	1 ug/g	60.4	97.8	80.4	59.8	390 ug/g	-
Beryllium	0.5 ug/g	0.6	0.6	0.7	0.6	4 ug/g	-
Boron	5 ug/g	<5.0	<5.0	<5.0	<5.0	120 ug/g	-
Cadmium	0.5 ug/g	<0.5	<0.5	<0.5	<0.5	1.2 ug/g	-
Chromium	5 ug/g	21.3	22.1	22.7	22.2	160 ug/g	-
Cobalt	1 ug/g	10.3	9.7	9.7	9.4	22 ug/g	-
Copper	5 ug/g	27.8	18.0	27.0	22.0	140 ug/g	-
Lead	1 ug/g	6.5	6.8	8.8	8.5	120 ug/g	-
Molybdenum	1 ug/g	<1.0	<1.0	<1.0	<1.0	6.9 ug/g	-
Nickel	5 ug/g	21.6	21.1	21.3	16.9	100 ug/g	-
Selenium	1 ug/g	<1.0	<1.0	<1.0	<1.0	2.4 ug/g	-
Silver	0.3 ug/g	<0.3	<0.3	<0.3	<0.3	20 ug/g	-
Thallium	1 ug/g	<1.0	<1.0	<1.0	<1.0	1 ug/g	-
Uranium	1 ug/g	<1.0	<1.0	<1.0	<1.0	23 ug/g	-
Vanadium	10 ug/g	27.7	31.6	31.4	33.1	86 ug/g	-
Zinc	20 ug/g	48.1	46.4	59.5	57.9	340 ug/g	-

#### Volatiles

Acetone	0.5 ug/g	-	<0.50	<0.50	-	16 ug/g	-
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

**Volatiles**

Benzene	0.02 ug/g	-	<0.02	<0.02	-	0.21 ug/g	-
Bromodichloromethane	0.05 ug/g	-	<0.05	<0.05	-	13 ug/g	-
Bromoform	0.05 ug/g	-	<0.05	<0.05	-	0.27 ug/g	-
Bromomethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Carbon Tetrachloride	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Chlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	2.4 ug/g	-
Chloroform	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Dibromochloromethane	0.05 ug/g	-	<0.05	<0.05	-	9.4 ug/g	-
Dichlorodifluoromethane	0.05 ug/g	-	<0.05	<0.05	-	16 ug/g	-
1,2-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	3.4 ug/g	-
1,3-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	4.8 ug/g	-
1,4-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.083 ug/g	-
1,1-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	3.5 ug/g	-
1,2-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
cis-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	3.4 ug/g	-
trans-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.084 ug/g	-
1,2-Dichloropropane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
cis-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Ethylbenzene	0.05 ug/g	-	<0.05	<0.05	-	2 ug/g	-
Ethylene dibromide (dibromoethane,	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Hexane	0.05 ug/g	-	<0.05	<0.05	-	2.8 ug/g	-
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	-	<0.50	<0.50	-	16 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

**Volatiles**

Methyl Isobutyl Ketone	0.5 ug/g	-	<0.50	<0.50	-	1.7 ug/g	-
Methyl tert-butyl ether	0.05 ug/g	-	<0.05	<0.05	-	0.75 ug/g	-
Methylene Chloride	0.05 ug/g	-	<0.05	<0.05	-	0.1 ug/g	-
Styrene	0.05 ug/g	-	<0.05	<0.05	-	0.7 ug/g	-
1,1,1,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.058 ug/g	-
1,1,2,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Tetrachloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.28 ug/g	-
Toluene	0.05 ug/g	-	<0.05	<0.05	-	2.3 ug/g	-
1,1,1-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.38 ug/g	-
1,1,2-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Trichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.061 ug/g	-
Trichlorofluoromethane	0.05 ug/g	-	<0.05	<0.05	-	4 ug/g	-
Vinyl chloride	0.02 ug/g	-	<0.02	<0.02	-	0.02 ug/g	-
m,p-Xylenes	0.05 ug/g	-	<0.05	<0.05	-	-	-
o-Xylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
Xylenes, total	0.05 ug/g	-	<0.05	<0.05	-	3.1 ug/g	-
4-Bromofluorobenzene	Surrogate	-	99.3%	99.7%	-	-	-
Toluene-d8	Surrogate	-	93.0%	93.1%	-	-	-
Dibromofluoromethane	Surrogate	-	98.3%	98.5%	-	-	-
Benzene	0.02 ug/g	<0.02	-	-	<0.02	0.21 ug/g	-
Ethylbenzene	0.05 ug/g	<0.05	-	-	<0.05	2 ug/g	-
Toluene	0.05 ug/g	<0.05	-	-	<0.05	2.3 ug/g	-
m,p-Xylenes	0.05 ug/g	<0.05	-	-	<0.05	-	-
o-Xylene	0.05 ug/g	<0.05	-	-	<0.05	-	-
Xylenes, total	0.05 ug/g	<0.05	-	-	<0.05	3.1 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Volatiles

Toluene-d8	Surrogate	92.7%	-	-	92.8%	-
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#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	<7	<7	55 ug/g	-
F2 PHCs (C10-C16)	4 ug/g	<4	<4	<4	<4	98 ug/g	-
F3 PHCs (C16-C34)	8 ug/g	<8	<8	<8	<8	300 ug/g	-
F4 PHCs (C34-C50)	6 ug/g	<6	<6	<6	<6	2800 ug/g	-

#### Semi-Volatiles

1,2,4-Trichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.36 ug/g	-
1-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.99 ug/g	-
2-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.99 ug/g	-
Methylnaphthalene (1&2)	0.05 ug/g	-	<0.05	<0.05	-	0.99 ug/g	-
2,4-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	-	<0.2	<0.2	-	0.92 ug/g	-
3,3'-Dichlorobenzidine	0.1 ug/g	-	<0.1	<0.1	-	1 ug/g	-
4-Chloroaniline	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Acenaphthene	0.05 ug/g	-	<0.05	<0.05	-	7.9 ug/g	-
Acenaphthylene	0.05 ug/g	-	<0.05	<0.05	-	0.15 ug/g	-
Anthracene	0.05 ug/g	-	<0.05	<0.05	-	0.67 ug/g	-
Benzo [a] anthracene	0.05 ug/g	-	<0.05	<0.05	-	0.5 ug/g	-
Benzo [a] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.3 ug/g	-
Benzo [b] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.78 ug/g	-
Benzo [g,h,i] perylene	0.05 ug/g	-	<0.05	<0.05	-	6.6 ug/g	-
Benzo [k] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.78 ug/g	-
Biphenyl	0.05 ug/g	-	<0.05	<0.05	-	0.31 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

Semi-Volatiles

Bis(2-chloroethyl)ether	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Bis(2-chloroisopropyl)ether	0.1 ug/g	-	<0.1	<0.1	-	0.67 ug/g	-
Bis(2-ethylhexyl)phthalate	0.1 ug/g	-	<0.1	<0.1	-	5 ug/g	-
Chrysene	0.05 ug/g	-	<0.05	<0.05	-	7 ug/g	-
Diethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Dimethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Dibenzo [a,h] anthracene	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
Fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.69 ug/g	-
Fluorene	0.05 ug/g	-	<0.05	<0.05	-	62 ug/g	-
Indeno [1,2,3-cd] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.38 ug/g	-
Naphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.6 ug/g	-
Phenanthrene	0.05 ug/g	-	<0.05	<0.05	-	6.2 ug/g	-
Pyrene	0.05 ug/g	-	<0.05	<0.05	-	78 ug/g	-
2,4,5-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	4.4 ug/g	-
2,4,6-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	3.8 ug/g	-
2,4-Dichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	1.7 ug/g	-
2,4-Dimethylphenol	0.1 ug/g	-	<0.1	<0.1	-	390 ug/g	-
2,4-Dinitrophenol	0.1 ug/g	-	<0.1	<0.1	-	38 ug/g	-
2-Chlorophenol	0.1 ug/g	-	<0.1	<0.1	-	1.6 ug/g	-
Pentachlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
Phenol	0.1 ug/g	-	<0.1	<0.1	-	9.4 ug/g	-
2-Fluorobiphenyl	Surrogate	-	63.7%	64.4%	-	-	-
Nitrobenzene-d5	Surrogate	-	60.1%	69.6%	-	-	-
Terphenyl-d14	Surrogate	-	83.7%	72.8%	-	-	-
2,4,6-Tribromophenol	Surrogate	-	70.0%	71.9%	-	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Semi-Volatiles

2-Fluorophenol	Surrogate	-	0.0 [1]	70.6%	-	-
Phenol-d6	Surrogate	-	67.9%	72.5%	-	-

#### Pesticides, OC

Aldrin	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.056 ug/g	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
o,p'-DDD	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	3.3 ug/g	-
o,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.26 ug/g	-
o,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	1.4 ug/g	-
Dieldrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.05 ug/g	-
Endrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	-
Endosulfan I	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	-
Heptachlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.15 ug/g	-
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.52 ug/g	-



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 153/04 -T3
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park, coarse
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

Pesticides, OC

Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.012 ug/g	-
Hexachloroethane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.089 ug/g	-
Methoxychlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.13 ug/g	-
Decachlorobiphenyl	Surrogate	99.1%	100%	110%	61.3%	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

**Physical Characteristics**

% Solids	0.1 % by Wt.	90.7	90.0	-	-	-	-
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**General Inorganics**

SAR	0.01 N/A	0.21	0.19	-	-	5 N/A	-
Conductivity	0.005 mS/cm	0.225	0.113	-	-	0.7 mS/cm	-

**Metals**

Antimony	1 ug/g	<1.0	<1.0	-	-	7.5 ug/g	-
Arsenic	1 ug/g	3.4	3.9	-	-	18 ug/g	-
Barium	1 ug/g	60.2	59.0	-	-	390 ug/g	-
Beryllium	0.5 ug/g	<0.5	0.6	-	-	4 ug/g	-
Boron	5 ug/g	<5.0	<5.0	-	-	120 ug/g	-
Cadmium	0.5 ug/g	<0.5	<0.5	-	-	1.2 ug/g	-
Chromium	5 ug/g	19.9	19.3	-	-	160 ug/g	-
Cobalt	1 ug/g	7.5	10.1	-	-	22 ug/g	-
Copper	5 ug/g	21.9	26.2	-	-	140 ug/g	-
Lead	1 ug/g	8.2	5.5	-	-	120 ug/g	-
Molybdenum	1 ug/g	<1.0	<1.0	-	-	6.9 ug/g	-
Nickel	5 ug/g	15.8	20.3	-	-	100 ug/g	-
Selenium	1 ug/g	<1.0	<1.0	-	-	2.4 ug/g	-
Silver	0.3 ug/g	<0.3	<0.3	-	-	20 ug/g	-
Thallium	1 ug/g	<1.0	<1.0	-	-	1 ug/g	-
Uranium	1 ug/g	<1.0	<1.0	-	-	23 ug/g	-
Vanadium	10 ug/g	27.1	29.1	-	-	86 ug/g	-
Zinc	20 ug/g	62.3	42.8	-	-	340 ug/g	-

**Volatiles**

Acetone	0.5 ug/g	<0.50	<0.50	-	-	16 ug/g	-
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

**Volatiles**

Benzene	0.02 ug/g	<0.02	<0.02	-	-	0.21 ug/g	-
Bromodichloromethane	0.05 ug/g	<0.05	<0.05	-	-	13 ug/g	-
Bromoform	0.05 ug/g	<0.05	<0.05	-	-	0.27 ug/g	-
Bromomethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Carbon Tetrachloride	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Chlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	2.4 ug/g	-
Chloroform	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Dibromochloromethane	0.05 ug/g	<0.05	<0.05	-	-	9.4 ug/g	-
Dichlorodifluoromethane	0.05 ug/g	<0.05	<0.05	-	-	16 ug/g	-
1,2-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	3.4 ug/g	-
1,3-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	4.8 ug/g	-
1,4-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.083 ug/g	-
1,1-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	3.5 ug/g	-
1,2-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
cis-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	3.4 ug/g	-
trans-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.084 ug/g	-
1,2-Dichloropropane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
cis-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Ethylbenzene	0.05 ug/g	<0.05	<0.05	-	-	2 ug/g	-
Ethylene dibromide (dibromoethane,	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Hexane	0.05 ug/g	<0.05	<0.05	-	-	2.8 ug/g	-
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	<0.50	<0.50	-	-	16 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

#### Volatiles

Methyl Isobutyl Ketone	0.5 ug/g	<0.50	<0.50	-	-	1.7 ug/g	-
Methyl tert-butyl ether	0.05 ug/g	<0.05	<0.05	-	-	0.75 ug/g	-
Methylene Chloride	0.05 ug/g	<0.05	<0.05	-	-	0.1 ug/g	-
Styrene	0.05 ug/g	<0.05	<0.05	-	-	0.7 ug/g	-
1,1,1,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.058 ug/g	-
1,1,2,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Tetrachloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.28 ug/g	-
Toluene	0.05 ug/g	<0.05	<0.05	-	-	2.3 ug/g	-
1,1,1-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.38 ug/g	-
1,1,2-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Trichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.061 ug/g	-
Trichlorofluoromethane	0.05 ug/g	<0.05	<0.05	-	-	4 ug/g	-
Vinyl chloride	0.02 ug/g	<0.02	<0.02	-	-	0.02 ug/g	-
m,p-Xylenes	0.05 ug/g	<0.05	<0.05	-	-	-	-
o-Xylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
Xylenes, total	0.05 ug/g	<0.05	<0.05	-	-	3.1 ug/g	-
Toluene-d8	Surrogate	91.5%	94.7%	-	-	-	-
Dibromofluoromethane	Surrogate	116%	102%	-	-	-	-
4-Bromofluorobenzene	Surrogate	94.3%	98.8%	-	-	-	-

#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	-	-	55 ug/g	-
F2 PHCs (C10-C16)	4 ug/g	<4	<4	-	-	98 ug/g	-
F3 PHCs (C16-C34)	8 ug/g	76	<8	-	-	300 ug/g	-
F4 PHCs (C34-C50)	6 ug/g	121	<6	-	-	2800 ug/g	-

#### Semi-Volatiles

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

Semi-Volatiles

1,2,4-Trichlorobenzene	0.05 ug/g	<0.05	-	-	-	0.36 ug/g	-
1-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	0.99 ug/g	-
2-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	0.99 ug/g	-
Methylnaphthalene (1&2)	0.05 ug/g	<0.05	-	-	-	0.99 ug/g	-
2,4-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	<0.2	-	-	-	0.92 ug/g	-
3,3'-Dichlorobenzidine	0.1 ug/g	<0.1	-	-	-	1 ug/g	-
4-Chloroaniline	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Acenaphthene	0.05 ug/g	<0.05	-	-	-	7.9 ug/g	-
Acenaphthylene	0.05 ug/g	<0.05	-	-	-	0.15 ug/g	-
Anthracene	0.05 ug/g	<0.05	-	-	-	0.67 ug/g	-
Benzo [a] anthracene	0.05 ug/g	<0.05	-	-	-	0.5 ug/g	-
Benzo [a] pyrene	0.05 ug/g	0.09	-	-	-	0.3 ug/g	-
Benzo [b] fluoranthene	0.05 ug/g	0.1	-	-	-	0.78 ug/g	-
Benzo [g,h,i] perylene	0.05 ug/g	0.08	-	-	-	6.6 ug/g	-
Benzo [k] fluoranthene	0.05 ug/g	0.06	-	-	-	0.78 ug/g	-
Biphenyl	0.05 ug/g	<0.05	-	-	-	0.31 ug/g	-
Bis(2-chloroethyl)ether	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Bis(2-chloroisopropyl)ether	0.1 ug/g	<0.1	-	-	-	0.67 ug/g	-
Bis(2-ethylhexyl)phthalate	0.1 ug/g	<0.1	-	-	-	5 ug/g	-
Chrysene	0.05 ug/g	0.09	-	-	-	7 ug/g	-
Diethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Dimethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Dibenzo [a,h] anthracene	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

#### Semi-Volatiles

Fluoranthene	0.05 ug/g	0.1	-	-	-	0.69 ug/g	-
Fluorene	0.05 ug/g	<0.05	-	-	-	62 ug/g	-
Indeno [1,2,3-cd] pyrene	0.05 ug/g	0.06	-	-	-	0.38 ug/g	-
Naphthalene	0.05 ug/g	<0.05	-	-	-	0.6 ug/g	-
Phenanthrene	0.05 ug/g	<0.05	-	-	-	6.2 ug/g	-
Pyrene	0.05 ug/g	0.1	-	-	-	78 ug/g	-
2,4,5-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	4.4 ug/g	-
2,4,6-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	3.8 ug/g	-
2,4-Dichlorophenol	0.1 ug/g	<0.1	-	-	-	1.7 ug/g	-
2,4-Dimethylphenol	0.1 ug/g	<0.1	-	-	-	390 ug/g	-
2,4-Dinitrophenol	0.1 ug/g	<0.1	-	-	-	38 ug/g	-
2-Chlorophenol	0.1 ug/g	<0.1	-	-	-	1.6 ug/g	-
Pentachlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
Phenol	0.1 ug/g	<0.1	-	-	-	9.4 ug/g	-
2-Fluorobiphenyl	Surrogate	70.5%	-	-	-	-	-
Nitrobenzene-d5	Surrogate	78.5%	-	-	-	-	-
Terphenyl-d14	Surrogate	74.0%	-	-	-	-	-
2,4,6-Tribromophenol	Surrogate	73.9%	-	-	-	-	-
2-Fluorophenol	Surrogate	81.8%	-	-	-	-	-
Phenol-d6	Surrogate	81.2%	-	-	-	-	-

#### Pesticides, OC

Aldrin	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	-	-	0.056 ug/g	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 153/04 -T3
Sample ID:	2334448-05	2334448-06			Res/Park, coarse
Matrix:	Soil	Soil			-
MDL/Units					

Pesticides, OC

Chlordane	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
o,p'-DDD	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	-	-	-	-
DDD	0.02 ug/g	<0.02	<0.02	-	-	3.3 ug/g	-
o,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDE	0.01 ug/g	<0.01	<0.01	-	-	0.26 ug/g	-
o,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDT	0.01 ug/g	<0.01	<0.01	-	-	1.4 ug/g	-
Dieldrin	0.02 ug/g	<0.02	<0.02	-	-	0.05 ug/g	-
Endrin	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	-
Endosulfan I	0.01 ug/g	<0.01	<0.01	-	-	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	-	-	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	-
Heptachlor	0.01 ug/g	<0.01	<0.01	-	-	0.15 ug/g	-
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	-	-	0.52 ug/g	-
Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	-	-	0.012 ug/g	-
Hexachloroethane	0.01 ug/g	<0.01	<0.01	-	-	0.089 ug/g	-
Methoxychlor	0.01 ug/g	<0.01	<0.01	-	-	0.13 ug/g	-
Decachlorobiphenyl	Surrogate	80.1%	79.6%	-	-	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>								
SAR	ND	0.01	N/A					
Conductivity	ND	0.005	mS/cm					
<b>Hydrocarbons</b>								
F1 PHCs (C6-C10)	ND	7	ug/g					
F2 PHCs (C10-C16)	ND	4	ug/g					
F3 PHCs (C16-C34)	ND	8	ug/g					
F4 PHCs (C34-C50)	ND	6	ug/g					
<b>Metals</b>								
Antimony	ND	1.0	ug/g					
Arsenic	ND	1.0	ug/g					
Barium	ND	1.0	ug/g					
Beryllium	ND	0.5	ug/g					
Boron	ND	5.0	ug/g					
Cadmium	ND	0.5	ug/g					
Chromium	ND	5.0	ug/g					
Cobalt	ND	1.0	ug/g					
Copper	ND	5.0	ug/g					
Lead	ND	1.0	ug/g					
Molybdenum	ND	1.0	ug/g					
Nickel	ND	5.0	ug/g					
Selenium	ND	1.0	ug/g					
Silver	ND	0.3	ug/g					
Thallium	ND	1.0	ug/g					
Uranium	ND	1.0	ug/g					
Vanadium	ND	10.0	ug/g					
Zinc	ND	20.0	ug/g					
<b>Pesticides, OC</b>								
Aldrin	ND	0.01	ug/g					
gamma-BHC (Lindane)	ND	0.01	ug/g					
alpha-Chlordane	ND	0.01	ug/g					
gamma-Chlordane	ND	0.01	ug/g					
Chlordane	ND	0.01	ug/g					



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDD	ND	0.01	ug/g					
p,p'-DDD	ND	0.02	ug/g					
DDD	ND	0.02	ug/g					
o,p'-DDE	ND	0.01	ug/g					
p,p'-DDE	ND	0.01	ug/g					
DDE	ND	0.01	ug/g					
o,p'-DDT	ND	0.01	ug/g					
p,p'-DDT	ND	0.01	ug/g					
DDT	ND	0.01	ug/g					
Dieldrin	ND	0.02	ug/g					
Endrin	ND	0.02	ug/g					
Endosulfan I	ND	0.01	ug/g					
Endosulfan II	ND	0.02	ug/g					
Endosulfan I/II	ND	0.02	ug/g					
Heptachlor	ND	0.01	ug/g					
Heptachlor epoxide	ND	0.01	ug/g					
Hexachlorobenzene	ND	0.01	ug/g					
Hexachlorobutadiene	ND	0.01	ug/g					
Hexachloroethane	ND	0.01	ug/g					
Methoxychlor	ND	0.01	ug/g					
Surrogate: Decachlorobiphenyl	0.0848		%	84.8	50-140			
<b>Semi-Volatiles</b>								
1,2,4-Trichlorobenzene	ND	0.05	ug/g					
1-Methylnaphthalene	ND	0.05	ug/g					
2-Methylnaphthalene	ND	0.05	ug/g					
Methylnaphthalene (1&2)	ND	0.07	ug/g					
2,4-Dinitrotoluene	ND	0.1	ug/g					
2,6-Dinitrotoluene	ND	0.1	ug/g					
Dinitrotoluene (2,4 & 2,6)	ND	0.2	ug/g					
3,3'-Dichlorobenzidine	ND	0.1	ug/g					
4-Chloroaniline	ND	0.1	ug/g					
Acenaphthene	ND	0.05	ug/g					

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthylene	ND	0.05	ug/g					
Anthracene	ND	0.05	ug/g					
Benzo [a] anthracene	ND	0.05	ug/g					
Benzo [a] pyrene	ND	0.05	ug/g					
Benzo [b] fluoranthene	ND	0.05	ug/g					
Benzo [g,h,i] perylene	ND	0.05	ug/g					
Benzo [k] fluoranthene	ND	0.05	ug/g					
Biphenyl	ND	0.05	ug/g					
Bis(2-chloroethyl)ether	ND	0.1	ug/g					
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g					
Bis(2-ethylhexyl)phthalate	ND	0.1	ug/g					
Chrysene	ND	0.05	ug/g					
Diethylphthalate	ND	0.1	ug/g					
Dimethylphthalate	ND	0.1	ug/g					
Dibenzo [a,h] anthracene	ND	0.1	ug/g					
Fluoranthene	ND	0.05	ug/g					
Fluorene	ND	0.05	ug/g					
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g					
Naphthalene	ND	0.05	ug/g					
Phenanthrene	ND	0.05	ug/g					
Pyrene	ND	0.05	ug/g					
2,4,5-Trichlorophenol	ND	0.1	ug/g					
2,4,6-Trichlorophenol	ND	0.1	ug/g					
2,4-Dichlorophenol	ND	0.1	ug/g					
2,4-Dimethylphenol	ND	0.1	ug/g					
2,4-Dinitrophenol	ND	0.1	ug/g					
2-Chlorophenol	ND	0.1	ug/g					
Pentachlorophenol	ND	0.1	ug/g					
Phenol	ND	0.1	ug/g					
Surrogate: 2-Fluorobiphenyl	0.394		%	78.7	50-140			
Surrogate: Nitrobenzene-d5	0.367		%	73.5	40-140			
Surrogate: Terphenyl-d14	0.418		%	83.6	40-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2,4,6-Tribromophenol	0.372		%	74.4	50-140			
Surrogate: 2-Fluorophenol	0.397		%	79.5	40-140			
Surrogate: Phenol-d6	0.379		%	75.9	40-140			
<b>Volatiles</b>								
Acetone	ND	0.50	ug/g					
Benzene	ND	0.02	ug/g					
Bromodichloromethane	ND	0.05	ug/g					
Bromoform	ND	0.05	ug/g					
Bromomethane	ND	0.05	ug/g					
Carbon Tetrachloride	ND	0.05	ug/g					
Chlorobenzene	ND	0.05	ug/g					
Chloroform	ND	0.05	ug/g					
Dibromochloromethane	ND	0.05	ug/g					
Dichlorodifluoromethane	ND	0.05	ug/g					
1,2-Dichlorobenzene	ND	0.05	ug/g					
1,3-Dichlorobenzene	ND	0.05	ug/g					
1,4-Dichlorobenzene	ND	0.05	ug/g					
1,1-Dichloroethane	ND	0.05	ug/g					
1,2-Dichloroethane	ND	0.05	ug/g					
1,1-Dichloroethylene	ND	0.05	ug/g					
cis-1,2-Dichloroethylene	ND	0.05	ug/g					
trans-1,2-Dichloroethylene	ND	0.05	ug/g					
1,2-Dichloropropane	ND	0.05	ug/g					
cis-1,3-Dichloropropylene	ND	0.05	ug/g					
trans-1,3-Dichloropropylene	ND	0.05	ug/g					
1,3-Dichloropropene, total	ND	0.05	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g					
Hexane	ND	0.05	ug/g					
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g					
Methyl Isobutyl Ketone	ND	0.50	ug/g					
Methyl tert-butyl ether	ND	0.05	ug/g					

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylene Chloride	ND	0.05	ug/g					
Styrene	ND	0.05	ug/g					
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g					
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g					
Tetrachloroethylene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
1,1,1-Trichloroethane	ND	0.05	ug/g					
1,1,2-Trichloroethane	ND	0.05	ug/g					
Trichloroethylene	ND	0.05	ug/g					
Trichlorofluoromethane	ND	0.05	ug/g					
Vinyl chloride	ND	0.02	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: 4-Bromofluorobenzene	7.87		%	97.7	50-140			
Surrogate: Dibromofluoromethane	8.59		%	107	50-140			
Surrogate: Toluene-d8	7.53		%	93.8	50-140			
Benzene	ND	0.02	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: Toluene-d8	7.53		%	93.8	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>									
SAR	0.19	0.01	N/A	0.19			0.0	30	
Conductivity	0.116	0.005	mS/cm	0.113			2.4	5	
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g	ND			NC	30	
<b>Metals</b>									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	1.8	1.0	ug/g	1.6			12.1	30	
Barium	12.2	1.0	ug/g	12.0			1.4	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	ND	5.0	ug/g	ND			NC	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	7.2	5.0	ug/g	6.7			8.5	30	
Cobalt	2.7	1.0	ug/g	2.4			11.9	30	
Copper	8.0	5.0	ug/g	8.0			1.2	30	
Lead	2.2	1.0	ug/g	1.8			25.0	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	ND	5.0	ug/g	ND			NC	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	15.1	10.0	ug/g	16.9			11.2	30	
Zinc	ND	20.0	ug/g	ND			NC	30	
<b>Physical Characteristics</b>									
% Solids	80.4	0.1	% by Wt.	82.2			2.3	25	
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	ND	0.05	ug/g	ND			NC	40	

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2,4-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
2,6-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
3,3'-Dichlorobenzidine	ND	0.1	ug/g	ND			NC	40	
4-Chloroaniline	ND	0.1	ug/g	ND			NC	40	
Acenaphthene	ND	0.05	ug/g	ND			NC	40	
Acenaphthylene	ND	0.05	ug/g	ND			NC	40	
Anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] pyrene	ND	0.05	ug/g	ND			NC	40	
Benzo [b] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.05	ug/g	ND			NC	40	
Benzo [k] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Biphenyl	ND	0.05	ug/g	ND			NC	40	
Bis(2-chloroethyl)ether	ND	0.1	ug/g	ND			NC	40	
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g	ND			NC	40	
Chrysene	ND	0.05	ug/g	ND			NC	40	
Diethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dimethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.1	ug/g	ND			NC	40	
Fluoranthene	ND	0.05	ug/g	ND			NC	40	
Fluorene	ND	0.05	ug/g	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g	ND			NC	40	
Naphthalene	ND	0.05	ug/g	ND			NC	40	
Phenanthrene	ND	0.05	ug/g	ND			NC	40	
Pyrene	ND	0.05	ug/g	ND			NC	40	
2,4,5-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4,6-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4-Dinitrophenol	ND	0.1	ug/g	ND			NC	40	
2-Chlorophenol	ND	0.1	ug/g	ND			NC	40	

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Pentachlorophenol	ND	0.1	ug/g	ND			NC	40	
Phenol	ND	0.1	ug/g	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	0.344		%		61.8	50-140			
Surrogate: Nitrobenzene-d5	0.372		%		66.8	40-140			
Surrogate: Terphenyl-d14	0.420		%		75.4	40-140			
Surrogate: 2,4,6-Tribromophenol	0.401		%		72.1	50-140			
Surrogate: 2-Fluorophenol	0.429		%		77.0	40-140			
Surrogate: Phenol-d6	0.409		%		73.5	40-140			
<b>Volatiles</b>									
Acetone	ND	0.50	ug/g	ND			NC	50	
Benzene	ND	0.02	ug/g	ND			NC	50	
Bromodichloromethane	ND	0.05	ug/g	ND			NC	50	
Bromoform	ND	0.05	ug/g	ND			NC	50	
Bromomethane	ND	0.05	ug/g	ND			NC	50	
Carbon Tetrachloride	ND	0.05	ug/g	ND			NC	50	
Chlorobenzene	ND	0.05	ug/g	ND			NC	50	
Chloroform	ND	0.05	ug/g	ND			NC	50	
Dibromochloromethane	ND	0.05	ug/g	ND			NC	50	
Dichlorodifluoromethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,3-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,4-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloropropane	ND	0.05	ug/g	ND			NC	50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	

Certificate of Analysis

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Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g	ND			NC	50	
Hexane	ND	0.05	ug/g	ND			NC	50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g	ND			NC	50	
Methyl Isobutyl Ketone	ND	0.50	ug/g	ND			NC	50	
Methyl tert-butyl ether	ND	0.05	ug/g	ND			NC	50	
Methylene Chloride	ND	0.05	ug/g	ND			NC	50	
Styrene	ND	0.05	ug/g	ND			NC	50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
Tetrachloroethylene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
1,1,1-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
Trichloroethylene	ND	0.05	ug/g	ND			NC	50	
Trichlorofluoromethane	ND	0.05	ug/g	ND			NC	50	
Vinyl chloride	ND	0.02	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: 4-Bromofluorobenzene	12.6		%		97.5	50-140			
Surrogate: Dibromofluoromethane	15.5		%		120	50-140			
Surrogate: Toluene-d8	12.3		%		95.7	50-140			
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	12.3		%		95.7	50-140			



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	58	7	ug/g	ND	82.6	80-120			
F2 PHCs (C10-C16)	120	4	ug/g	ND	131	60-140			
F3 PHCs (C16-C34)	233	8	ug/g	ND	113	60-140			
F4 PHCs (C34-C50)	160	6	ug/g	ND	108	60-140			
<b>Metals</b>									
Antimony	132	1.0	ug/g	ND	105	70-130			
Arsenic	125	1.0	ug/g	1.6	98.8	70-130			
Barium	139	1.0	ug/g	12.0	101	70-130			
Beryllium	119	0.5	ug/g	ND	95.6	70-130			
Boron	117	5.0	ug/g	ND	93.9	70-130			
Cadmium	125	0.5	ug/g	ND	99.7	70-130			
Chromium	138	5.0	ug/g	6.7	105	70-130			
Cobalt	131	1.0	ug/g	2.4	103	70-130			
Copper	131	5.0	ug/g	8.0	98.4	70-130			
Lead	117	1.0	ug/g	1.8	92.4	70-130			
Molybdenum	127	1.0	ug/g	ND	101	70-130			
Nickel	128	5.0	ug/g	ND	103	70-130			
Selenium	131	1.0	ug/g	ND	105	70-130			
Silver	100	0.3	ug/g	ND	80.2	70-130			
Thallium	114	1.0	ug/g	ND	91.3	70-130			
Uranium	117	1.0	ug/g	ND	93.8	70-130			
Vanadium	148	10.0	ug/g	16.9	105	70-130			
Zinc	137	20.0	ug/g	ND	110	70-130			
<b>Pesticides, OC</b>									
Aldrin	0.27	0.01	ug/g	ND	135	50-140			
gamma-BHC (Lindane)	0.26	0.01	ug/g	ND	128	50-140			
alpha-Chlordane	0.21	0.01	ug/g	ND	106	50-140			
gamma-Chlordane	0.21	0.01	ug/g	ND	104	50-140			
o,p'-DDD	0.23	0.01	ug/g	ND	115	50-140			
p,p'-DDD	0.14	0.02	ug/g	ND	68.0	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDE	0.20	0.01	ug/g	ND	98.8	50-140			
p,p'-DDE	0.18	0.01	ug/g	ND	92.1	50-140			
o,p'-DDT	0.16	0.01	ug/g	ND	77.9	50-140			
p,p'-DDT	0.15	0.01	ug/g	ND	76.9	50-140			
Dieldrin	0.20	0.02	ug/g	ND	101	50-140			
Endrin	0.12	0.02	ug/g	ND	57.7	50-140			
Endosulfan I	0.22	0.01	ug/g	ND	108	50-140			
Endosulfan II	0.13	0.02	ug/g	ND	64.2	50-140			
Heptachlor	0.25	0.01	ug/g	ND	127	50-140			
Heptachlor epoxide	0.24	0.01	ug/g	ND	121	50-140			
Hexachlorobenzene	0.26	0.01	ug/g	ND	129	50-140			
Hexachlorobutadiene	0.19	0.01	ug/g	ND	96.9	50-140			
Hexachloroethane	0.17	0.01	ug/g	ND	87.3	50-140			
Methoxychlor	0.21	0.01	ug/g	ND	104	50-140			
Surrogate: Decachlorobiphenyl	0.0961		%		96.1	50-140			
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	0.37	0.05	ug/g	ND	67.2	50-140			
1-Methylnaphthalene	0.45	0.05	ug/g	ND	81.3	50-140			
2-Methylnaphthalene	0.43	0.05	ug/g	ND	76.9	50-140			
2,4-Dinitrotoluene	0.54	0.1	ug/g	ND	97.7	50-140			
2,6-Dinitrotoluene	0.52	0.1	ug/g	ND	93.2	50-140			
3,3'-Dichlorobenzidine	0.35	0.1	ug/g	ND	63.5	30-130			
4-Chloroaniline	0.47	0.1	ug/g	ND	84.6	30-130			
Acenaphthene	0.46	0.05	ug/g	ND	81.9	50-140			
Acenaphthylene	0.50	0.05	ug/g	ND	89.5	50-140			
Anthracene	0.45	0.05	ug/g	ND	80.8	50-140			
Benzo [a] anthracene	0.46	0.05	ug/g	ND	82.0	50-140			
Benzo [a] pyrene	0.48	0.05	ug/g	ND	86.8	50-140			
Benzo [b] fluoranthene	0.46	0.05	ug/g	ND	83.5	50-140			
Benzo [g,h,i] perylene	0.47	0.05	ug/g	ND	84.2	50-140			
Benzo [k] fluoranthene	0.48	0.05	ug/g	ND	86.1	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Biphenyl	0.47	0.05	ug/g	ND	81.8	50-140			
Bis(2-chloroethyl)ether	0.56	0.1	ug/g	ND	101	50-140			
Bis(2-chloroisopropyl)ether	0.39	0.1	ug/g	ND	69.7	50-140			
Chrysene	0.47	0.05	ug/g	ND	84.9	50-140			
Diethylphthalate	0.59	0.1	ug/g	ND	107	50-140			
Dimethylphthalate	0.53	0.1	ug/g	ND	95.2	50-140			
Dibenzo [a,h] anthracene	0.46	0.1	ug/g	ND	83.4	50-140			
Fluoranthene	0.52	0.05	ug/g	ND	92.6	50-140			
Fluorene	0.52	0.05	ug/g	ND	93.3	50-140			
Indeno [1,2,3-cd] pyrene	0.47	0.05	ug/g	ND	84.1	50-140			
Naphthalene	0.41	0.05	ug/g	ND	73.9	50-140			
Phenanthrene	0.46	0.05	ug/g	ND	82.5	50-140			
Pyrene	0.44	0.05	ug/g	ND	78.8	50-140			
2,4,5-Trichlorophenol	0.47	0.1	ug/g	ND	84.1	50-140			
2,4,6-Trichlorophenol	0.45	0.1	ug/g	ND	80.0	50-140			
2,4-Dinitrophenol	4.52	0.1	ug/g	ND	50.4	50-140			
2-Chlorophenol	0.44	0.1	ug/g	ND	79.5	50-140			
Pentachlorophenol	0.45	0.1	ug/g	ND	80.4	50-140			
Phenol	0.46	0.1	ug/g	ND	82.5	30-140			
Surrogate: 2-Fluorobiphenyl	0.396		%		71.2	50-140			
Surrogate: Nitrobenzene-d5	0.425		%		76.4	40-140			
Surrogate: Terphenyl-d14	0.430		%		77.3	40-140			
Surrogate: 2,4,6-Tribromophenol	0.549		%		98.6	50-140			
Surrogate: 2-Fluorophenol	0.489		%		87.8	40-140			
Surrogate: Phenol-d6	0.453		%		81.4	40-140			
<b>Volatiles</b>									
Acetone	11.3	0.50	ug/g	ND	113	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Bromodichloromethane	3.65	0.05	ug/g	ND	90.9	60-130			
Bromoform	4.06	0.05	ug/g	ND	100	60-130			
Bromomethane	4.37	0.05	ug/g	ND	109	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Carbon Tetrachloride	3.71	0.05	ug/g	ND	92.3	60-130			
Chlorobenzene	3.95	0.05	ug/g	ND	97.7	60-130			
Chloroform	3.53	0.05	ug/g	ND	87.8	60-130			
Dibromochloromethane	3.62	0.05	ug/g	ND	89.7	60-130			
Dichlorodifluoromethane	5.18	0.05	ug/g	ND	129	50-140			
1,2-Dichlorobenzene	3.89	0.05	ug/g	ND	96.7	60-130			
1,3-Dichlorobenzene	3.86	0.05	ug/g	ND	95.6	60-130			
1,4-Dichlorobenzene	3.81	0.05	ug/g	ND	94.3	60-130			
1,1-Dichloroethane	3.51	0.05	ug/g	ND	87.3	60-130			
1,2-Dichloroethane	3.93	0.05	ug/g	ND	97.2	60-130			
1,1-Dichloroethylene	3.61	0.05	ug/g	ND	89.8	60-130			
cis-1,2-Dichloroethylene	3.62	0.05	ug/g	ND	90.5	60-130			
trans-1,2-Dichloroethylene	3.57	0.05	ug/g	ND	88.9	60-130			
1,2-Dichloropropane	3.80	0.05	ug/g	ND	94.0	60-130			
cis-1,3-Dichloropropylene	3.77	0.05	ug/g	ND	93.7	60-130			
trans-1,3-Dichloropropylene	4.04	0.05	ug/g	ND	100	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Ethylene dibromide (dibromoethane, 1,2-)	3.65	0.05	ug/g	ND	90.7	60-130			
Hexane	4.01	0.05	ug/g	ND	100	60-130			
Methyl Ethyl Ketone (2-Butanone)	10.3	0.50	ug/g	ND	103	50-140			
Methyl Isobutyl Ketone	9.99	0.50	ug/g	ND	99.9	50-140			
Methyl tert-butyl ether	9.96	0.05	ug/g	ND	99.6	50-140			
Methylene Chloride	4.68	0.05	ug/g	ND	116	60-130			
Styrene	4.31	0.05	ug/g	ND	107	60-130			
1,1,1,2-Tetrachloroethane	3.49	0.05	ug/g	ND	86.7	60-130			
1,1,2,2-Tetrachloroethane	3.65	0.05	ug/g	ND	90.8	60-130			
Tetrachloroethylene	3.62	0.05	ug/g	ND	90.0	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
1,1,1-Trichloroethane	3.74	0.05	ug/g	ND	93.0	60-130			
1,1,2-Trichloroethane	4.01	0.05	ug/g	ND	99.8	60-130			
Trichloroethylene	3.78	0.05	ug/g	ND	94.1	60-130			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	3.38	0.05	ug/g	ND	83.7	50-140			
Vinyl chloride	4.47	0.02	ug/g	ND	111	50-140			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: 4-Bromofluorobenzene	7.48		%		92.8	50-140			
Surrogate: Dibromofluoromethane	7.04		%		87.3	50-140			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Qualifier Notes:

**Sample Qualifiers :**

- 1: Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

Sample Data Revisions:

None

## Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

**Work Order Revisions / Comments:**

Revision-1: Guideline comparisons updated as per client request.

Revision-2: This report includes an updated parameter list, as per client.

Revision-3: Guideline comparisons updated as per client request.

**Other Report Notes:**

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unless otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Benzo[b]fluoranthene results may be biased high due to co-elution with Benzo[j]fluoranthene

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Paracel ID: 2334448



**Chain Of Custody**  
(Lab Use Only)

Client Name: G2S Consulting	Project Ref: G2S23256	Page 1 of 1
Contact Name: Dana Haslett	Quote #: Standing Offer	<b>Turnaround Time</b> <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address: 4361 Harvester Road, Unit 12 Burlington, ON	PO #:	
Telephone:	E-mail: danah@g2sconsulting.cm	
		Date Required: _____

<input type="checkbox"/> REG 153/04 <input checked="" type="checkbox"/> REG 406/19		Other Regulation		<b>Matrix Type:</b> S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis																	
<input checked="" type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input checked="" type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input checked="" type="checkbox"/> Table 3,1 For RSC: <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> REG 558 <input type="checkbox"/> PWQO <input type="checkbox"/> CCME <input type="checkbox"/> MISA <input type="checkbox"/> SU - Sani <input type="checkbox"/> SU - Storm Mun: _____ <input type="checkbox"/> Other: _____																					
Sample ID/Location Name				Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	Cr/VI	B (HWS)	EC/SAR	OCP						
							Date	Time															
1	BH101 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
2	BH103 S5		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
3	BH104 S1		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
4	BH105 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
5	BH108 S1		S		3		23-8-18	AM	✓	✓		✓				✓	✓						
6	BH109 S4		S		3		23-8-18	AM	✓			✓				✓	✓						
7																							
8																							
9																							
10																							

Comments: AGAT methanol vial used as preservatives Analyze VOC/SVOCs				Method of Delivery: <b>Zoom</b>	
Relinquished By (Sign): <i>Samantha Patrick</i>		Received By Driver/Depot:		Received at Lab: <i>C-PM</i>	
Relinquished By (Print): Samantha Patrick		Date/Time:		Date/Time: <i>08/24/24 12:40</i>	
Date/Time: 23-8-24 9:30		Temperature: °C		Date/Time: <i>08/24/23 15:00</i>	
		Temperature: <i>13.9</i>		pH Verified: <input type="checkbox"/> By:	



## Certificate of Analysis

**G2S Environmental Consulting Inc. (Burlington)**

4361 Harvester Road, Unit 12

Burlington, ON L7L 5M4

Attn: Dana Haslett

Client PO:

Project: G2S23256

Custody:

Report Date: 18-Sep-2023

Order Date: 24-Aug-2023

Revised Report

**Order #: 2334448**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2334448-01	BH101 S2
2334448-02	BH103 S5
2334448-03	BH104 S1
2334448-04	BH105 S2
2334448-05	BH108 S1
2334448-06	BH109 S4

Approved By:



Milan Ralitsch, PhD

Senior Technical Manager

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
Conductivity	MOE E3138 - probe @25 °C, water ext	30-Aug-23	30-Aug-23
PHC F1	CWS Tier 1 - P&T GC-FID	25-Aug-23	28-Aug-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Aug-23	30-Aug-23
REG 153: ABNs + PAHs	based on SW-846 8270	8-Sep-23	12-Sep-23
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	31-Aug-23	31-Aug-23
REG 153: Pesticides, OC	EPA 8081B - GC-ECD	25-Aug-23	28-Aug-23
REG 153: VOCs by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
SAR	Calculated	30-Aug-23	30-Aug-23
Solids, %	CWS Tier 1 - Gravimetric	28-Aug-23	28-Aug-23

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

**Regulatory Comparison:**

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Reg 406/19 -T1 Res/Park/Ind/Com	-
BH108 S1	F4 PHCs (C34-C50)	6 ug/g	121	120 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Physical Characteristics

% Solids	0.1 % by Wt.	89.7	89.8	90.7	87.7	-	-
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#### General Inorganics

SAR	0.01 N/A	0.31	0.15	0.31	0.68	2.4 N/A	-
Conductivity	0.005 mS/cm	0.119	0.131	0.220	0.184	0.57 mS/cm	-

#### Metals

Antimony	1 ug/g	<1.0	<1.0	<1.0	<1.0	1.3 ug/g	-
Arsenic	1 ug/g	4.6	3.3	5.1	4.0	18 ug/g	-
Barium	1 ug/g	60.4	97.8	80.4	59.8	220 ug/g	-
Beryllium	0.5 ug/g	0.6	0.6	0.7	0.6	2.5 ug/g	-
Boron	5 ug/g	<5.0	<5.0	<5.0	<5.0	36 ug/g	-
Cadmium	0.5 ug/g	<0.5	<0.5	<0.5	<0.5	1.2 ug/g	-
Chromium	5 ug/g	21.3	22.1	22.7	22.2	70 ug/g	-
Cobalt	1 ug/g	10.3	9.7	9.7	9.4	21 ug/g	-
Copper	5 ug/g	27.8	18.0	27.0	22.0	92 ug/g	-
Lead	1 ug/g	6.5	6.8	8.8	8.5	120 ug/g	-
Molybdenum	1 ug/g	<1.0	<1.0	<1.0	<1.0	2 ug/g	-
Nickel	5 ug/g	21.6	21.1	21.3	16.9	82 ug/g	-
Selenium	1 ug/g	<1.0	<1.0	<1.0	<1.0	1.5 ug/g	-
Silver	0.3 ug/g	<0.3	<0.3	<0.3	<0.3	0.5 ug/g	-
Thallium	1 ug/g	<1.0	<1.0	<1.0	<1.0	1 ug/g	-
Uranium	1 ug/g	<1.0	<1.0	<1.0	<1.0	2.5 ug/g	-
Vanadium	10 ug/g	27.7	31.6	31.4	33.1	86 ug/g	-
Zinc	20 ug/g	48.1	46.4	59.5	57.9	290 ug/g	-

#### Volatiles

Acetone	0.5 ug/g	-	<0.50	<0.50	-	0.5 ug/g	-
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

**Volatiles**

Benzene	0.02 ug/g	-	<0.02	<0.02	-	0.02 ug/g	-
Bromodichloromethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Bromoform	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Bromomethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Carbon Tetrachloride	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Chlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Chloroform	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Dibromochloromethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Dichlorodifluoromethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,2-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,3-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,4-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,2-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
cis-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
trans-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,2-Dichloropropane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
cis-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Ethylbenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Ethylene dibromide (dibromoethane,	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Hexane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	-	<0.50	<0.50	-	0.5 ug/g	-

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Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

**Volatiles**

Methyl Isobutyl Ketone	0.5 ug/g	-	<0.50	<0.50	-	0.5 ug/g	-
Methyl tert-butyl ether	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Methylene Chloride	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Styrene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1,1,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1,2,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Tetrachloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Toluene	0.05 ug/g	-	<0.05	<0.05	-	0.2 ug/g	-
1,1,1-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1,1,2-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Trichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
Trichlorofluoromethane	0.05 ug/g	-	<0.05	<0.05	-	0.25 ug/g	-
Vinyl chloride	0.02 ug/g	-	<0.02	<0.02	-	0.02 ug/g	-
m,p-Xylenes	0.05 ug/g	-	<0.05	<0.05	-	-	-
o-Xylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
Xylenes, total	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
4-Bromofluorobenzene	Surrogate	-	99.3%	99.7%	-	-	-
Toluene-d8	Surrogate	-	93.0%	93.1%	-	-	-
Dibromofluoromethane	Surrogate	-	98.3%	98.5%	-	-	-
Benzene	0.02 ug/g	<0.02	-	-	<0.02	0.02 ug/g	-
Ethylbenzene	0.05 ug/g	<0.05	-	-	<0.05	0.05 ug/g	-
Toluene	0.05 ug/g	<0.05	-	-	<0.05	0.2 ug/g	-
m,p-Xylenes	0.05 ug/g	<0.05	-	-	<0.05	-	-
o-Xylene	0.05 ug/g	<0.05	-	-	<0.05	-	-
Xylenes, total	0.05 ug/g	<0.05	-	-	<0.05	0.05 ug/g	-

Certificate of Analysis

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Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Volatiles

Toluene-d8	Surrogate	92.7%	-	-	92.8%	-
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#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	<7	<7	25 ug/g	-
F2 PHCs (C10-C16)	4 ug/g	<4	<4	<4	<4	10 ug/g	-
F3 PHCs (C16-C34)	8 ug/g	<8	<8	<8	<8	240 ug/g	-
F4 PHCs (C34-C50)	6 ug/g	<6	<6	<6	<6	120 ug/g	-

#### Semi-Volatiles

1,2,4-Trichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-
1-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.59 ug/g	-
2-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.59 ug/g	-
Methylnaphthalene (1&2)	0.05 ug/g	-	<0.05	<0.05	-	0.59 ug/g	-
2,4-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	-	<0.2	<0.2	-	0.5 ug/g	-
3,3'-Dichlorobenzidine	0.1 ug/g	-	<0.1	<0.1	-	1 ug/g	-
4-Chloroaniline	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Acenaphthene	0.05 ug/g	-	<0.05	<0.05	-	0.072 ug/g	-
Acenaphthylene	0.05 ug/g	-	<0.05	<0.05	-	0.093 ug/g	-
Anthracene	0.05 ug/g	-	<0.05	<0.05	-	0.16 ug/g	-
Benzo [a] anthracene	0.05 ug/g	-	<0.05	<0.05	-	0.36 ug/g	-
Benzo [a] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.3 ug/g	-
Benzo [b] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.47 ug/g	-
Benzo [g,h,i] perylene	0.05 ug/g	-	<0.05	<0.05	-	0.68 ug/g	-
Benzo [k] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.48 ug/g	-
Biphenyl	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	-

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Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

Semi-Volatiles

Bis(2-chloroethyl)ether	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Bis(2-chloroisopropyl)ether	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Bis(2-ethylhexyl)phthalate	0.1 ug/g	-	<0.1	<0.1	-	5 ug/g	-
Chrysene	0.05 ug/g	-	<0.05	<0.05	-	2.8 ug/g	-
Diethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Dimethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
Dibenzo [a,h] anthracene	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
Fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	0.56 ug/g	-
Fluorene	0.05 ug/g	-	<0.05	<0.05	-	0.12 ug/g	-
Indeno [1,2,3-cd] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.23 ug/g	-
Naphthalene	0.05 ug/g	-	<0.05	<0.05	-	0.09 ug/g	-
Phenanthrene	0.05 ug/g	-	<0.05	<0.05	-	0.69 ug/g	-
Pyrene	0.05 ug/g	-	<0.05	<0.05	-	1 ug/g	-
2,4,5-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
2,4,6-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
2,4-Dichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
2,4-Dimethylphenol	0.1 ug/g	-	<0.1	<0.1	-	0.2 ug/g	-
2,4-Dinitrophenol	0.1 ug/g	-	<0.1	<0.1	-	2 ug/g	-
2-Chlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
Pentachlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.1 ug/g	-
Phenol	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	-
2-Fluorobiphenyl	Surrogate	-	63.7%	64.4%	-	-	-
Nitrobenzene-d5	Surrogate	-	60.1%	69.6%	-	-	-
Terphenyl-d14	Surrogate	-	83.7%	72.8%	-	-	-
2,4,6-Tribromophenol	Surrogate	-	70.0%	71.9%	-	-	-



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Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

#### Semi-Volatiles

2-Fluorophenol	Surrogate	-	0.0 [1]	70.6%	-	-
Phenol-d6	Surrogate	-	67.9%	72.5%	-	-

#### Pesticides, OC

Aldrin	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
o,p'-DDD	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.05 ug/g	-
o,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
o,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	1.4 ug/g	-
Dieldrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.05 ug/g	-
Endrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	-
Endosulfan I	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	-
Heptachlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.01 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Res/Park/Ind/Com
Matrix:	Soil	Soil	Soil	Soil	-
MDL/Units					

Pesticides, OC

Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.01 ug/g	-
Hexachloroethane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.01 ug/g	-
Methoxychlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	-
Decachlorobiphenyl	Surrogate	99.1%	100%	110%	61.3%	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

**Physical Characteristics**

% Solids	0.1 % by Wt.	90.7	90.0	-	-	-	-
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**General Inorganics**

SAR	0.01 N/A	0.21	0.19	-	-	2.4 N/A	-
Conductivity	0.005 mS/cm	0.225	0.113	-	-	0.57 mS/cm	-

**Metals**

Antimony	1 ug/g	<1.0	<1.0	-	-	1.3 ug/g	-
Arsenic	1 ug/g	3.4	3.9	-	-	18 ug/g	-
Barium	1 ug/g	60.2	59.0	-	-	220 ug/g	-
Beryllium	0.5 ug/g	<0.5	0.6	-	-	2.5 ug/g	-
Boron	5 ug/g	<5.0	<5.0	-	-	36 ug/g	-
Cadmium	0.5 ug/g	<0.5	<0.5	-	-	1.2 ug/g	-
Chromium	5 ug/g	19.9	19.3	-	-	70 ug/g	-
Cobalt	1 ug/g	7.5	10.1	-	-	21 ug/g	-
Copper	5 ug/g	21.9	26.2	-	-	92 ug/g	-
Lead	1 ug/g	8.2	5.5	-	-	120 ug/g	-
Molybdenum	1 ug/g	<1.0	<1.0	-	-	2 ug/g	-
Nickel	5 ug/g	15.8	20.3	-	-	82 ug/g	-
Selenium	1 ug/g	<1.0	<1.0	-	-	1.5 ug/g	-
Silver	0.3 ug/g	<0.3	<0.3	-	-	0.5 ug/g	-
Thallium	1 ug/g	<1.0	<1.0	-	-	1 ug/g	-
Uranium	1 ug/g	<1.0	<1.0	-	-	2.5 ug/g	-
Vanadium	10 ug/g	27.1	29.1	-	-	86 ug/g	-
Zinc	20 ug/g	62.3	42.8	-	-	290 ug/g	-

**Volatiles**

Acetone	0.5 ug/g	<0.50	<0.50	-	-	0.5 ug/g	-
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

**Volatiles**

Benzene	0.02 ug/g	<0.02	<0.02	-	-	0.02 ug/g	-
Bromodichloromethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Bromoform	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Bromomethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Carbon Tetrachloride	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Chlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Chloroform	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Dibromochloromethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Dichlorodifluoromethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,2-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,3-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,4-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,2-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
cis-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
trans-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,2-Dichloropropane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
cis-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Ethylbenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Ethylene dibromide (dibromoethane,	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Hexane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	<0.50	<0.50	-	-	0.5 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

#### Volatiles

Methyl Isobutyl Ketone	0.5 ug/g	<0.50	<0.50	-	-	0.5 ug/g	-
Methyl tert-butyl ether	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Methylene Chloride	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Styrene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1,1,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1,2,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Tetrachloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Toluene	0.05 ug/g	<0.05	<0.05	-	-	0.2 ug/g	-
1,1,1-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
1,1,2-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Trichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Trichlorofluoromethane	0.05 ug/g	<0.05	<0.05	-	-	0.25 ug/g	-
Vinyl chloride	0.02 ug/g	<0.02	<0.02	-	-	0.02 ug/g	-
m,p-Xylenes	0.05 ug/g	<0.05	<0.05	-	-	-	-
o-Xylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
Xylenes, total	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	-
Toluene-d8	Surrogate	91.5%	94.7%	-	-	-	-
Dibromofluoromethane	Surrogate	116%	102%	-	-	-	-
4-Bromofluorobenzene	Surrogate	94.3%	98.8%	-	-	-	-

#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	-	-	25 ug/g	-
F2 PHCs (C10-C16)	4 ug/g	<4	<4	-	-	10 ug/g	-
F3 PHCs (C16-C34)	8 ug/g	76	<8	-	-	240 ug/g	-
F4 PHCs (C34-C50)	6 ug/g	121	<6	-	-	120 ug/g	-

#### Semi-Volatiles

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

Semi-Volatiles

1,2,4-Trichlorobenzene	0.05 ug/g	<0.05	-	-	-	0.05 ug/g	-
1-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	0.59 ug/g	-
2-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	0.59 ug/g	-
Methylnaphthalene (1&2)	0.05 ug/g	<0.05	-	-	-	0.59 ug/g	-
2,4-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	<0.2	-	-	-	0.5 ug/g	-
3,3'-Dichlorobenzidine	0.1 ug/g	<0.1	-	-	-	1 ug/g	-
4-Chloroaniline	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Acenaphthene	0.05 ug/g	<0.05	-	-	-	0.072 ug/g	-
Acenaphthylene	0.05 ug/g	<0.05	-	-	-	0.093 ug/g	-
Anthracene	0.05 ug/g	<0.05	-	-	-	0.16 ug/g	-
Benzo [a] anthracene	0.05 ug/g	<0.05	-	-	-	0.36 ug/g	-
Benzo [a] pyrene	0.05 ug/g	0.09	-	-	-	0.3 ug/g	-
Benzo [b] fluoranthene	0.05 ug/g	0.1	-	-	-	0.47 ug/g	-
Benzo [g,h,i] perylene	0.05 ug/g	0.08	-	-	-	0.68 ug/g	-
Benzo [k] fluoranthene	0.05 ug/g	0.06	-	-	-	0.48 ug/g	-
Biphenyl	0.05 ug/g	<0.05	-	-	-	0.05 ug/g	-
Bis(2-chloroethyl)ether	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Bis(2-chloroisopropyl)ether	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Bis(2-ethylhexyl)phthalate	0.1 ug/g	<0.1	-	-	-	5 ug/g	-
Chrysene	0.05 ug/g	0.09	-	-	-	2.8 ug/g	-
Diethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Dimethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
Dibenzo [a,h] anthracene	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

#### Semi-Volatiles

Fluoranthene	0.05 ug/g	0.1	-	-	-	0.56 ug/g	-
Fluorene	0.05 ug/g	<0.05	-	-	-	0.12 ug/g	-
Indeno [1,2,3-cd] pyrene	0.05 ug/g	0.06	-	-	-	0.23 ug/g	-
Naphthalene	0.05 ug/g	<0.05	-	-	-	0.09 ug/g	-
Phenanthrene	0.05 ug/g	<0.05	-	-	-	0.69 ug/g	-
Pyrene	0.05 ug/g	0.1	-	-	-	1 ug/g	-
2,4,5-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
2,4,6-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
2,4-Dichlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
2,4-Dimethylphenol	0.1 ug/g	<0.1	-	-	-	0.2 ug/g	-
2,4-Dinitrophenol	0.1 ug/g	<0.1	-	-	-	2 ug/g	-
2-Chlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
Pentachlorophenol	0.1 ug/g	<0.1	-	-	-	0.1 ug/g	-
Phenol	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	-
2-Fluorobiphenyl	Surrogate	70.5%	-	-	-	-	-
Nitrobenzene-d5	Surrogate	78.5%	-	-	-	-	-
Terphenyl-d14	Surrogate	74.0%	-	-	-	-	-
2,4,6-Tribromophenol	Surrogate	73.9%	-	-	-	-	-
2-Fluorophenol	Surrogate	81.8%	-	-	-	-	-
Phenol-d6	Surrogate	81.2%	-	-	-	-	-

#### Pesticides, OC

Aldrin	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	-	-	-	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T1
Sample ID:	2334448-05	2334448-06			Res/Park/Ind/Com
Matrix:	Soil	Soil			-
MDL/Units					

Pesticides, OC

Chlordane	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
o,p'-DDD	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	-	-	-	-
DDD	0.02 ug/g	<0.02	<0.02	-	-	0.05 ug/g	-
o,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDE	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
o,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDT	0.01 ug/g	<0.01	<0.01	-	-	1.4 ug/g	-
Dieldrin	0.02 ug/g	<0.02	<0.02	-	-	0.05 ug/g	-
Endrin	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	-
Endosulfan I	0.01 ug/g	<0.01	<0.01	-	-	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	-	-	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	-
Heptachlor	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	-	-	0.01 ug/g	-
Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	-	-	0.01 ug/g	-
Hexachloroethane	0.01 ug/g	<0.01	<0.01	-	-	0.01 ug/g	-
Methoxychlor	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	-
Decachlorobiphenyl	Surrogate	80.1%	79.6%	-	-	-	-



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>								
SAR	ND	0.01	N/A					
Conductivity	ND	0.005	mS/cm					
<b>Hydrocarbons</b>								
F1 PHCs (C6-C10)	ND	7	ug/g					
F2 PHCs (C10-C16)	ND	4	ug/g					
F3 PHCs (C16-C34)	ND	8	ug/g					
F4 PHCs (C34-C50)	ND	6	ug/g					
<b>Metals</b>								
Antimony	ND	1.0	ug/g					
Arsenic	ND	1.0	ug/g					
Barium	ND	1.0	ug/g					
Beryllium	ND	0.5	ug/g					
Boron	ND	5.0	ug/g					
Cadmium	ND	0.5	ug/g					
Chromium	ND	5.0	ug/g					
Cobalt	ND	1.0	ug/g					
Copper	ND	5.0	ug/g					
Lead	ND	1.0	ug/g					
Molybdenum	ND	1.0	ug/g					
Nickel	ND	5.0	ug/g					
Selenium	ND	1.0	ug/g					
Silver	ND	0.3	ug/g					
Thallium	ND	1.0	ug/g					
Uranium	ND	1.0	ug/g					
Vanadium	ND	10.0	ug/g					
Zinc	ND	20.0	ug/g					
<b>Pesticides, OC</b>								
Aldrin	ND	0.01	ug/g					
gamma-BHC (Lindane)	ND	0.01	ug/g					
alpha-Chlordane	ND	0.01	ug/g					
gamma-Chlordane	ND	0.01	ug/g					
Chlordane	ND	0.01	ug/g					

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDD	ND	0.01	ug/g					
p,p'-DDD	ND	0.02	ug/g					
DDD	ND	0.02	ug/g					
o,p'-DDE	ND	0.01	ug/g					
p,p'-DDE	ND	0.01	ug/g					
DDE	ND	0.01	ug/g					
o,p'-DDT	ND	0.01	ug/g					
p,p'-DDT	ND	0.01	ug/g					
DDT	ND	0.01	ug/g					
Dieldrin	ND	0.02	ug/g					
Endrin	ND	0.02	ug/g					
Endosulfan I	ND	0.01	ug/g					
Endosulfan II	ND	0.02	ug/g					
Endosulfan I/II	ND	0.02	ug/g					
Heptachlor	ND	0.01	ug/g					
Heptachlor epoxide	ND	0.01	ug/g					
Hexachlorobenzene	ND	0.01	ug/g					
Hexachlorobutadiene	ND	0.01	ug/g					
Hexachloroethane	ND	0.01	ug/g					
Methoxychlor	ND	0.01	ug/g					
Surrogate: Decachlorobiphenyl	0.0848		%	84.8	50-140			
<b>Semi-Volatiles</b>								
1,2,4-Trichlorobenzene	ND	0.05	ug/g					
1-Methylnaphthalene	ND	0.05	ug/g					
2-Methylnaphthalene	ND	0.05	ug/g					
Methylnaphthalene (1&2)	ND	0.07	ug/g					
2,4-Dinitrotoluene	ND	0.1	ug/g					
2,6-Dinitrotoluene	ND	0.1	ug/g					
Dinitrotoluene (2,4 & 2,6)	ND	0.2	ug/g					
3,3'-Dichlorobenzidine	ND	0.1	ug/g					
4-Chloroaniline	ND	0.1	ug/g					
Acenaphthene	ND	0.05	ug/g					

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthylene	ND	0.05	ug/g					
Anthracene	ND	0.05	ug/g					
Benzo [a] anthracene	ND	0.05	ug/g					
Benzo [a] pyrene	ND	0.05	ug/g					
Benzo [b] fluoranthene	ND	0.05	ug/g					
Benzo [g,h,i] perylene	ND	0.05	ug/g					
Benzo [k] fluoranthene	ND	0.05	ug/g					
Biphenyl	ND	0.05	ug/g					
Bis(2-chloroethyl)ether	ND	0.1	ug/g					
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g					
Bis(2-ethylhexyl)phthalate	ND	0.1	ug/g					
Chrysene	ND	0.05	ug/g					
Diethylphthalate	ND	0.1	ug/g					
Dimethylphthalate	ND	0.1	ug/g					
Dibenzo [a,h] anthracene	ND	0.1	ug/g					
Fluoranthene	ND	0.05	ug/g					
Fluorene	ND	0.05	ug/g					
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g					
Naphthalene	ND	0.05	ug/g					
Phenanthrene	ND	0.05	ug/g					
Pyrene	ND	0.05	ug/g					
2,4,5-Trichlorophenol	ND	0.1	ug/g					
2,4,6-Trichlorophenol	ND	0.1	ug/g					
2,4-Dichlorophenol	ND	0.1	ug/g					
2,4-Dimethylphenol	ND	0.1	ug/g					
2,4-Dinitrophenol	ND	0.1	ug/g					
2-Chlorophenol	ND	0.1	ug/g					
Pentachlorophenol	ND	0.1	ug/g					
Phenol	ND	0.1	ug/g					
Surrogate: 2-Fluorobiphenyl	0.394		%	78.7	50-140			
Surrogate: Nitrobenzene-d5	0.367		%	73.5	40-140			
Surrogate: Terphenyl-d14	0.418		%	83.6	40-140			

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Client: G2S Environmental Consulting Inc. (Burlington)

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Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2,4,6-Tribromophenol	0.372		%	74.4	50-140			
Surrogate: 2-Fluorophenol	0.397		%	79.5	40-140			
Surrogate: Phenol-d6	0.379		%	75.9	40-140			
<b>Volatiles</b>								
Acetone	ND	0.50	ug/g					
Benzene	ND	0.02	ug/g					
Bromodichloromethane	ND	0.05	ug/g					
Bromoform	ND	0.05	ug/g					
Bromomethane	ND	0.05	ug/g					
Carbon Tetrachloride	ND	0.05	ug/g					
Chlorobenzene	ND	0.05	ug/g					
Chloroform	ND	0.05	ug/g					
Dibromochloromethane	ND	0.05	ug/g					
Dichlorodifluoromethane	ND	0.05	ug/g					
1,2-Dichlorobenzene	ND	0.05	ug/g					
1,3-Dichlorobenzene	ND	0.05	ug/g					
1,4-Dichlorobenzene	ND	0.05	ug/g					
1,1-Dichloroethane	ND	0.05	ug/g					
1,2-Dichloroethane	ND	0.05	ug/g					
1,1-Dichloroethylene	ND	0.05	ug/g					
cis-1,2-Dichloroethylene	ND	0.05	ug/g					
trans-1,2-Dichloroethylene	ND	0.05	ug/g					
1,2-Dichloropropane	ND	0.05	ug/g					
cis-1,3-Dichloropropylene	ND	0.05	ug/g					
trans-1,3-Dichloropropylene	ND	0.05	ug/g					
1,3-Dichloropropene, total	ND	0.05	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g					
Hexane	ND	0.05	ug/g					
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g					
Methyl Isobutyl Ketone	ND	0.50	ug/g					
Methyl tert-butyl ether	ND	0.05	ug/g					

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### Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylene Chloride	ND	0.05	ug/g					
Styrene	ND	0.05	ug/g					
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g					
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g					
Tetrachloroethylene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
1,1,1-Trichloroethane	ND	0.05	ug/g					
1,1,2-Trichloroethane	ND	0.05	ug/g					
Trichloroethylene	ND	0.05	ug/g					
Trichlorofluoromethane	ND	0.05	ug/g					
Vinyl chloride	ND	0.02	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: 4-Bromofluorobenzene	7.87		%	97.7	50-140			
Surrogate: Dibromofluoromethane	8.59		%	107	50-140			
Surrogate: Toluene-d8	7.53		%	93.8	50-140			
Benzene	ND	0.02	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: Toluene-d8	7.53		%	93.8	50-140			

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## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>									
SAR	0.19	0.01	N/A	0.19			0.0	30	
Conductivity	0.116	0.005	mS/cm	0.113			2.4	5	
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g	ND			NC	30	
<b>Metals</b>									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	1.8	1.0	ug/g	1.6			12.1	30	
Barium	12.2	1.0	ug/g	12.0			1.4	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	ND	5.0	ug/g	ND			NC	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	7.2	5.0	ug/g	6.7			8.5	30	
Cobalt	2.7	1.0	ug/g	2.4			11.9	30	
Copper	8.0	5.0	ug/g	8.0			1.2	30	
Lead	2.2	1.0	ug/g	1.8			25.0	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	ND	5.0	ug/g	ND			NC	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	15.1	10.0	ug/g	16.9			11.2	30	
Zinc	ND	20.0	ug/g	ND			NC	30	
<b>Physical Characteristics</b>									
% Solids	80.4	0.1	% by Wt.	82.2			2.3	25	
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	ND	0.05	ug/g	ND			NC	40	

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### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2,4-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
2,6-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
3,3'-Dichlorobenzidine	ND	0.1	ug/g	ND			NC	40	
4-Chloroaniline	ND	0.1	ug/g	ND			NC	40	
Acenaphthene	ND	0.05	ug/g	ND			NC	40	
Acenaphthylene	ND	0.05	ug/g	ND			NC	40	
Anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] pyrene	ND	0.05	ug/g	ND			NC	40	
Benzo [b] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.05	ug/g	ND			NC	40	
Benzo [k] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Biphenyl	ND	0.05	ug/g	ND			NC	40	
Bis(2-chloroethyl)ether	ND	0.1	ug/g	ND			NC	40	
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g	ND			NC	40	
Chrysene	ND	0.05	ug/g	ND			NC	40	
Diethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dimethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.1	ug/g	ND			NC	40	
Fluoranthene	ND	0.05	ug/g	ND			NC	40	
Fluorene	ND	0.05	ug/g	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g	ND			NC	40	
Naphthalene	ND	0.05	ug/g	ND			NC	40	
Phenanthrene	ND	0.05	ug/g	ND			NC	40	
Pyrene	ND	0.05	ug/g	ND			NC	40	
2,4,5-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4,6-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4-Dinitrophenol	ND	0.1	ug/g	ND			NC	40	
2-Chlorophenol	ND	0.1	ug/g	ND			NC	40	

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### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Pentachlorophenol	ND	0.1	ug/g	ND			NC	40	
Phenol	ND	0.1	ug/g	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	0.344		%		61.8	50-140			
Surrogate: Nitrobenzene-d5	0.372		%		66.8	40-140			
Surrogate: Terphenyl-d14	0.420		%		75.4	40-140			
Surrogate: 2,4,6-Tribromophenol	0.401		%		72.1	50-140			
Surrogate: 2-Fluorophenol	0.429		%		77.0	40-140			
Surrogate: Phenol-d6	0.409		%		73.5	40-140			
<b>Volatiles</b>									
Acetone	ND	0.50	ug/g	ND			NC	50	
Benzene	ND	0.02	ug/g	ND			NC	50	
Bromodichloromethane	ND	0.05	ug/g	ND			NC	50	
Bromoform	ND	0.05	ug/g	ND			NC	50	
Bromomethane	ND	0.05	ug/g	ND			NC	50	
Carbon Tetrachloride	ND	0.05	ug/g	ND			NC	50	
Chlorobenzene	ND	0.05	ug/g	ND			NC	50	
Chloroform	ND	0.05	ug/g	ND			NC	50	
Dibromochloromethane	ND	0.05	ug/g	ND			NC	50	
Dichlorodifluoromethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,3-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,4-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloropropane	ND	0.05	ug/g	ND			NC	50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	



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Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g	ND			NC	50	
Hexane	ND	0.05	ug/g	ND			NC	50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g	ND			NC	50	
Methyl Isobutyl Ketone	ND	0.50	ug/g	ND			NC	50	
Methyl tert-butyl ether	ND	0.05	ug/g	ND			NC	50	
Methylene Chloride	ND	0.05	ug/g	ND			NC	50	
Styrene	ND	0.05	ug/g	ND			NC	50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
Tetrachloroethylene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
1,1,1-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
Trichloroethylene	ND	0.05	ug/g	ND			NC	50	
Trichlorofluoromethane	ND	0.05	ug/g	ND			NC	50	
Vinyl chloride	ND	0.02	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: 4-Bromofluorobenzene	12.6		%		97.5	50-140			
Surrogate: Dibromofluoromethane	15.5		%		120	50-140			
Surrogate: Toluene-d8	12.3		%		95.7	50-140			
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	12.3		%		95.7	50-140			

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Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	58	7	ug/g	ND	82.6	80-120			
F2 PHCs (C10-C16)	120	4	ug/g	ND	131	60-140			
F3 PHCs (C16-C34)	233	8	ug/g	ND	113	60-140			
F4 PHCs (C34-C50)	160	6	ug/g	ND	108	60-140			
<b>Metals</b>									
Antimony	132	1.0	ug/g	ND	105	70-130			
Arsenic	125	1.0	ug/g	1.6	98.8	70-130			
Barium	139	1.0	ug/g	12.0	101	70-130			
Beryllium	119	0.5	ug/g	ND	95.6	70-130			
Boron	117	5.0	ug/g	ND	93.9	70-130			
Cadmium	125	0.5	ug/g	ND	99.7	70-130			
Chromium	138	5.0	ug/g	6.7	105	70-130			
Cobalt	131	1.0	ug/g	2.4	103	70-130			
Copper	131	5.0	ug/g	8.0	98.4	70-130			
Lead	117	1.0	ug/g	1.8	92.4	70-130			
Molybdenum	127	1.0	ug/g	ND	101	70-130			
Nickel	128	5.0	ug/g	ND	103	70-130			
Selenium	131	1.0	ug/g	ND	105	70-130			
Silver	100	0.3	ug/g	ND	80.2	70-130			
Thallium	114	1.0	ug/g	ND	91.3	70-130			
Uranium	117	1.0	ug/g	ND	93.8	70-130			
Vanadium	148	10.0	ug/g	16.9	105	70-130			
Zinc	137	20.0	ug/g	ND	110	70-130			
<b>Pesticides, OC</b>									
Aldrin	0.27	0.01	ug/g	ND	135	50-140			
gamma-BHC (Lindane)	0.26	0.01	ug/g	ND	128	50-140			
alpha-Chlordane	0.21	0.01	ug/g	ND	106	50-140			
gamma-Chlordane	0.21	0.01	ug/g	ND	104	50-140			
o,p'-DDD	0.23	0.01	ug/g	ND	115	50-140			
p,p'-DDD	0.14	0.02	ug/g	ND	68.0	50-140			

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Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDE	0.20	0.01	ug/g	ND	98.8	50-140			
p,p'-DDE	0.18	0.01	ug/g	ND	92.1	50-140			
o,p'-DDT	0.16	0.01	ug/g	ND	77.9	50-140			
p,p'-DDT	0.15	0.01	ug/g	ND	76.9	50-140			
Dieldrin	0.20	0.02	ug/g	ND	101	50-140			
Endrin	0.12	0.02	ug/g	ND	57.7	50-140			
Endosulfan I	0.22	0.01	ug/g	ND	108	50-140			
Endosulfan II	0.13	0.02	ug/g	ND	64.2	50-140			
Heptachlor	0.25	0.01	ug/g	ND	127	50-140			
Heptachlor epoxide	0.24	0.01	ug/g	ND	121	50-140			
Hexachlorobenzene	0.26	0.01	ug/g	ND	129	50-140			
Hexachlorobutadiene	0.19	0.01	ug/g	ND	96.9	50-140			
Hexachloroethane	0.17	0.01	ug/g	ND	87.3	50-140			
Methoxychlor	0.21	0.01	ug/g	ND	104	50-140			
Surrogate: Decachlorobiphenyl	0.0961		%		96.1	50-140			
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	0.37	0.05	ug/g	ND	67.2	50-140			
1-Methylnaphthalene	0.45	0.05	ug/g	ND	81.3	50-140			
2-Methylnaphthalene	0.43	0.05	ug/g	ND	76.9	50-140			
2,4-Dinitrotoluene	0.54	0.1	ug/g	ND	97.7	50-140			
2,6-Dinitrotoluene	0.52	0.1	ug/g	ND	93.2	50-140			
3,3'-Dichlorobenzidine	0.35	0.1	ug/g	ND	63.5	30-130			
4-Chloroaniline	0.47	0.1	ug/g	ND	84.6	30-130			
Acenaphthene	0.46	0.05	ug/g	ND	81.9	50-140			
Acenaphthylene	0.50	0.05	ug/g	ND	89.5	50-140			
Anthracene	0.45	0.05	ug/g	ND	80.8	50-140			
Benzo [a] anthracene	0.46	0.05	ug/g	ND	82.0	50-140			
Benzo [a] pyrene	0.48	0.05	ug/g	ND	86.8	50-140			
Benzo [b] fluoranthene	0.46	0.05	ug/g	ND	83.5	50-140			
Benzo [g,h,i] perylene	0.47	0.05	ug/g	ND	84.2	50-140			
Benzo [k] fluoranthene	0.48	0.05	ug/g	ND	86.1	50-140			

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## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Biphenyl	0.47	0.05	ug/g	ND	81.8	50-140			
Bis(2-chloroethyl)ether	0.56	0.1	ug/g	ND	101	50-140			
Bis(2-chloroisopropyl)ether	0.39	0.1	ug/g	ND	69.7	50-140			
Chrysene	0.47	0.05	ug/g	ND	84.9	50-140			
Diethylphthalate	0.59	0.1	ug/g	ND	107	50-140			
Dimethylphthalate	0.53	0.1	ug/g	ND	95.2	50-140			
Dibenzo [a,h] anthracene	0.46	0.1	ug/g	ND	83.4	50-140			
Fluoranthene	0.52	0.05	ug/g	ND	92.6	50-140			
Fluorene	0.52	0.05	ug/g	ND	93.3	50-140			
Indeno [1,2,3-cd] pyrene	0.47	0.05	ug/g	ND	84.1	50-140			
Naphthalene	0.41	0.05	ug/g	ND	73.9	50-140			
Phenanthrene	0.46	0.05	ug/g	ND	82.5	50-140			
Pyrene	0.44	0.05	ug/g	ND	78.8	50-140			
2,4,5-Trichlorophenol	0.47	0.1	ug/g	ND	84.1	50-140			
2,4,6-Trichlorophenol	0.45	0.1	ug/g	ND	80.0	50-140			
2,4-Dinitrophenol	4.52	0.1	ug/g	ND	50.4	50-140			
2-Chlorophenol	0.44	0.1	ug/g	ND	79.5	50-140			
Pentachlorophenol	0.45	0.1	ug/g	ND	80.4	50-140			
Phenol	0.46	0.1	ug/g	ND	82.5	30-140			
Surrogate: 2-Fluorobiphenyl	0.396		%		71.2	50-140			
Surrogate: Nitrobenzene-d5	0.425		%		76.4	40-140			
Surrogate: Terphenyl-d14	0.430		%		77.3	40-140			
Surrogate: 2,4,6-Tribromophenol	0.549		%		98.6	50-140			
Surrogate: 2-Fluorophenol	0.489		%		87.8	40-140			
Surrogate: Phenol-d6	0.453		%		81.4	40-140			
<b>Volatiles</b>									
Acetone	11.3	0.50	ug/g	ND	113	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Bromodichloromethane	3.65	0.05	ug/g	ND	90.9	60-130			
Bromoform	4.06	0.05	ug/g	ND	100	60-130			
Bromomethane	4.37	0.05	ug/g	ND	109	50-140			

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## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Carbon Tetrachloride	3.71	0.05	ug/g	ND	92.3	60-130			
Chlorobenzene	3.95	0.05	ug/g	ND	97.7	60-130			
Chloroform	3.53	0.05	ug/g	ND	87.8	60-130			
Dibromochloromethane	3.62	0.05	ug/g	ND	89.7	60-130			
Dichlorodifluoromethane	5.18	0.05	ug/g	ND	129	50-140			
1,2-Dichlorobenzene	3.89	0.05	ug/g	ND	96.7	60-130			
1,3-Dichlorobenzene	3.86	0.05	ug/g	ND	95.6	60-130			
1,4-Dichlorobenzene	3.81	0.05	ug/g	ND	94.3	60-130			
1,1-Dichloroethane	3.51	0.05	ug/g	ND	87.3	60-130			
1,2-Dichloroethane	3.93	0.05	ug/g	ND	97.2	60-130			
1,1-Dichloroethylene	3.61	0.05	ug/g	ND	89.8	60-130			
cis-1,2-Dichloroethylene	3.62	0.05	ug/g	ND	90.5	60-130			
trans-1,2-Dichloroethylene	3.57	0.05	ug/g	ND	88.9	60-130			
1,2-Dichloropropane	3.80	0.05	ug/g	ND	94.0	60-130			
cis-1,3-Dichloropropylene	3.77	0.05	ug/g	ND	93.7	60-130			
trans-1,3-Dichloropropylene	4.04	0.05	ug/g	ND	100	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Ethylene dibromide (dibromoethane, 1,2-)	3.65	0.05	ug/g	ND	90.7	60-130			
Hexane	4.01	0.05	ug/g	ND	100	60-130			
Methyl Ethyl Ketone (2-Butanone)	10.3	0.50	ug/g	ND	103	50-140			
Methyl Isobutyl Ketone	9.99	0.50	ug/g	ND	99.9	50-140			
Methyl tert-butyl ether	9.96	0.05	ug/g	ND	99.6	50-140			
Methylene Chloride	4.68	0.05	ug/g	ND	116	60-130			
Styrene	4.31	0.05	ug/g	ND	107	60-130			
1,1,1,2-Tetrachloroethane	3.49	0.05	ug/g	ND	86.7	60-130			
1,1,2,2-Tetrachloroethane	3.65	0.05	ug/g	ND	90.8	60-130			
Tetrachloroethylene	3.62	0.05	ug/g	ND	90.0	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
1,1,1-Trichloroethane	3.74	0.05	ug/g	ND	93.0	60-130			
1,1,2-Trichloroethane	4.01	0.05	ug/g	ND	99.8	60-130			
Trichloroethylene	3.78	0.05	ug/g	ND	94.1	60-130			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	3.38	0.05	ug/g	ND	83.7	50-140			
Vinyl chloride	4.47	0.02	ug/g	ND	111	50-140			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: 4-Bromofluorobenzene	7.48		%		92.8	50-140			
Surrogate: Dibromofluoromethane	7.04		%		87.3	50-140			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Qualifier Notes:

**Sample Qualifiers :**

- 1: Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

Sample Data Revisions:

None

## Certificate of Analysis

Client: G2S Environmental Consulting Inc. (Burlington)

Client PO:

Report Date: 18-Sep-2023

Order Date: 24-Aug-2023

Project Description: G2S23256

**Work Order Revisions / Comments:**

Revision-1: Guideline comparisons updated as per client request.

Revision-2: This report includes an updated parameter list, as per client.

Revision-3: Guideline comparisons updated as per client request.

**Other Report Notes:**

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unless otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Benzo[b]fluoranthene results may be biased high due to co-elution with Benzo[j]fluoranthene

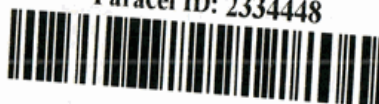
*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Paracel ID: 2334448



**Chain Of Custody**  
(Lab Use Only)

Client Name: G2S Consulting	Project Ref: G2S23256	Page 1 of 1
Contact Name: Dana Haslett	Quote #: Standing Offer	<b>Turnaround Time</b> <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address: 4361 Harvester Road, Unit 12 Burlington, ON	PO #:	
Telephone:	E-mail: danah@g2sconsulting.cm	
		Date Required: _____

<input type="checkbox"/> REG 153/04 <input checked="" type="checkbox"/> REG 406/19		Other Regulation		<b>Matrix Type:</b> S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis																	
<input checked="" type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input checked="" type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input checked="" type="checkbox"/> Table 3,1 For RSC: <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> REG 558 <input type="checkbox"/> PWQO <input type="checkbox"/> CCME <input type="checkbox"/> MISA <input type="checkbox"/> SU - Sani <input type="checkbox"/> SU - Storm Mun: _____ <input type="checkbox"/> Other: _____																					
Sample ID/Location Name				Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	Cr/VI	B (HWS)	EC/SAR	OCP						
							Date	Time															
1	BH101 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
2	BH103 S5		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
3	BH104 S1		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
4	BH105 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
5	BH108 S1		S		3		23-8-18	AM	✓	✓		✓				✓	✓						
6	BH109 S4		S		3		23-8-18	AM	✓			✓				✓	✓						
7																							
8																							
9																							
10																							

Comments: AGAT methanol vial used as preservatives Analyze VOC/SVOCs				Method of Delivery: <b>Zoom</b>	
Relinquished By (Sign): <i>Samantha Patrick</i>		Received By Driver/Depot:		Received at Lab: <i>C-PM</i>	
Relinquished By (Print): Samantha Patrick		Date/Time:		Date/Time: <i>08/24/24 12:40</i>	
Date/Time: 23-8-24 9:30		Temperature: °C		Date/Time: <i>08/24/23 15:00</i>	
		Temperature: <i>13.9</i>		pH Verified: <input type="checkbox"/> By:	

## Certificate of Analysis

**G2S Environmental Consulting Inc. (Burlington)**

4361 Harvester Road, Unit 12

Burlington, ON L7L 5M4

Attn: Dana Haslett

Client PO:

Project: G2S23256

Custody:

Report Date: 18-Sep-2023

Order Date: 24-Aug-2023

Revised Report

**Order #: 2334448**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2334448-01	BH101 S2
2334448-02	BH103 S5
2334448-03	BH104 S1
2334448-04	BH105 S2
2334448-05	BH108 S1
2334448-06	BH109 S4

Approved By:



Milan Ralitsch, PhD

Senior Technical Manager

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
Conductivity	MOE E3138 - probe @25 °C, water ext	30-Aug-23	30-Aug-23
PHC F1	CWS Tier 1 - P&T GC-FID	25-Aug-23	28-Aug-23
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Aug-23	30-Aug-23
REG 153: ABNs + PAHs	based on SW-846 8270	8-Sep-23	12-Sep-23
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	31-Aug-23	31-Aug-23
REG 153: Pesticides, OC	EPA 8081B - GC-ECD	25-Aug-23	28-Aug-23
REG 153: VOCs by P&T GC-MS	EPA 8260 - P&T GC-MS	25-Aug-23	28-Aug-23
SAR	Calculated	30-Aug-23	30-Aug-23
Solids, %	CWS Tier 1 - Gravimetric	28-Aug-23	28-Aug-23

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

**Regulatory Comparison:**

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Reg 406/19 -T3.1 Ind/Com	Reg 406/19 -T3.1 Res/Park
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

#### Physical Characteristics

% Solids	0.1 % by Wt.	89.7	89.8	90.7	87.7	-	-
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#### General Inorganics

SAR	0.01 N/A	0.31	0.15	0.31	0.68	12 N/A	5 N/A
Conductivity	0.005 mS/cm	0.119	0.131	0.220	0.184	1.4 mS/cm	0.7 mS/cm

#### Metals

Antimony	1 ug/g	<1.0	<1.0	<1.0	<1.0	40 ug/g	7.5 ug/g
Arsenic	1 ug/g	4.6	3.3	5.1	4.0	18 ug/g	18 ug/g
Barium	1 ug/g	60.4	97.8	80.4	59.8	670 ug/g	390 ug/g
Beryllium	0.5 ug/g	0.6	0.6	0.7	0.6	8 ug/g	4 ug/g
Boron	5 ug/g	<5.0	<5.0	<5.0	<5.0	120 ug/g	120 ug/g
Cadmium	0.5 ug/g	<0.5	<0.5	<0.5	<0.5	1.9 ug/g	1.2 ug/g
Chromium	5 ug/g	21.3	22.1	22.7	22.2	160 ug/g	160 ug/g
Cobalt	1 ug/g	10.3	9.7	9.7	9.4	80 ug/g	22 ug/g
Copper	5 ug/g	27.8	18.0	27.0	22.0	230 ug/g	140 ug/g
Lead	1 ug/g	6.5	6.8	8.8	8.5	120 ug/g	120 ug/g
Molybdenum	1 ug/g	<1.0	<1.0	<1.0	<1.0	40 ug/g	6.9 ug/g
Nickel	5 ug/g	21.6	21.1	21.3	16.9	270 ug/g	100 ug/g
Selenium	1 ug/g	<1.0	<1.0	<1.0	<1.0	5.5 ug/g	2.4 ug/g
Silver	0.3 ug/g	<0.3	<0.3	<0.3	<0.3	40 ug/g	20 ug/g
Thallium	1 ug/g	<1.0	<1.0	<1.0	<1.0	3.3 ug/g	1 ug/g
Uranium	1 ug/g	<1.0	<1.0	<1.0	<1.0	33 ug/g	23 ug/g
Vanadium	10 ug/g	27.7	31.6	31.4	33.1	86 ug/g	86 ug/g
Zinc	20 ug/g	48.1	46.4	59.5	57.9	340 ug/g	340 ug/g

#### Volatiles

Acetone	0.5 ug/g	-	<0.50	<0.50	-	1.8 ug/g	1.8 ug/g
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

**Volatiles**

Benzene	0.02 ug/g	-	<0.02	<0.02	-	0.034 ug/g	0.02 ug/g
Bromodichloromethane	0.05 ug/g	-	<0.05	<0.05	-	5.8 ug/g	5.8 ug/g
Bromoform	0.05 ug/g	-	<0.05	<0.05	-	2.5 ug/g	2.5 ug/g
Bromomethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Carbon Tetrachloride	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Chlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.28 ug/g	0.28 ug/g
Chloroform	0.05 ug/g	-	<0.05	<0.05	-	0.26 ug/g	0.08 ug/g
Dibromochloromethane	0.05 ug/g	-	<0.05	<0.05	-	5.5 ug/g	5.5 ug/g
Dichlorodifluoromethane	0.05 ug/g	-	<0.05	<0.05	-	1.8 ug/g	1.8 ug/g
1,2-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	6.8 ug/g	3.4 ug/g
1,3-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	6.8 ug/g	4.8 ug/g
1,4-Dichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
1,1-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.57 ug/g	0.14 ug/g
1,2-Dichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
1,1-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
cis-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
trans-1,2-Dichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
1,2-Dichloropropane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
cis-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Ethylbenzene	0.05 ug/g	-	<0.05	<0.05	-	1.9 ug/g	1.9 ug/g
Ethylene dibromide (dibromoethane,	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Hexane	0.05 ug/g	-	<0.05	<0.05	-	2.5 ug/g	2.5 ug/g
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	-	<0.50	<0.50	-	26 ug/g	14 ug/g

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

**Volatiles**

Methyl Isobutyl Ketone	0.5 ug/g	-	<0.50	<0.50	-	17 ug/g	0.89 ug/g
Methyl tert-butyl ether	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Methylene Chloride	0.05 ug/g	-	<0.05	<0.05	-	0.2 ug/g	0.06 ug/g
Styrene	0.05 ug/g	-	<0.05	<0.05	-	6.8 ug/g	0.5 ug/g
1,1,1,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
1,1,2,2-Tetrachloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Tetrachloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Toluene	0.05 ug/g	-	<0.05	<0.05	-	7.8 ug/g	0.99 ug/g
1,1,1-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.4 ug/g	0.11 ug/g
1,1,2-Trichloroethane	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Trichloroethylene	0.05 ug/g	-	<0.05	<0.05	-	0.05 ug/g	0.05 ug/g
Trichlorofluoromethane	0.05 ug/g	-	<0.05	<0.05	-	0.46 ug/g	0.46 ug/g
Vinyl chloride	0.02 ug/g	-	<0.02	<0.02	-	0.02 ug/g	0.02 ug/g
m,p-Xylenes	0.05 ug/g	-	<0.05	<0.05	-	-	-
o-Xylene	0.05 ug/g	-	<0.05	<0.05	-	-	-
Xylenes, total	0.05 ug/g	-	<0.05	<0.05	-	3 ug/g	0.9 ug/g
4-Bromofluorobenzene	Surrogate	-	99.3%	99.7%	-	-	-
Toluene-d8	Surrogate	-	93.0%	93.1%	-	-	-
Dibromofluoromethane	Surrogate	-	98.3%	98.5%	-	-	-
Benzene	0.02 ug/g	<0.02	-	-	<0.02	0.034 ug/g	0.02 ug/g
Ethylbenzene	0.05 ug/g	<0.05	-	-	<0.05	1.9 ug/g	1.9 ug/g
Toluene	0.05 ug/g	<0.05	-	-	<0.05	7.8 ug/g	0.99 ug/g
m,p-Xylenes	0.05 ug/g	<0.05	-	-	<0.05	-	-
o-Xylene	0.05 ug/g	<0.05	-	-	<0.05	-	-
Xylenes, total	0.05 ug/g	<0.05	-	-	<0.05	3 ug/g	0.9 ug/g

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

#### Volatiles

Toluene-d8	Surrogate	92.7%	-	-	92.8%	-	-
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#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	<7	<7	25 ug/g	25 ug/g
F2 PHCs (C10-C16)	4 ug/g	<4	<4	<4	<4	26 ug/g	10 ug/g
F3 PHCs (C16-C34)	8 ug/g	<8	<8	<8	<8	1700 ug/g	300 ug/g
F4 PHCs (C34-C50)	6 ug/g	<6	<6	<6	<6	3300 ug/g	2800 ug/g

#### Semi-Volatiles

1,2,4-Trichlorobenzene	0.05 ug/g	-	<0.05	<0.05	-	1.3 ug/g	0.17 ug/g
1-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	8.7 ug/g	0.92 ug/g
2-Methylnaphthalene	0.05 ug/g	-	<0.05	<0.05	-	8.7 ug/g	0.92 ug/g
Methylnaphthalene (1&2)	0.05 ug/g	-	<0.05	<0.05	-	8.7 ug/g	0.92 ug/g
2,4-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	-	<0.1	<0.1	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	-	<0.2	<0.2	-	1.2 ug/g	0.92 ug/g
3,3'-Dichlorobenzidine	0.1 ug/g	-	<0.1	<0.1	-	1 ug/g	1 ug/g
4-Chloroaniline	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	0.5 ug/g
Acenaphthene	0.05 ug/g	-	<0.05	<0.05	-	15 ug/g	14 ug/g
Acenaphthylene	0.05 ug/g	-	<0.05	<0.05	-	0.093 ug/g	0.093 ug/g
Anthracene	0.05 ug/g	-	<0.05	<0.05	-	0.16 ug/g	0.16 ug/g
Benzo [a] anthracene	0.05 ug/g	-	<0.05	<0.05	-	1 ug/g	0.5 ug/g
Benzo [a] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.7 ug/g	0.57 ug/g
Benzo [b] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	7 ug/g	5.7 ug/g
Benzo [g,h,i] perylene	0.05 ug/g	-	<0.05	<0.05	-	13 ug/g	6.6 ug/g
Benzo [k] fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	7 ug/g	5.7 ug/g
Biphenyl	0.05 ug/g	-	<0.05	<0.05	-	21 ug/g	0.3 ug/g



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

**Semi-Volatiles**

Bis(2-chloroethyl)ether	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	0.5 ug/g
Bis(2-chloroisopropyl)ether	0.1 ug/g	-	<0.1	<0.1	-	11 ug/g	0.5 ug/g
Bis(2-ethylhexyl)phthalate	0.1 ug/g	-	<0.1	<0.1	-	28 ug/g	5 ug/g
Chrysene	0.05 ug/g	-	<0.05	<0.05	-	14 ug/g	7 ug/g
Diethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	0.5 ug/g
Dimethylphthalate	0.1 ug/g	-	<0.1	<0.1	-	0.5 ug/g	0.5 ug/g
Dibenzo [a,h] anthracene	0.1 ug/g	-	<0.1	<0.1	-	0.7 ug/g	0.57 ug/g
Fluoranthene	0.05 ug/g	-	<0.05	<0.05	-	70 ug/g	0.69 ug/g
Fluorene	0.05 ug/g	-	<0.05	<0.05	-	6.8 ug/g	6.8 ug/g
Indeno [1,2,3-cd] pyrene	0.05 ug/g	-	<0.05	<0.05	-	0.76 ug/g	0.38 ug/g
Naphthalene	0.05 ug/g	-	<0.05	<0.05	-	1.8 ug/g	0.59 ug/g
Phenanthrene	0.05 ug/g	-	<0.05	<0.05	-	12 ug/g	6.2 ug/g
Pyrene	0.05 ug/g	-	<0.05	<0.05	-	70 ug/g	70 ug/g
2,4,5-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	3.1 ug/g	3.1 ug/g
2,4,6-Trichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.43 ug/g	0.43 ug/g
2,4-Dichlorophenol	0.1 ug/g	-	<0.1	<0.1	-	3.4 ug/g	1.7 ug/g
2,4-Dimethylphenol	0.1 ug/g	-	<0.1	<0.1	-	45 ug/g	45 ug/g
2,4-Dinitrophenol	0.1 ug/g	-	<0.1	<0.1	-	6.7 ug/g	6.7 ug/g
2-Chlorophenol	0.1 ug/g	-	<0.1	<0.1	-	2.3 ug/g	1.6 ug/g
Pentachlorophenol	0.1 ug/g	-	<0.1	<0.1	-	0.34 ug/g	0.1 ug/g
Phenol	0.1 ug/g	-	<0.1	<0.1	-	5.3 ug/g	5.3 ug/g
2-Fluorobiphenyl	Surrogate	-	63.7%	64.4%	-	-	-
Nitrobenzene-d5	Surrogate	-	60.1%	69.6%	-	-	-
Terphenyl-d14	Surrogate	-	83.7%	72.8%	-	-	-
2,4,6-Tribromophenol	Surrogate	-	70.0%	71.9%	-	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1 Ind/Com	Reg 406/19 -T3.1 Res/Park
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04		
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

#### Semi-Volatiles

2-Fluorophenol	Surrogate	-	0.0 [1]	70.6%	-	-
Phenol-d6	Surrogate	-	67.9%	72.5%	-	-

#### Pesticides, OC

Aldrin	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.088 ug/g	0.05 ug/g
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Chlordane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	0.05 ug/g
o,p'-DDD	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
DDD	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	4.6 ug/g	3.3 ug/g
o,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDE	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.52 ug/g	0.26 ug/g
o,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
DDT	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	1.4 ug/g	1.4 ug/g
Dieldrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.088 ug/g	0.05 ug/g
Endrin	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	0.04 ug/g
Endosulfan I	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.04 ug/g	0.04 ug/g
Heptachlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.072 ug/g	0.072 ug/g
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.05 ug/g	0.05 ug/g
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.66 ug/g	0.52 ug/g

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH101 S2	BH103 S5	BH104 S1	BH105 S2	Criteria:	
Sample Date:	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	17-Aug-23 12:00	Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-01	2334448-02	2334448-03	2334448-04	Ind/Com	Res/Park
Matrix:	Soil	Soil	Soil	Soil		
MDL/Units						

Pesticides, OC

Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.01 ug/g	0.01 ug/g
Hexachloroethane	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.13 ug/g	0.01 ug/g
Methoxychlor	0.01 ug/g	<0.01	<0.01	<0.01	<0.01	0.19 ug/g	0.13 ug/g
Decachlorobiphenyl	Surrogate	99.1%	100%	110%	61.3%	-	-

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:	
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com	Res/Park
Matrix:	Soil	Soil				
MDL/Units						

#### Physical Characteristics

% Solids	0.1 % by Wt.	90.7	90.0	-	-	-	-
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#### General Inorganics

SAR	0.01 N/A	0.21	0.19	-	-	12 N/A	5 N/A
Conductivity	0.005 mS/cm	0.225	0.113	-	-	1.4 mS/cm	0.7 mS/cm

#### Metals

Antimony	1 ug/g	<1.0	<1.0	-	-	40 ug/g	7.5 ug/g
Arsenic	1 ug/g	3.4	3.9	-	-	18 ug/g	18 ug/g
Barium	1 ug/g	60.2	59.0	-	-	670 ug/g	390 ug/g
Beryllium	0.5 ug/g	<0.5	0.6	-	-	8 ug/g	4 ug/g
Boron	5 ug/g	<5.0	<5.0	-	-	120 ug/g	120 ug/g
Cadmium	0.5 ug/g	<0.5	<0.5	-	-	1.9 ug/g	1.2 ug/g
Chromium	5 ug/g	19.9	19.3	-	-	160 ug/g	160 ug/g
Cobalt	1 ug/g	7.5	10.1	-	-	80 ug/g	22 ug/g
Copper	5 ug/g	21.9	26.2	-	-	230 ug/g	140 ug/g
Lead	1 ug/g	8.2	5.5	-	-	120 ug/g	120 ug/g
Molybdenum	1 ug/g	<1.0	<1.0	-	-	40 ug/g	6.9 ug/g
Nickel	5 ug/g	15.8	20.3	-	-	270 ug/g	100 ug/g
Selenium	1 ug/g	<1.0	<1.0	-	-	5.5 ug/g	2.4 ug/g
Silver	0.3 ug/g	<0.3	<0.3	-	-	40 ug/g	20 ug/g
Thallium	1 ug/g	<1.0	<1.0	-	-	3.3 ug/g	1 ug/g
Uranium	1 ug/g	<1.0	<1.0	-	-	33 ug/g	23 ug/g
Vanadium	10 ug/g	27.1	29.1	-	-	86 ug/g	86 ug/g
Zinc	20 ug/g	62.3	42.8	-	-	340 ug/g	340 ug/g

#### Volatiles

Acetone	0.5 ug/g	<0.50	<0.50	-	-	1.8 ug/g	1.8 ug/g
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Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com
Matrix:	Soil	Soil			Reg 406/19 -T3.1
					Res/Park
MDL/Units					

**Volatiles**

Benzene	0.02 ug/g	<0.02	<0.02	-	-	0.034 ug/g	0.02 ug/g
Bromodichloromethane	0.05 ug/g	<0.05	<0.05	-	-	5.8 ug/g	5.8 ug/g
Bromoform	0.05 ug/g	<0.05	<0.05	-	-	2.5 ug/g	2.5 ug/g
Bromomethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Carbon Tetrachloride	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Chlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.28 ug/g	0.28 ug/g
Chloroform	0.05 ug/g	<0.05	<0.05	-	-	0.26 ug/g	0.08 ug/g
Dibromochloromethane	0.05 ug/g	<0.05	<0.05	-	-	5.5 ug/g	5.5 ug/g
Dichlorodifluoromethane	0.05 ug/g	<0.05	<0.05	-	-	1.8 ug/g	1.8 ug/g
1,2-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	6.8 ug/g	3.4 ug/g
1,3-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	6.8 ug/g	4.8 ug/g
1,4-Dichlorobenzene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
1,1-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.57 ug/g	0.14 ug/g
1,2-Dichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
1,1-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
cis-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
trans-1,2-Dichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
1,2-Dichloropropane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
cis-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
1,3-Dichloropropene, total	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Ethylbenzene	0.05 ug/g	<0.05	<0.05	-	-	1.9 ug/g	1.9 ug/g
Ethylene dibromide (dibromoethane,	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Hexane	0.05 ug/g	<0.05	<0.05	-	-	2.5 ug/g	2.5 ug/g
Methyl Ethyl Ketone (2-Butanone)	0.5 ug/g	<0.50	<0.50	-	-	26 ug/g	14 ug/g

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com
Matrix:	Soil	Soil			Reg 406/19 -T3.1
					Res/Park
MDL/Units					

#### Volatiles

Methyl Isobutyl Ketone	0.5 ug/g	<0.50	<0.50	-	-	17 ug/g	0.89 ug/g
Methyl tert-butyl ether	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Methylene Chloride	0.05 ug/g	<0.05	<0.05	-	-	0.2 ug/g	0.06 ug/g
Styrene	0.05 ug/g	<0.05	<0.05	-	-	6.8 ug/g	0.5 ug/g
1,1,1,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
1,1,2,2-Tetrachloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Tetrachloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Toluene	0.05 ug/g	<0.05	<0.05	-	-	7.8 ug/g	0.99 ug/g
1,1,1-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.4 ug/g	0.11 ug/g
1,1,2-Trichloroethane	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Trichloroethylene	0.05 ug/g	<0.05	<0.05	-	-	0.05 ug/g	0.05 ug/g
Trichlorofluoromethane	0.05 ug/g	<0.05	<0.05	-	-	0.46 ug/g	0.46 ug/g
Vinyl chloride	0.02 ug/g	<0.02	<0.02	-	-	0.02 ug/g	0.02 ug/g
m,p-Xylenes	0.05 ug/g	<0.05	<0.05	-	-	-	-
o-Xylene	0.05 ug/g	<0.05	<0.05	-	-	-	-
Xylenes, total	0.05 ug/g	<0.05	<0.05	-	-	3 ug/g	0.9 ug/g
Toluene-d8	Surrogate	91.5%	94.7%	-	-	-	-
Dibromofluoromethane	Surrogate	116%	102%	-	-	-	-
4-Bromofluorobenzene	Surrogate	94.3%	98.8%	-	-	-	-

#### Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g	<7	<7	-	-	25 ug/g	25 ug/g
F2 PHCs (C10-C16)	4 ug/g	<4	<4	-	-	26 ug/g	10 ug/g
F3 PHCs (C16-C34)	8 ug/g	76	<8	-	-	1700 ug/g	300 ug/g
F4 PHCs (C34-C50)	6 ug/g	121	<6	-	-	3300 ug/g	2800 ug/g

#### Semi-Volatiles

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com
Matrix:	Soil	Soil			Reg 406/19 -T3.1
					Res/Park
MDL/Units					

**Semi-Volatiles**

1,2,4-Trichlorobenzene	0.05 ug/g	<0.05	-	-	-	1.3 ug/g	0.17 ug/g
1-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	8.7 ug/g	0.92 ug/g
2-Methylnaphthalene	0.05 ug/g	<0.05	-	-	-	8.7 ug/g	0.92 ug/g
Methylnaphthalene (1&2)	0.05 ug/g	<0.05	-	-	-	8.7 ug/g	0.92 ug/g
2,4-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
2,6-Dinitrotoluene	0.1 ug/g	<0.1	-	-	-	-	-
Dinitrotoluene (2,4 & 2,6)	0.2 ug/g	<0.2	-	-	-	1.2 ug/g	0.92 ug/g
3,3'-Dichlorobenzidine	0.1 ug/g	<0.1	-	-	-	1 ug/g	1 ug/g
4-Chloroaniline	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	0.5 ug/g
Acenaphthene	0.05 ug/g	<0.05	-	-	-	15 ug/g	14 ug/g
Acenaphthylene	0.05 ug/g	<0.05	-	-	-	0.093 ug/g	0.093 ug/g
Anthracene	0.05 ug/g	<0.05	-	-	-	0.16 ug/g	0.16 ug/g
Benzo [a] anthracene	0.05 ug/g	<0.05	-	-	-	1 ug/g	0.5 ug/g
Benzo [a] pyrene	0.05 ug/g	0.09	-	-	-	0.7 ug/g	0.57 ug/g
Benzo [b] fluoranthene	0.05 ug/g	0.1	-	-	-	7 ug/g	5.7 ug/g
Benzo [g,h,i] perylene	0.05 ug/g	0.08	-	-	-	13 ug/g	6.6 ug/g
Benzo [k] fluoranthene	0.05 ug/g	0.06	-	-	-	7 ug/g	5.7 ug/g
Biphenyl	0.05 ug/g	<0.05	-	-	-	21 ug/g	0.3 ug/g
Bis(2-chloroethyl)ether	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	0.5 ug/g
Bis(2-chloroisopropyl)ether	0.1 ug/g	<0.1	-	-	-	11 ug/g	0.5 ug/g
Bis(2-ethylhexyl)phthalate	0.1 ug/g	<0.1	-	-	-	28 ug/g	5 ug/g
Chrysene	0.05 ug/g	0.09	-	-	-	14 ug/g	7 ug/g
Diethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	0.5 ug/g
Dimethylphthalate	0.1 ug/g	<0.1	-	-	-	0.5 ug/g	0.5 ug/g
Dibenzo [a,h] anthracene	0.1 ug/g	<0.1	-	-	-	0.7 ug/g	0.57 ug/g

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:	
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com	Res/Park
Matrix:	Soil	Soil				
MDL/Units						

**Semi-Volatiles**

Fluoranthene	0.05 ug/g	0.1	-	-	-	70 ug/g	0.69 ug/g
Fluorene	0.05 ug/g	<0.05	-	-	-	6.8 ug/g	6.8 ug/g
Indeno [1,2,3-cd] pyrene	0.05 ug/g	0.06	-	-	-	0.76 ug/g	0.38 ug/g
Naphthalene	0.05 ug/g	<0.05	-	-	-	1.8 ug/g	0.59 ug/g
Phenanthrene	0.05 ug/g	<0.05	-	-	-	12 ug/g	6.2 ug/g
Pyrene	0.05 ug/g	0.1	-	-	-	70 ug/g	70 ug/g
2,4,5-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	3.1 ug/g	3.1 ug/g
2,4,6-Trichlorophenol	0.1 ug/g	<0.1	-	-	-	0.43 ug/g	0.43 ug/g
2,4-Dichlorophenol	0.1 ug/g	<0.1	-	-	-	3.4 ug/g	1.7 ug/g
2,4-Dimethylphenol	0.1 ug/g	<0.1	-	-	-	45 ug/g	45 ug/g
2,4-Dinitrophenol	0.1 ug/g	<0.1	-	-	-	6.7 ug/g	6.7 ug/g
2-Chlorophenol	0.1 ug/g	<0.1	-	-	-	2.3 ug/g	1.6 ug/g
Pentachlorophenol	0.1 ug/g	<0.1	-	-	-	0.34 ug/g	0.1 ug/g
Phenol	0.1 ug/g	<0.1	-	-	-	5.3 ug/g	5.3 ug/g
2-Fluorobiphenyl	Surrogate	70.5%	-	-	-	-	-
Nitrobenzene-d5	Surrogate	78.5%	-	-	-	-	-
Terphenyl-d14	Surrogate	74.0%	-	-	-	-	-
2,4,6-Tribromophenol	Surrogate	73.9%	-	-	-	-	-
2-Fluorophenol	Surrogate	81.8%	-	-	-	-	-
Phenol-d6	Surrogate	81.2%	-	-	-	-	-

**Pesticides, OC**

Aldrin	0.01 ug/g	<0.01	<0.01	-	-	0.088 ug/g	0.05 ug/g
gamma-BHC (Lindane)	0.01 ug/g	<0.01	<0.01	-	-	-	-
alpha-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-
gamma-Chlordane	0.01 ug/g	<0.01	<0.01	-	-	-	-



Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Client ID:	BH108 S1	BH109 S4			Criteria:	
Sample Date:	18-Aug-23 09:00	18-Aug-23 09:00			Reg 406/19 -T3.1	Reg 406/19 -T3.1
Sample ID:	2334448-05	2334448-06			Ind/Com	Res/Park
Matrix:	Soil	Soil				
MDL/Units						

Pesticides, OC

Chlordane	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	0.05 ug/g
o,p'-DDD	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDD	0.02 ug/g	<0.02	<0.02	-	-	-	-
DDD	0.02 ug/g	<0.02	<0.02	-	-	4.6 ug/g	3.3 ug/g
o,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDE	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDE	0.01 ug/g	<0.01	<0.01	-	-	0.52 ug/g	0.26 ug/g
o,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
p,p'-DDT	0.01 ug/g	<0.01	<0.01	-	-	-	-
DDT	0.01 ug/g	<0.01	<0.01	-	-	1.4 ug/g	1.4 ug/g
Dieldrin	0.02 ug/g	<0.02	<0.02	-	-	0.088 ug/g	0.05 ug/g
Endrin	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	0.04 ug/g
Endosulfan I	0.01 ug/g	<0.01	<0.01	-	-	-	-
Endosulfan II	0.02 ug/g	<0.02	<0.02	-	-	-	-
Endosulfan I/II	0.02 ug/g	<0.02	<0.02	-	-	0.04 ug/g	0.04 ug/g
Heptachlor	0.01 ug/g	<0.01	<0.01	-	-	0.072 ug/g	0.072 ug/g
Heptachlor epoxide	0.01 ug/g	<0.01	<0.01	-	-	0.05 ug/g	0.05 ug/g
Hexachlorobenzene	0.01 ug/g	<0.01	<0.01	-	-	0.66 ug/g	0.52 ug/g
Hexachlorobutadiene	0.01 ug/g	<0.01	<0.01	-	-	0.01 ug/g	0.01 ug/g
Hexachloroethane	0.01 ug/g	<0.01	<0.01	-	-	0.13 ug/g	0.01 ug/g
Methoxychlor	0.01 ug/g	<0.01	<0.01	-	-	0.19 ug/g	0.13 ug/g
Decachlorobiphenyl	Surrogate	80.1%	79.6%	-	-	-	-

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Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>								
SAR	ND	0.01	N/A					
Conductivity	ND	0.005	mS/cm					
<b>Hydrocarbons</b>								
F1 PHCs (C6-C10)	ND	7	ug/g					
F2 PHCs (C10-C16)	ND	4	ug/g					
F3 PHCs (C16-C34)	ND	8	ug/g					
F4 PHCs (C34-C50)	ND	6	ug/g					
<b>Metals</b>								
Antimony	ND	1.0	ug/g					
Arsenic	ND	1.0	ug/g					
Barium	ND	1.0	ug/g					
Beryllium	ND	0.5	ug/g					
Boron	ND	5.0	ug/g					
Cadmium	ND	0.5	ug/g					
Chromium	ND	5.0	ug/g					
Cobalt	ND	1.0	ug/g					
Copper	ND	5.0	ug/g					
Lead	ND	1.0	ug/g					
Molybdenum	ND	1.0	ug/g					
Nickel	ND	5.0	ug/g					
Selenium	ND	1.0	ug/g					
Silver	ND	0.3	ug/g					
Thallium	ND	1.0	ug/g					
Uranium	ND	1.0	ug/g					
Vanadium	ND	10.0	ug/g					
Zinc	ND	20.0	ug/g					
<b>Pesticides, OC</b>								
Aldrin	ND	0.01	ug/g					
gamma-BHC (Lindane)	ND	0.01	ug/g					
alpha-Chlordane	ND	0.01	ug/g					
gamma-Chlordane	ND	0.01	ug/g					
Chlordane	ND	0.01	ug/g					

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Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDD	ND	0.01	ug/g					
p,p'-DDD	ND	0.02	ug/g					
DDD	ND	0.02	ug/g					
o,p'-DDE	ND	0.01	ug/g					
p,p'-DDE	ND	0.01	ug/g					
DDE	ND	0.01	ug/g					
o,p'-DDT	ND	0.01	ug/g					
p,p'-DDT	ND	0.01	ug/g					
DDT	ND	0.01	ug/g					
Dieldrin	ND	0.02	ug/g					
Endrin	ND	0.02	ug/g					
Endosulfan I	ND	0.01	ug/g					
Endosulfan II	ND	0.02	ug/g					
Endosulfan I/II	ND	0.02	ug/g					
Heptachlor	ND	0.01	ug/g					
Heptachlor epoxide	ND	0.01	ug/g					
Hexachlorobenzene	ND	0.01	ug/g					
Hexachlorobutadiene	ND	0.01	ug/g					
Hexachloroethane	ND	0.01	ug/g					
Methoxychlor	ND	0.01	ug/g					
Surrogate: Decachlorobiphenyl	0.0848		%	84.8	50-140			
<b>Semi-Volatiles</b>								
1,2,4-Trichlorobenzene	ND	0.05	ug/g					
1-Methylnaphthalene	ND	0.05	ug/g					
2-Methylnaphthalene	ND	0.05	ug/g					
Methylnaphthalene (1&2)	ND	0.07	ug/g					
2,4-Dinitrotoluene	ND	0.1	ug/g					
2,6-Dinitrotoluene	ND	0.1	ug/g					
Dinitrotoluene (2,4 & 2,6)	ND	0.2	ug/g					
3,3'-Dichlorobenzidine	ND	0.1	ug/g					
4-Chloroaniline	ND	0.1	ug/g					
Acenaphthene	ND	0.05	ug/g					

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Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Acenaphthylene	ND	0.05	ug/g					
Anthracene	ND	0.05	ug/g					
Benzo [a] anthracene	ND	0.05	ug/g					
Benzo [a] pyrene	ND	0.05	ug/g					
Benzo [b] fluoranthene	ND	0.05	ug/g					
Benzo [g,h,i] perylene	ND	0.05	ug/g					
Benzo [k] fluoranthene	ND	0.05	ug/g					
Biphenyl	ND	0.05	ug/g					
Bis(2-chloroethyl)ether	ND	0.1	ug/g					
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g					
Bis(2-ethylhexyl)phthalate	ND	0.1	ug/g					
Chrysene	ND	0.05	ug/g					
Diethylphthalate	ND	0.1	ug/g					
Dimethylphthalate	ND	0.1	ug/g					
Dibenzo [a,h] anthracene	ND	0.1	ug/g					
Fluoranthene	ND	0.05	ug/g					
Fluorene	ND	0.05	ug/g					
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g					
Naphthalene	ND	0.05	ug/g					
Phenanthrene	ND	0.05	ug/g					
Pyrene	ND	0.05	ug/g					
2,4,5-Trichlorophenol	ND	0.1	ug/g					
2,4,6-Trichlorophenol	ND	0.1	ug/g					
2,4-Dichlorophenol	ND	0.1	ug/g					
2,4-Dimethylphenol	ND	0.1	ug/g					
2,4-Dinitrophenol	ND	0.1	ug/g					
2-Chlorophenol	ND	0.1	ug/g					
Pentachlorophenol	ND	0.1	ug/g					
Phenol	ND	0.1	ug/g					
Surrogate: 2-Fluorobiphenyl	0.394		%	78.7	50-140			
Surrogate: Nitrobenzene-d5	0.367		%	73.5	40-140			
Surrogate: Terphenyl-d14	0.418		%	83.6	40-140			

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Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2,4,6-Tribromophenol	0.372		%	74.4	50-140			
Surrogate: 2-Fluorophenol	0.397		%	79.5	40-140			
Surrogate: Phenol-d6	0.379		%	75.9	40-140			
<b>Volatiles</b>								
Acetone	ND	0.50	ug/g					
Benzene	ND	0.02	ug/g					
Bromodichloromethane	ND	0.05	ug/g					
Bromoform	ND	0.05	ug/g					
Bromomethane	ND	0.05	ug/g					
Carbon Tetrachloride	ND	0.05	ug/g					
Chlorobenzene	ND	0.05	ug/g					
Chloroform	ND	0.05	ug/g					
Dibromochloromethane	ND	0.05	ug/g					
Dichlorodifluoromethane	ND	0.05	ug/g					
1,2-Dichlorobenzene	ND	0.05	ug/g					
1,3-Dichlorobenzene	ND	0.05	ug/g					
1,4-Dichlorobenzene	ND	0.05	ug/g					
1,1-Dichloroethane	ND	0.05	ug/g					
1,2-Dichloroethane	ND	0.05	ug/g					
1,1-Dichloroethylene	ND	0.05	ug/g					
cis-1,2-Dichloroethylene	ND	0.05	ug/g					
trans-1,2-Dichloroethylene	ND	0.05	ug/g					
1,2-Dichloropropane	ND	0.05	ug/g					
cis-1,3-Dichloropropylene	ND	0.05	ug/g					
trans-1,3-Dichloropropylene	ND	0.05	ug/g					
1,3-Dichloropropene, total	ND	0.05	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g					
Hexane	ND	0.05	ug/g					
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g					
Methyl Isobutyl Ketone	ND	0.50	ug/g					
Methyl tert-butyl ether	ND	0.05	ug/g					

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Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Methylene Chloride	ND	0.05	ug/g					
Styrene	ND	0.05	ug/g					
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g					
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g					
Tetrachloroethylene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
1,1,1-Trichloroethane	ND	0.05	ug/g					
1,1,2-Trichloroethane	ND	0.05	ug/g					
Trichloroethylene	ND	0.05	ug/g					
Trichlorofluoromethane	ND	0.05	ug/g					
Vinyl chloride	ND	0.02	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: 4-Bromofluorobenzene	7.87		%	97.7	50-140			
Surrogate: Dibromofluoromethane	8.59		%	107	50-140			
Surrogate: Toluene-d8	7.53		%	93.8	50-140			
Benzene	ND	0.02	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: Toluene-d8	7.53		%	93.8	50-140			

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Client: G2S Environmental Consulting Inc. (Burlington)

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Client PO:

Project Description: G2S23256

## Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>General Inorganics</b>									
SAR	0.19	0.01	N/A	0.19			0.0	30	
Conductivity	0.116	0.005	mS/cm	0.113			2.4	5	
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g	ND			NC	30	
<b>Metals</b>									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	1.8	1.0	ug/g	1.6			12.1	30	
Barium	12.2	1.0	ug/g	12.0			1.4	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	ND	5.0	ug/g	ND			NC	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	7.2	5.0	ug/g	6.7			8.5	30	
Cobalt	2.7	1.0	ug/g	2.4			11.9	30	
Copper	8.0	5.0	ug/g	8.0			1.2	30	
Lead	2.2	1.0	ug/g	1.8			25.0	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	ND	5.0	ug/g	ND			NC	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	15.1	10.0	ug/g	16.9			11.2	30	
Zinc	ND	20.0	ug/g	ND			NC	30	
<b>Physical Characteristics</b>									
% Solids	80.4	0.1	% by Wt.	82.2			2.3	25	
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	ND	0.05	ug/g	ND			NC	40	

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Report Date: 18-Sep-2023

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Client PO:

Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2-Methylnaphthalene	ND	0.05	ug/g	ND			NC	40	
2,4-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
2,6-Dinitrotoluene	ND	0.1	ug/g	ND			NC	40	
3,3'-Dichlorobenzidine	ND	0.1	ug/g	ND			NC	40	
4-Chloroaniline	ND	0.1	ug/g	ND			NC	40	
Acenaphthene	ND	0.05	ug/g	ND			NC	40	
Acenaphthylene	ND	0.05	ug/g	ND			NC	40	
Anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] anthracene	ND	0.05	ug/g	ND			NC	40	
Benzo [a] pyrene	ND	0.05	ug/g	ND			NC	40	
Benzo [b] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.05	ug/g	ND			NC	40	
Benzo [k] fluoranthene	ND	0.05	ug/g	ND			NC	40	
Biphenyl	ND	0.05	ug/g	ND			NC	40	
Bis(2-chloroethyl)ether	ND	0.1	ug/g	ND			NC	40	
Bis(2-chloroisopropyl)ether	ND	0.1	ug/g	ND			NC	40	
Chrysene	ND	0.05	ug/g	ND			NC	40	
Diethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dimethylphthalate	ND	0.1	ug/g	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.1	ug/g	ND			NC	40	
Fluoranthene	ND	0.05	ug/g	ND			NC	40	
Fluorene	ND	0.05	ug/g	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/g	ND			NC	40	
Naphthalene	ND	0.05	ug/g	ND			NC	40	
Phenanthrene	ND	0.05	ug/g	ND			NC	40	
Pyrene	ND	0.05	ug/g	ND			NC	40	
2,4,5-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4,6-Trichlorophenol	ND	0.1	ug/g	ND			NC	40	
2,4-Dinitrophenol	ND	0.1	ug/g	ND			NC	40	
2-Chlorophenol	ND	0.1	ug/g	ND			NC	40	



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Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Pentachlorophenol	ND	0.1	ug/g	ND			NC	40	
Phenol	ND	0.1	ug/g	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	0.344		%		61.8	50-140			
Surrogate: Nitrobenzene-d5	0.372		%		66.8	40-140			
Surrogate: Terphenyl-d14	0.420		%		75.4	40-140			
Surrogate: 2,4,6-Tribromophenol	0.401		%		72.1	50-140			
Surrogate: 2-Fluorophenol	0.429		%		77.0	40-140			
Surrogate: Phenol-d6	0.409		%		73.5	40-140			
<b>Volatiles</b>									
Acetone	ND	0.50	ug/g	ND			NC	50	
Benzene	ND	0.02	ug/g	ND			NC	50	
Bromodichloromethane	ND	0.05	ug/g	ND			NC	50	
Bromoform	ND	0.05	ug/g	ND			NC	50	
Bromomethane	ND	0.05	ug/g	ND			NC	50	
Carbon Tetrachloride	ND	0.05	ug/g	ND			NC	50	
Chlorobenzene	ND	0.05	ug/g	ND			NC	50	
Chloroform	ND	0.05	ug/g	ND			NC	50	
Dibromochloromethane	ND	0.05	ug/g	ND			NC	50	
Dichlorodifluoromethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,3-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,4-Dichlorobenzene	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g	ND			NC	50	
1,2-Dichloropropane	ND	0.05	ug/g	ND			NC	50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	

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Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylene dibromide (dibromoethane, 1,2-)	ND	0.05	ug/g	ND			NC	50	
Hexane	ND	0.05	ug/g	ND			NC	50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g	ND			NC	50	
Methyl Isobutyl Ketone	ND	0.50	ug/g	ND			NC	50	
Methyl tert-butyl ether	ND	0.05	ug/g	ND			NC	50	
Methylene Chloride	ND	0.05	ug/g	ND			NC	50	
Styrene	ND	0.05	ug/g	ND			NC	50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g	ND			NC	50	
Tetrachloroethylene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
1,1,1-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
1,1,2-Trichloroethane	ND	0.05	ug/g	ND			NC	50	
Trichloroethylene	ND	0.05	ug/g	ND			NC	50	
Trichlorofluoromethane	ND	0.05	ug/g	ND			NC	50	
Vinyl chloride	ND	0.02	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: 4-Bromofluorobenzene	12.6		%		97.5	50-140			
Surrogate: Dibromofluoromethane	15.5		%		120	50-140			
Surrogate: Toluene-d8	12.3		%		95.7	50-140			
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	12.3		%		95.7	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	58	7	ug/g	ND	82.6	80-120			
F2 PHCs (C10-C16)	120	4	ug/g	ND	131	60-140			
F3 PHCs (C16-C34)	233	8	ug/g	ND	113	60-140			
F4 PHCs (C34-C50)	160	6	ug/g	ND	108	60-140			
<b>Metals</b>									
Antimony	132	1.0	ug/g	ND	105	70-130			
Arsenic	125	1.0	ug/g	1.6	98.8	70-130			
Barium	139	1.0	ug/g	12.0	101	70-130			
Beryllium	119	0.5	ug/g	ND	95.6	70-130			
Boron	117	5.0	ug/g	ND	93.9	70-130			
Cadmium	125	0.5	ug/g	ND	99.7	70-130			
Chromium	138	5.0	ug/g	6.7	105	70-130			
Cobalt	131	1.0	ug/g	2.4	103	70-130			
Copper	131	5.0	ug/g	8.0	98.4	70-130			
Lead	117	1.0	ug/g	1.8	92.4	70-130			
Molybdenum	127	1.0	ug/g	ND	101	70-130			
Nickel	128	5.0	ug/g	ND	103	70-130			
Selenium	131	1.0	ug/g	ND	105	70-130			
Silver	100	0.3	ug/g	ND	80.2	70-130			
Thallium	114	1.0	ug/g	ND	91.3	70-130			
Uranium	117	1.0	ug/g	ND	93.8	70-130			
Vanadium	148	10.0	ug/g	16.9	105	70-130			
Zinc	137	20.0	ug/g	ND	110	70-130			
<b>Pesticides, OC</b>									
Aldrin	0.27	0.01	ug/g	ND	135	50-140			
gamma-BHC (Lindane)	0.26	0.01	ug/g	ND	128	50-140			
alpha-Chlordane	0.21	0.01	ug/g	ND	106	50-140			
gamma-Chlordane	0.21	0.01	ug/g	ND	104	50-140			
o,p'-DDD	0.23	0.01	ug/g	ND	115	50-140			
p,p'-DDD	0.14	0.02	ug/g	ND	68.0	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o,p'-DDE	0.20	0.01	ug/g	ND	98.8	50-140			
p,p'-DDE	0.18	0.01	ug/g	ND	92.1	50-140			
o,p'-DDT	0.16	0.01	ug/g	ND	77.9	50-140			
p,p'-DDT	0.15	0.01	ug/g	ND	76.9	50-140			
Dieldrin	0.20	0.02	ug/g	ND	101	50-140			
Endrin	0.12	0.02	ug/g	ND	57.7	50-140			
Endosulfan I	0.22	0.01	ug/g	ND	108	50-140			
Endosulfan II	0.13	0.02	ug/g	ND	64.2	50-140			
Heptachlor	0.25	0.01	ug/g	ND	127	50-140			
Heptachlor epoxide	0.24	0.01	ug/g	ND	121	50-140			
Hexachlorobenzene	0.26	0.01	ug/g	ND	129	50-140			
Hexachlorobutadiene	0.19	0.01	ug/g	ND	96.9	50-140			
Hexachloroethane	0.17	0.01	ug/g	ND	87.3	50-140			
Methoxychlor	0.21	0.01	ug/g	ND	104	50-140			
Surrogate: Decachlorobiphenyl	0.0961		%		96.1	50-140			
<b>Semi-Volatiles</b>									
1,2,4-Trichlorobenzene	0.37	0.05	ug/g	ND	67.2	50-140			
1-Methylnaphthalene	0.45	0.05	ug/g	ND	81.3	50-140			
2-Methylnaphthalene	0.43	0.05	ug/g	ND	76.9	50-140			
2,4-Dinitrotoluene	0.54	0.1	ug/g	ND	97.7	50-140			
2,6-Dinitrotoluene	0.52	0.1	ug/g	ND	93.2	50-140			
3,3'-Dichlorobenzidine	0.35	0.1	ug/g	ND	63.5	30-130			
4-Chloroaniline	0.47	0.1	ug/g	ND	84.6	30-130			
Acenaphthene	0.46	0.05	ug/g	ND	81.9	50-140			
Acenaphthylene	0.50	0.05	ug/g	ND	89.5	50-140			
Anthracene	0.45	0.05	ug/g	ND	80.8	50-140			
Benzo [a] anthracene	0.46	0.05	ug/g	ND	82.0	50-140			
Benzo [a] pyrene	0.48	0.05	ug/g	ND	86.8	50-140			
Benzo [b] fluoranthene	0.46	0.05	ug/g	ND	83.5	50-140			
Benzo [g,h,i] perylene	0.47	0.05	ug/g	ND	84.2	50-140			
Benzo [k] fluoranthene	0.48	0.05	ug/g	ND	86.1	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Biphenyl	0.47	0.05	ug/g	ND	81.8	50-140			
Bis(2-chloroethyl)ether	0.56	0.1	ug/g	ND	101	50-140			
Bis(2-chloroisopropyl)ether	0.39	0.1	ug/g	ND	69.7	50-140			
Chrysene	0.47	0.05	ug/g	ND	84.9	50-140			
Diethylphthalate	0.59	0.1	ug/g	ND	107	50-140			
Dimethylphthalate	0.53	0.1	ug/g	ND	95.2	50-140			
Dibenzo [a,h] anthracene	0.46	0.1	ug/g	ND	83.4	50-140			
Fluoranthene	0.52	0.05	ug/g	ND	92.6	50-140			
Fluorene	0.52	0.05	ug/g	ND	93.3	50-140			
Indeno [1,2,3-cd] pyrene	0.47	0.05	ug/g	ND	84.1	50-140			
Naphthalene	0.41	0.05	ug/g	ND	73.9	50-140			
Phenanthrene	0.46	0.05	ug/g	ND	82.5	50-140			
Pyrene	0.44	0.05	ug/g	ND	78.8	50-140			
2,4,5-Trichlorophenol	0.47	0.1	ug/g	ND	84.1	50-140			
2,4,6-Trichlorophenol	0.45	0.1	ug/g	ND	80.0	50-140			
2,4-Dinitrophenol	4.52	0.1	ug/g	ND	50.4	50-140			
2-Chlorophenol	0.44	0.1	ug/g	ND	79.5	50-140			
Pentachlorophenol	0.45	0.1	ug/g	ND	80.4	50-140			
Phenol	0.46	0.1	ug/g	ND	82.5	30-140			
Surrogate: 2-Fluorobiphenyl	0.396		%		71.2	50-140			
Surrogate: Nitrobenzene-d5	0.425		%		76.4	40-140			
Surrogate: Terphenyl-d14	0.430		%		77.3	40-140			
Surrogate: 2,4,6-Tribromophenol	0.549		%		98.6	50-140			
Surrogate: 2-Fluorophenol	0.489		%		87.8	40-140			
Surrogate: Phenol-d6	0.453		%		81.4	40-140			
<b>Volatiles</b>									
Acetone	11.3	0.50	ug/g	ND	113	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Bromodichloromethane	3.65	0.05	ug/g	ND	90.9	60-130			
Bromoform	4.06	0.05	ug/g	ND	100	60-130			
Bromomethane	4.37	0.05	ug/g	ND	109	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Carbon Tetrachloride	3.71	0.05	ug/g	ND	92.3	60-130			
Chlorobenzene	3.95	0.05	ug/g	ND	97.7	60-130			
Chloroform	3.53	0.05	ug/g	ND	87.8	60-130			
Dibromochloromethane	3.62	0.05	ug/g	ND	89.7	60-130			
Dichlorodifluoromethane	5.18	0.05	ug/g	ND	129	50-140			
1,2-Dichlorobenzene	3.89	0.05	ug/g	ND	96.7	60-130			
1,3-Dichlorobenzene	3.86	0.05	ug/g	ND	95.6	60-130			
1,4-Dichlorobenzene	3.81	0.05	ug/g	ND	94.3	60-130			
1,1-Dichloroethane	3.51	0.05	ug/g	ND	87.3	60-130			
1,2-Dichloroethane	3.93	0.05	ug/g	ND	97.2	60-130			
1,1-Dichloroethylene	3.61	0.05	ug/g	ND	89.8	60-130			
cis-1,2-Dichloroethylene	3.62	0.05	ug/g	ND	90.5	60-130			
trans-1,2-Dichloroethylene	3.57	0.05	ug/g	ND	88.9	60-130			
1,2-Dichloropropane	3.80	0.05	ug/g	ND	94.0	60-130			
cis-1,3-Dichloropropylene	3.77	0.05	ug/g	ND	93.7	60-130			
trans-1,3-Dichloropropylene	4.04	0.05	ug/g	ND	100	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Ethylene dibromide (dibromoethane, 1,2-)	3.65	0.05	ug/g	ND	90.7	60-130			
Hexane	4.01	0.05	ug/g	ND	100	60-130			
Methyl Ethyl Ketone (2-Butanone)	10.3	0.50	ug/g	ND	103	50-140			
Methyl Isobutyl Ketone	9.99	0.50	ug/g	ND	99.9	50-140			
Methyl tert-butyl ether	9.96	0.05	ug/g	ND	99.6	50-140			
Methylene Chloride	4.68	0.05	ug/g	ND	116	60-130			
Styrene	4.31	0.05	ug/g	ND	107	60-130			
1,1,1,2-Tetrachloroethane	3.49	0.05	ug/g	ND	86.7	60-130			
1,1,2,2-Tetrachloroethane	3.65	0.05	ug/g	ND	90.8	60-130			
Tetrachloroethylene	3.62	0.05	ug/g	ND	90.0	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
1,1,1-Trichloroethane	3.74	0.05	ug/g	ND	93.0	60-130			
1,1,2-Trichloroethane	4.01	0.05	ug/g	ND	99.8	60-130			
Trichloroethylene	3.78	0.05	ug/g	ND	94.1	60-130			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	3.38	0.05	ug/g	ND	83.7	50-140			
Vinyl chloride	4.47	0.02	ug/g	ND	111	50-140			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: 4-Bromofluorobenzene	7.48		%		92.8	50-140			
Surrogate: Dibromofluoromethane	7.04		%		87.3	50-140			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			
Benzene	3.78	0.02	ug/g	ND	94.1	60-130			
Ethylbenzene	3.96	0.05	ug/g	ND	98.6	60-130			
Toluene	3.72	0.05	ug/g	ND	93.0	60-130			
m,p-Xylenes	8.33	0.05	ug/g	ND	104	60-130			
o-Xylene	4.31	0.05	ug/g	ND	107	60-130			
Surrogate: Toluene-d8	7.65		%		95.2	50-140			

Certificate of Analysis

Report Date: 18-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 24-Aug-2023

Client PO:

Project Description: G2S23256

Qualifier Notes:

**Sample Qualifiers :**

- 1: Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

Sample Data Revisions:

None



Certificate of Analysis

Client: G2S Environmental Consulting Inc. (Burlington)

Client PO:

Report Date: 18-Sep-2023

Order Date: 24-Aug-2023

Project Description: G2S23256

**Work Order Revisions / Comments:**

Revision-1: Guideline comparisons updated as per client request.

Revision-2: This report includes an updated parameter list, as per client.

Revision-3: Guideline comparisons updated as per client request.

**Other Report Notes:**

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unless otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Benzo[b]fluoranthene results may be biased high due to co-elution with Benzo[j]fluoranthene

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Paracel ID: 2334448



**Chain Of Custody**  
(Lab Use Only)

Client Name: G2S Consulting	Project Ref: G2S23256	Page 1 of 1
Contact Name: Dana Haslett	Quote #: Standing Offer	<b>Turnaround Time</b> <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address: 4361 Harvester Road, Unit 12 Burlington, ON	PO #:	
Telephone:	E-mail: danah@g2sconsulting.cm	
		Date Required: _____

<input type="checkbox"/> REG 153/04 <input checked="" type="checkbox"/> REG 406/19		Other Regulation		<b>Matrix Type:</b> S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis																	
<input checked="" type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input checked="" type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input checked="" type="checkbox"/> Table 3,1 For RSC: <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> REG 558 <input type="checkbox"/> PWQO <input type="checkbox"/> CCME <input type="checkbox"/> MISA <input type="checkbox"/> SU - Sani <input type="checkbox"/> SU - Storm Mun: _____ <input type="checkbox"/> Other: _____																					
Sample ID/Location Name				Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	Cr/VI	B (HWS)	EC/SAR	OCP						
							Date	Time															
1	BH101 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
2	BH103 S5		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
3	BH104 S1		S		3		23-8-17	PM	✓	✓		✓				✓	✓						
4	BH105 S2		S		3		23-8-17	PM	✓			✓				✓	✓						
5	BH108 S1		S		3		23-8-18	AM	✓	✓		✓				✓	✓						
6	BH109 S4		S		3		23-8-18	AM	✓			✓				✓	✓						
7																							
8																							
9																							
10																							

Comments: AGAT methanol vial used as preservatives Analyze VOC/SVOCs				Method of Delivery: <b>Zoom</b>	
Relinquished By (Sign): <i>Samantha Patrick</i>		Received By Driver/Depot:		Received at Lab: <i>C-PM</i>	
Relinquished By (Print): Samantha Patrick		Date/Time:		Date/Time: <i>08/24/24 12:40</i>	
Date/Time: 23-8-24 9:30		Temperature: °C		Date/Time: <i>08/24/23 15:00</i>	
		Temperature: <i>13.9</i>		pH Verified: <input type="checkbox"/> By:	

## Certificate of Analysis

**G2S Environmental Consulting Inc. (Burlington)**

4361 Harvester Road, Unit 12

Burlington, ON L7L 5M4

Attn: Dana Haslett

Client PO: Mississauga

Project: G2S23256

Custody: 70889

Report Date: 14-Sep-2023

Order Date: 6-Sep-2023

**Order #: 2336138**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2336138-01	TCLP-1

Approved By:



Milan Ralitsch, PhD

Senior Technical Manager

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

## Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Ignitability	based on EPA 1030	11-Sep-23	11-Sep-23
REG 558 - Cyanide	TCLP MOE E3015- Auto Colour	11-Sep-23	11-Sep-23
REG 558 - Fluoride	TCLP EPA 340.2 - ISE	8-Sep-23	12-Sep-23
REG 558 - Mercury by CVAA	TCLP EPA 7470A, CVAA	11-Sep-23	12-Sep-23
REG 558 - Metals, ICP-MS	TCLP EPA 6020 - Digestion - ICP-MS	7-Sep-23	8-Sep-23
REG 558 - NO3/NO2	TCLP EPA 300.1 - IC	9-Sep-23	9-Sep-23
REG 558 - PCBs	TCLP EPA 608 - GC-ECD	8-Sep-23	8-Sep-23
REG 558 - SVOCs	TCLP EPA 625 - GC-MS	13-Sep-23	14-Sep-23
REG 558 - VOCs	TCLP ZHE EPA 624 - P&T GC-MS	11-Sep-23	12-Sep-23
Solids, %	CWS Tier 1 - Gravimetric	8-Sep-23	11-Sep-23

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

## Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

**Regulatory Comparison:**

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Reg 558 Schedule 4	-
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Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

Client ID:	TCLP-1	-	-	-	Criteria:
Sample Date:	17-Aug-23 00:00	-	-	-	Reg 558 Schedule 4
Sample ID:	2336138-01	-	-	-	-
Matrix:	Soil	-	-	-	
MDL/Units					

#### Physical Characteristics

% Solids	0.1 % by Wt.	91.8	-	-	-	-
Ignitability	N/A	Negative [1]	-	-	-	-

#### EPA 1311 - TCLP Leachate Inorganics

Fluoride	0.05 mg/L	0.44	-	-	-	150 mg/L	-
Nitrate as N	1 mg/L	<1	-	-	-	1000 mg/L	-
Nitrite as N	1 mg/L	<1	-	-	-	1000 mg/L	-
Cyanide, free	0.02 mg/L	<0.02	-	-	-	20 mg/L	-

#### EPA 1311 - TCLP Leachate Metals

Arsenic	0.05 mg/L	<0.05	-	-	-	2.5 mg/L	-
Barium	0.05 mg/L	0.54	-	-	-	100 mg/L	-
Boron	0.05 mg/L	<0.05	-	-	-	500 mg/L	-
Cadmium	0.01 mg/L	<0.01	-	-	-	0.5 mg/L	-
Chromium	0.05 mg/L	<0.05	-	-	-	5 mg/L	-
Lead	0.05 mg/L	<0.05	-	-	-	5 mg/L	-
Mercury	0.005 mg/L	<0.005	-	-	-	0.1 mg/L	-
Selenium	0.05 mg/L	<0.05	-	-	-	1 mg/L	-
Silver	0.05 mg/L	<0.05	-	-	-	5 mg/L	-
Uranium	0.05 mg/L	<0.05	-	-	-	10 mg/L	-

#### EPA 1311 - TCLP Leachate Volatiles

Benzene	0.005 mg/L	<0.005	-	-	-	0.5 mg/L	-
Carbon Tetrachloride	0.005 mg/L	<0.005	-	-	-	0.5 mg/L	-
Chlorobenzene	0.004 mg/L	<0.004	-	-	-	8 mg/L	-
Chloroform	0.006 mg/L	<0.006	-	-	-	10 mg/L	-
1,2-Dichlorobenzene	0.004 mg/L	<0.004	-	-	-	20 mg/L	-
1,4-Dichlorobenzene	0.004 mg/L	<0.004	-	-	-	0.5 mg/L	-

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

Client ID:	TCLP-1	-	-	-	Criteria:
Sample Date:	17-Aug-23 00:00	-	-	-	Reg 558 Schedule 4
Sample ID:	2336138-01	-	-	-	-
Matrix:	Soil	-	-	-	
MDL/Units					

**EPA 1311 - TCLP Leachate Volatiles**

1,2-Dichloroethane	0.005 mg/L	<0.005	-	-	-	0.5 mg/L	-
1,1-Dichloroethylene	0.006 mg/L	<0.006	-	-	-	1.4 mg/L	-
Methyl Ethyl Ketone (2-Butanone)	0.3 mg/L	<0.30	-	-	-	200 mg/L	-
Methylene Chloride	0.04 mg/L	<0.04	-	-	-	5 mg/L	-
Tetrachloroethylene	0.005 mg/L	<0.005	-	-	-	3 mg/L	-
Trichloroethylene	0.004 mg/L	<0.004	-	-	-	5 mg/L	-
Vinyl chloride	0.005 mg/L	<0.005	-	-	-	0.2 mg/L	-
4-Bromofluorobenzene	Surrogate	132%	-	-	-	-	-
Dibromofluoromethane	Surrogate	86.0%	-	-	-	-	-
Toluene-d8	Surrogate	107%	-	-	-	-	-

**EPA 1311 - TCLP Leachate Organics**

2,4-Dinitrotoluene	0.001 mg/L	<0.0010	-	-	-	0.13 mg/L	-
Benzo [a] pyrene	0.001 mg/L	<0.0010	-	-	-	0.001 mg/L	-
Nitrobenzene	0.001 mg/L	<0.0010	-	-	-	2 mg/L	-
Hexachloroethane	0.001 mg/L	<0.0010	-	-	-	3 mg/L	-
Hexachlorobenzene	0.05 mg/L	<0.0500	-	-	-	0.13 mg/L	-
Hexachlorobutadiene	0.001 mg/L	<0.0010	-	-	-	0.5 mg/L	-
2,3,4,6-Tetrachlorophenol	0.002 mg/L	<0.0020	-	-	-	10 mg/L	-
2,4,5-Trichlorophenol	0.001 mg/L	<0.0010	-	-	-	400 mg/L	-
2,4,6-Trichlorophenol	0.001 mg/L	<0.0010	-	-	-	0.5 mg/L	-
2,4-Dichlorophenol	0.001 mg/L	<0.0010	-	-	-	90 mg/L	-
2-Methylphenol	0.001 mg/L	<0.0010	-	-	-	200 mg/L	-
3/4-Methylphenol	0.001 mg/L	<0.0010	-	-	-	200 mg/L	-
Pentachlorophenol	0.005 mg/L	<0.0050	-	-	-	6 mg/L	-
2,4,6-Tribromophenol	Surrogate	75.0%	-	-	-	-	-

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

Client ID:	TCLP-1	-	-	-	Criteria:
Sample Date:	17-Aug-23 00:00	-	-	-	Reg 558 Schedule 4
Sample ID:	2336138-01	-	-	-	-
Matrix:	Soil	-	-	-	
MDL/Units					

EPA 1311 - TCLP Leachate Organics

2-Fluorobiphenyl	Surrogate	66.3%	-	-	-	-
2-Fluorophenol	Surrogate	60.8%	-	-	-	-
Terphenyl-d14	Surrogate	78.7%	-	-	-	-
PCBs, total	0.003 mg/L	<0.003 [1]	-	-	-	0.3 mg/L
Decachlorobiphenyl	Surrogate	97.5% [1]	-	-	-	-



Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

## Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>EPA 1311 - TCLP Leachate Inorganics</b>								
Fluoride	ND	0.05	mg/L					
Nitrate as N	ND	1	mg/L					
Nitrite as N	ND	1	mg/L					
Cyanide, free	ND	0.02	mg/L					
<b>EPA 1311 - TCLP Leachate Metals</b>								
Arsenic	ND	0.05	mg/L					
Barium	ND	0.05	mg/L					
Boron	ND	0.05	mg/L					
Cadmium	ND	0.01	mg/L					
Chromium	ND	0.05	mg/L					
Lead	ND	0.05	mg/L					
Mercury	ND	0.005	mg/L					
Selenium	ND	0.05	mg/L					
Silver	ND	0.05	mg/L					
Uranium	ND	0.05	mg/L					
<b>EPA 1311 - TCLP Leachate Organics</b>								
2,4-Dinitrotoluene	ND	0.0010	mg/L					
Benzo [a] pyrene	ND	0.0010	mg/L					
Nitrobenzene	ND	0.0010	mg/L					
Hexachloroethane	ND	0.0010	mg/L					
Hexachlorobenzene	ND	0.0500	mg/L					
Hexachlorobutadiene	ND	0.0010	mg/L					
2,3,4,6-Tetrachlorophenol	ND	0.0020	mg/L					
2,4,5-Trichlorophenol	ND	0.0010	mg/L					
2,4,6-Trichlorophenol	ND	0.0010	mg/L					
2,4-Dichlorophenol	ND	0.0010	mg/L					
2-Methylphenol	ND	0.0010	mg/L					
3/4-Methylphenol	ND	0.0010	mg/L					
Pentachlorophenol	ND	0.0050	mg/L					
Surrogate: 2,4,6-Tribromophenol	0.017		%	66.4	40-150			
Surrogate: 2-Fluorobiphenyl	0.014		%	54.7	40-150			

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

### Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2-Fluorophenol	0.013		%	52.1	40-150			
Surrogate: Terphenyl-d14	0.018		%	73.1	40-150			
PCBs, total	ND	0.003	mg/L					
Surrogate: Decachlorobiphenyl	0.0088		%	87.8	62-138			

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

### Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>EPA 1311 - TCLP Leachate Inorganics</b>									
Fluoride	0.21	0.05	mg/L	0.20			5.4	20	
Nitrate as N	ND	1	mg/L	ND			NC	20	
Nitrite as N	ND	1	mg/L	ND			NC	20	
Cyanide, free	ND	0.02	mg/L	ND			NC	20	
<b>EPA 1311 - TCLP Leachate Metals</b>									
Arsenic	ND	0.05	mg/L	ND			NC	29	
Barium	0.422	0.05	mg/L	0.426			0.9	34	
Boron	0.348	0.05	mg/L	0.347			0.4	33	
Cadmium	0.039	0.01	mg/L	0.039			1.0	33	
Chromium	ND	0.05	mg/L	ND			NC	32	
Lead	ND	0.05	mg/L	ND			NC	32	
Mercury	ND	0.005	mg/L	ND			NC	30	
Selenium	ND	0.05	mg/L	ND			NC	28	
Silver	ND	0.05	mg/L	ND			NC	28	
Uranium	ND	0.05	mg/L	ND			NC	27	
<b>EPA 1311 - TCLP Leachate Organics</b>									
2,4-Dinitrotoluene	ND	0.0010	mg/L				NC	30	
Benzo [a] pyrene	ND	0.0010	mg/L				NC	30	
Nitrobenzene	ND	0.0010	mg/L				NC	30	
Hexachloroethane	ND	0.0010	mg/L				NC	30	
Hexachlorobenzene	ND	0.0500	mg/L				NC	30	
Hexachlorobutadiene	ND	0.0010	mg/L				NC	30	
2,3,4,6-Tetrachlorophenol	ND	0.0020	mg/L				NC	30	
2,4,5-Trichlorophenol	ND	0.0010	mg/L				NC	30	
2,4,6-Trichlorophenol	ND	0.0010	mg/L				NC	30	
2,4-Dichlorophenol	ND	0.0010	mg/L				NC	30	
2-Methylphenol	ND	0.0010	mg/L				NC	30	
3/4-Methylphenol	ND	0.0010	mg/L				NC	30	
Pentachlorophenol	ND	0.0050	mg/L				NC	30	
Surrogate: 2,4,6-Tribromophenol	0.019		%		77.0	40-150			

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

**Method Quality Control: Duplicate**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2-Fluorobiphenyl	0.018		%		71.3	40-150			
Surrogate: 2-Fluorophenol	0.0		%			40-150			S-GC
Surrogate: Terphenyl-d14	0.020		%		81.8	40-150			
PCBs, total	ND	0.003	mg/L	ND			NC	30	
Surrogate: Decachlorobiphenyl	0.0093		%		92.9	62-138			
<b>Physical Characteristics</b>									
% Solids	89.5	0.1	% by Wt.	90.6			1.2	25	

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

## Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>EPA 1311 - TCLP Leachate Inorganics</b>									
Fluoride	1.03	0.05	mg/L	0.44	117	70-130			
Nitrate as N	9	1	mg/L	ND	93.9	70-130			
Nitrite as N	9	1	mg/L	ND	89.0	80-120			
Cyanide, free	0.038	0.02	mg/L	ND	75.6	60-136			
<b>EPA 1311 - TCLP Leachate Metals</b>									
Arsenic	0.514	0.05	mg/L	ND	103	83-119			
Barium	0.910	0.05	mg/L	0.426	96.8	83-116			
Boron	0.725	0.05	mg/L	0.347	75.7	71-128			
Cadmium	0.514	0.01	mg/L	0.039	95.0	78-119			
Chromium	0.495	0.05	mg/L	ND	99.0	80-124			
Lead	0.471	0.05	mg/L	ND	94.2	77-126			
Mercury	0.0290	0.005	mg/L	ND	96.8	70-130			
Selenium	0.521	0.05	mg/L	ND	104	81-125			
Silver	0.425	0.05	mg/L	ND	85.0	70-128			
Uranium	0.454	0.05	mg/L	ND	90.7	70-131			
<b>EPA 1311 - TCLP Leachate Organics</b>									
2,4-Dinitrotoluene	0.0218	0.0010	mg/L	ND	87.1	50-140			
Benzo [a] pyrene	0.0228	0.0010	mg/L	ND	91.0	50-140			
Nitrobenzene	0.0194	0.0010	mg/L	ND	77.5	50-140			
Hexachloroethane	0.0041	0.0010	mg/L	ND	16.3	50-140			QS-02
Hexachlorobenzene	ND	0.0500	mg/L	ND		50-140			QS-01
Hexachlorobutadiene	0.0029	0.0010	mg/L	ND	11.7	50-140			QS-02
2,3,4,6-Tetrachlorophenol	0.0216	0.0020	mg/L	ND	86.6	50-140			
2,4,5-Trichlorophenol	0.0237	0.0010	mg/L	ND	94.7	50-140			
2,4,6-Trichlorophenol	0.0236	0.0010	mg/L	ND	94.3	50-140			
2,4-Dichlorophenol	0.0228	0.0010	mg/L	ND	91.2	50-140			
2-Methylphenol	0.0192	0.0010	mg/L	ND	76.8	50-140			
3/4-Methylphenol	0.0200	0.0010	mg/L	ND	79.8	50-140			
Pentachlorophenol	0.0237	0.0050	mg/L	ND	94.7	50-140			
Surrogate: 2,4,6-Tribromophenol	0.021		%		85.0	40-150			

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

### Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Surrogate: 2-Fluorobiphenyl	0.015		%		61.4	40-150			S-GC
Surrogate: 2-Fluorophenol	0.0		%			40-150			
Surrogate: Terphenyl-d14	0.020		%		80.6	40-150			
PCBs, total	0.040	0.003	mg/L	ND	101	86-145			
Surrogate: Decachlorobiphenyl	0.0092		%		92.1	62-138			
EPA 1311 - TCLP Leachate Volatiles									
Benzene	40.0	0.005	mg/L	ND	99.5	60-130			
Carbon Tetrachloride	42.5	0.005	mg/L	ND	106	60-130			
Chlorobenzene	39.8	0.004	mg/L	ND	98.5	60-130			
Chloroform	35.4	0.006	mg/L	ND	88.1	60-130			
1,2-Dichlorobenzene	41.0	0.004	mg/L	ND	102	60-130			
1,4-Dichlorobenzene	39.5	0.004	mg/L	ND	97.9	60-130			
1,2-Dichloroethane	36.3	0.005	mg/L	ND	89.7	60-130			
1,1-Dichloroethylene	34.4	0.006	mg/L	ND	85.5	60-130			
Methyl Ethyl Ketone (2-Butanone)	131	0.30	mg/L	ND	131	50-140			
Methylene Chloride	36.7	0.04	mg/L	ND	91.2	60-130			
Tetrachloroethylene	40.8	0.005	mg/L	ND	102	60-130			
Trichloroethylene	41.0	0.004	mg/L	ND	102	60-130			
Vinyl chloride	34.1	0.005	mg/L	ND	84.7	50-140			
Surrogate: 4-Bromofluorobenzene	0.766		%		110	50-140			
Surrogate: Dibromofluoromethane	0.671		%		96.8	50-140			
Surrogate: Toluene-d8	0.678		%		98.1	50-140			

Certificate of Analysis

Report Date: 14-Sep-2023

Client: G2S Environmental Consulting Inc. (Burlington)

Order Date: 6-Sep-2023

Client PO: Mississauga

Project Description: G2S23256

**Qualifier Notes:****Login Qualifiers :**

Sample - One or more parameter received past hold time - TCLP Extraction, Cyanide, PAHs, SVOCs, VOCs, Ignitability, PCBs  
Applies to Samples: TCLP-1

**Sample Qualifiers :**

- 1: Holding time had been exceeded upon receipt of the sample at the laboratory or prior to the analysis being requested.

**QC Qualifiers:**

- QS-01 Spike Level is less than the reporting MDL, however, recovery was acceptable.  
QS-02 Spike level outside of control limits. Analysis batch accepted based on other QC included in the batch.  
S-GC Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

**Sample Data Revisions:**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unless otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Any use of these results implies your agreement that our total liability in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.



Client Name: <b>G2S Consulting</b>	Project Ref: <b>G2S23256</b>	Page <b>1</b> of <b>1</b>
Contact Name: <b>Dana Haskett</b>	Quote #:	Turnaround Time <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address: <b>4361 Harvester Rd Unit 12 Burlington ON</b>	PO #: <b>Mississauga</b>	
Telephone: <b>905 228 8587</b>	E-mail: <b>dana.h@g2sconsulting.com hailey@g2sconsulting.com</b>	
Date Required: _____		

<input type="checkbox"/> REG 153/04 <input type="checkbox"/> REG 406/19 <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> Table _____ For RSC: <input type="checkbox"/> Yes <input type="checkbox"/> No		Other Regulation <input type="checkbox"/> REG 558 <input type="checkbox"/> PWQO <input type="checkbox"/> CCME <input type="checkbox"/> MISA <input type="checkbox"/> SU - Sani <input type="checkbox"/> SU - Storm Mun: _____ <input checked="" type="checkbox"/> Other: <b>0. Reg 347-TCLP</b>		Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis TCLP-Metals+Inorganics TCLP-VOCs TCLP-PCBs TCLP-Ignitability TCLP-Bak/PAHs TCLP-SVOCs														
Sample ID/Location Name		Matrix	Air Volume	# of Containers	Sample Taken															
					Date	Time														
1	<b>TCLP-1</b>	<b>S</b>		<b>2</b>	<b>08/17/23</b>		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>								
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:				Method of Delivery: <b>Zoom</b>			
Relinquished By (Sign): <b>Hailey Perras</b>	Received By Driver/Depot: <b>km</b>	Received at Lab: <b>6-Sep-2023</b>	Verified By: <b>km</b>				
Relinquished By (Print): <b>Hailey Perras</b>	Date/Time: <b>09/06/23 1045</b>	Date/Time: <b>09/06/23 1145</b>					
Date/Time: <b>09/06/2023 9:30 am</b>	Temperature: <b>15.6</b> °C	Temperature: _____ °C	pH Verified: <input type="checkbox"/> <b>NA</b>				



**PHASE ONE ESA  
THE COLLEGEWAY AND LOYALIST DRIVE  
MISSISSAUGA, ONTARIO**

Prepared for:

**CITY OF MISSISSAUGA**

**PATRIOT ENGINEERING LTD.  
Consulting Engineers**

Project 41108  
February 19, 2021

80 Nashdene Road, Unit 62  
Toronto, Ontario  
M1V 5E4  
416-293-7716



**PATRIOT  
ENGINEERING LTD.**  
Consulting Engineers

Project 41108

February 19, 2021

City of Mississauga  
300 City Centre Drive  
Mississauga, Ontario  
L5B 3C1

Attention: Mr. Ashley Goulden, PMP  
Project Manager

**Phase One - Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario**

**1.0 EXECUTIVE SUMMARY**

As requested, Patriot Engineering Ltd. has carried out a Phase One - Environmental Site Assessment (ESA) for the above project site. The subject property is vacant and unoccupied in a residential area. The property is located at the southwest intersection of The Collegeway and Loyalist Drive, in Mississauga, Ontario. Authorization to carry out the Phase One - ESA was provided by Mr. Ashley Goulden of the City of Mississauga. This assessment was carried out in accordance with Ontario Regulation 153/04.

The subject property is not believed to have been used as a landfill site. During the course of the site visit, the property was covered with snow and therefore it was not possible to observe if stressed vegetation or staining was exhibited at the site. The site is vacant and unoccupied and all records available to us show that it has been vacant. The surrounding properties have been found to be residential and commercial in nature.

Based on our site visit and research into the land use of the subject property and surrounding properties, there was evidence found, during our research of factors that might pose an environmental risk. The subject property and some of the surrounding properties are of potential environmental concern. In particular, the following environmental items and properties are of concern:

1. Subject Property:

A) Spill:

- (i) A spill of 50 litres of hydraulic oil has occurred in 2015 at the western edge of the site.

The spilled hydraulic oil had made contact with the subject property. In this regard, it may have infiltrated into the soil within the subject property. At this time, records indicating the spill was cleaned were not available.



B) Pesticides:

- (i) The subject property used to be a farm and pesticides may have been used.

The pesticides that may have been used at the subject property may have infiltrated into the soil within the subject property.

2. Surrounding Properties:

A) Waste Generation Code:

- (i) The property at 2686 The Collegeway, located northeast of the subject property is registered as a waste generator under Ontario Regulation 347. This regulation states that any property that produced collected, handled, or stored regulated waste has to be registered. The type of waste generated, handled and/or stored include pathological wastes.
- (ii) The property at 3521 Loyalist Drive, located northwest of the subject property is registered as a waste generator under Ontario Regulation 347. The type of waste generated, handled and/or stored include organic and inorganic laboratory chemicals.

There is a potential environmental risk from a spill and/or a leak of any of the chemicals from the items mentioned above that may migrate to the subject property.

B) Underground Storage Tanks:

- (i) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property contains underground fuel storage tanks.

There is a potential environmental risk from a spill and/or a leak of fuel from the above storage tanks that may migrate to the subject property.

C) Spills in Surrounding Properties:

- (i) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property is a site where spills of 30 litres and 140 litres of gasoline have occurred in 1995 and 1996, respectively.

It is possible that the spilled gasoline at the site may have migrated onto the subject property.



D) Pesticides:

- (i) The surrounding properties used to be farms at some time in the past and may have used pesticides.

It is possible that pesticides may have migrated into the subject property from the surrounding properties.

A Phase Two ESA is recommended. The Phase Two ESA should consist of a series of boreholes drilled at strategic locations throughout this property. Soil samples and groundwater samples, if groundwater is encountered, should be analysed for General Metal and Inorganic parameters, Total Petroleum Hydrocarbons (TPH F1 to F4), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Volatile Organic Compounds (VOC's), Polycyclic Aromatic Hydrocarbons (PAHs) and pesticides.



## **2.0 INTRODUCTION**

As requested, Patriot Engineering Ltd. has carried out a Phase I - Environmental Site Assessment (ESA) for the above project site. The subject property is a vacant property located in Mississauga, Ontario. Authorization to carry out the Phase I - ESA was provided by Mr. Ashley Goulden, on behalf of the The City of Mississauga, on February 2, 2021. This assessment was carried out in accordance with Ontario Regulation 153/04.

The purpose of this Phase One ESA was to identify any actual or potential environmental concerns that may exist, based on prior land use from tenants or owners. The Phase One ESA was performed through the use of readily available public records, combined with a site visit. A Phase One ESA does not include sampling and testing of soil, groundwater or building materials.

### **2.a Phase One Property Information**

The subject property is located on the south side of The Collegeway, approximately 140m west of the intersection of Winston Churchill Boulevard and The Collegeway, (Part of Block 124, Plan 43M745, Designate as Parts 1 and 2 on Reference Plan 43R35476) in Mississauga, Ontario. The property used to be part of 3010 The Collegeway in Mississauga, Ontario until it was acquired by the City of Mississauga in 2013. At this time a municipal address is not available. A location map is provided in Figure 1.

The property is vacant and unoccupied. Photographs of the subject property are provided in Appendix A.

## **3.0 SCOPE AND METHODOLOGY**

The site assessment of the subject property consisted of a site visit held on February 12, 2021, which included a site walk-through and photographic documentation of the property. An interview with the owner's representative, Mr. Ashley Goulden was carried out on February 18, 2021. A search of the title records was executed from the ONLand.ca website to establish current site ownership. Tenant history and development history were investigated by reviewing directory documents obtained from Ecolog Eris.

Fire Insurance Plans and Aerial photographs for the subject property were obtained from available data base of Ecolog ERIS. A search of available databases to determine potentially contaminating activities was also undertaken.

The results of the ESA are discussed in Sections 4 to 6. Environmental concerns are discussed in Section 7 and recommendations are provided in Section 8.



## **4.0 RECORDS REVIEW**

### **4.a General**

#### **4.a.i Phase One Study Area Determination**

The property is situated in a residential area, with residential and commercial properties surrounding the subject property. In accordance with O.Reg.153/04, the Phase One study area is determined to be within a 250m radius of the Phase One property. Since no major industrial properties were observed within a 500m radius of the property, the study area was kept within the 250m radius of the Phase One property.

#### **4.a.ii First Development Use Determination**

The first developed use of the Phase One property was determined by reviewing satellite maps and city directories. The study of these documents revealed that the expected use of the Phase One property was for residential purposes.

#### **4.a.iii Fire Insurance Plan**

The fire insurance drawings for the property at 3010 The Collegeway in Mississauga, Ontario, which included the subject property until 2013 were searched through Ecolog Eris. The fire insurance plans for the year 1998 were available. The review of these plans did not display any concern. The fire insurance plans are provided in Appendix B.

#### **4.a.iv Chain of Title/History of Site Land Use**

We have reviewed Regional Directory for the Year 2000 and 1990 to determine the history of land use, however we were unable to located the subject address in any of these directories.

#### **4.a.v Environmental Reports**

Previous environmental reports were not available at the time of writing this report.

### **4.b Environmental Source Information**

#### **4.b.i Ministry of the Environment (MOE) Records Review**

We have carried out a review of records from the Ministry of the Environment for the subject property. We had submitted a request to the ministry through the Freedom of Information Act to obtain any information regarding environmental concerns which have been reported to them. At the time of writing this report, this information was not yet available. Once we receive this information; if the findings demonstrate concerns, it will then be forwarded.



#### **4.b.ii National Pollutant Release Inventory (NPRI) - Environment Canada**

A search of the *National Pollutant Release Inventory* (NPRI) indicated that the subject property is not registered under the NPRI.

#### **4.b.iii Inventory of Coal Gasification Plant Waste Sites in Ontario - MOE**

A search of the *Inventory of Coal Gasification Plant Waste Sites in Ontario* indicates that the subject property is not listed in the inventory.

#### **4.b.iv Waste Disposal**

A review of the Ontario Ministry of the Environment's *Waste Disposal Site Inventory* (1991), as well as the *Landfill Inventory Management Ontario (LIMO)* database indicated that this property was not registered as a landfill site, whether active or inactive.

#### **4.b.v EcoLOG ERIS Report**

We have submitted a request to process an EcoLOG ERIS Report. The report provides a summary of a search of multiple environmental databases for the subject property and all surrounding properties within a 250m radius. The report generated 2 entries for the subject property and 54 entries within a 250m radius for a total of 56 entries. The report is attached in Appendix C.

The EcoLog Eris report showed that the subject property and several properties within the 250m radius may pose a potential environmental risk. In particular, the following properties are of concern:

1. Subject Property:

A) Spill:

- (i) A spill of 50 litres of hydraulic oil has occurred in 2015 at the western edge of the site.

The spilled hydraulic oil had made contact with the subject property. In this regard, it may have infiltrated into the soil within the subject property. At this time, records indicating the spill was cleaned were not available.

2. Surrounding Properties:

A) Waste Generation Code:

- (i) The property at 2686 The Collegeway, located northeast of the subject property is registered as a waste generator under Ontario Regulation 347. This regulation states that any property that produced collected, handled, or stored regulated waste has to be registered. The type of waste generated, handled and/or stored include pathological wastes.



- (ii) The property at 3521 Loyalist Drive, located northwest of the subject property is registered as a waste generator under Ontario Regulation 347. The type of waste generated, handled and/or stored include organic and inorganic laboratory chemicals.

There is a potential environmental risk from a spill and/or a leak of any of the chemicals from the items mentioned above that may migrate to the subject property.

**B) Underground Storage Tanks:**

- (i) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property contains underground fuel storage tanks.

There is a potential environmental risk from a spill and/or a leak of fuel from the above storage tank that may migrate to the subject property.

**C) Spills in Surrounding Properties:**

- (i) The property at 3395 Loyalist Drive, located south of the subject property is a site where a spill of 25 litres of oil has occurred. The type of oil is not known. This property is down gradient of the subject property.
- (ii) The property at 3372 Delfi Road, located northeast of the subject property is a site where a spill of water from a water main break has occurred. This property is down gradient of the subject property.
- (iii) At the intersection of Council Ring Road and The Collegeway, located northeast of the subject property is a site where a spill of water from a water main break occurred has occurred.
- (iv) The property at 3341 Winston Churchill Boulevard, located east of the subject property is a site where a spill of natural gas (methane) has occurred.
- (v) The property at 3055 Eden Oak Crescent, located southeast of the subject property is a site where a spill of natural gas (methane) has occurred.
- (vi) At the southwest corner of Loyalist Drive and Irwin Court, located northwest of the subject property is a site where a spill of natural gas (methane) has occurred.
- (vii) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property is a site where spills of 30 litres and 140 litres of gasoline have occurred in 1995 and 1996, respectively.





It is possible that the spilled gasoline at the site in Item (vii) may have migrated onto the Phase One Property. From the remaining items, the properties in Items (i) and (ii) are down gradient from the subject property, therefore migration of the chemicals is not expected. The spill in Item (iii) is water from a watermain break. Hence, an environmental impact is not expected. The Items (iv), (v) and (vi) are spills of methane gas and the receiving medium is expected to be in the atmosphere.

#### **4.c Physical Setting Sources**

##### **4.c.i Aerial Photographs**

Aerial photographs were ordered from the Ecolog Eris, for the years 1934, 1954, 1974 and 1988. These photographs are shown in Figures 2 to 5. No other aerial photographs were available for this project site.

1934:

**Description:** The subject site appears to be a farm. The surrounding areas appear to be farms and vacant in nature. Pesticides may have been used at the subject property and surrounding properties. The pesticides that may have been used at the subject property may have infiltrated the soil within the subject property. Also, pesticides that may have been used at surrounding properties may have migrated to the subject property.

1954:

**Description:** The subject site appears to be a farm. The surrounding areas appear to be farms and vacant in nature. Pesticides may have been used at the subject property and surrounding properties. The pesticides that may have been used at the subject property may have infiltrated the soil within the subject property. Also, pesticides that may have been used at surrounding properties may have migrated to the subject property.

1974:

**Description:** The subject site appears to be vacant. The surrounding areas appear to be residential and vacant in nature. Features that could be of environmental concern were not apparent in this photograph.

1988:

**Description:** The subject site appears to be vacant. The surrounding areas appear to be residential and vacant in nature. Features that could be of environmental concern were not apparent in this photograph.



#### **4.c.ii Topography, Hydrology, Geology**

In general the Phase One property is gently sloping down towards the south and west directions. Groundwater is anticipated to flow in the general west to southwest direction.

Surficial geology in the areas have been mapped as: clay to silt-textured till (derived from glaciolacustrine deposits or shale) (Surficial geology, Ministry of Northern Development and Mines, 2013).

#### **4.c.iii Fill Materials**

No evidence of fill material was observed during our site visit.

#### **4.c.iv Water Bodies and Areas of Natural Significance**

Based on maps and satellite images reviewed, the nearest water body is an unnamed river located approximately 3.3 km east of the property, which flows towards Lake Ontario. A man-made storm water control pond is present directly south of the subject property. No areas of natural significance were observed within the Phase One property or the Phase One study area.

#### **4.c.v Well Records**

A review of the well records revealed that there are no wells installed within the subject site but showed six (6) wells installed within the Phase One study area. All these wells are used as monitoring wells. The location and stratigraphy of these wells are included in the EcoLog Eris Report, which is attached in Appendix C.

#### **4.d Site Operating Records**

Since the Phase One property is vacant and unoccupied, site operating records are not applicable.

### **5.0 INTERVIEW**

During an interview conducted with Mr. Ashley Goulden of the City of Mississauga, on February 18, 2021, Mr. Goulden informed us that the property has formed part of the Erin Mills United Church on 3010 The Collegeway, in Mississauga, Ontario, until it was acquired by the City of Mississauga in 2013. A person with any further knowledge of the subject property was not available for an interview.



## **6.0 SITE RECONNAISSANCE**

### **6.a General Requirements**

The site investigation was carried out on February 12, 2021. The weather was cloudy and the temperature was -7 degrees Celsius during our visit. The site investigation took approximately 2 hours and was carried out by Mr. Milkias Woldegiorgis, P.Eng. (Qualified Person), under the supervision of Mr. Larry Galimanis, P.Eng. (Qualified Person).

### **6.b Specific Observations at Phase One Property**

The subject property is vacant and unoccupied and used to be part of Erin Mills United Church at 3010 The Collegeway, in Mississauga, Ontario until it was acquired by the City of Mississauga in 2013..

Surface runoff water is drained into catch basins on The Collegeway and into the man-made storm control pond south of the property. Groundwater is not used as a source of potable water and its depth is not known.

In general, based on satellite image the property is mostly covered with grass, plus a few trees. During the course of the site visit, the property was covered with snow and therefore it was not possible to observe if stressed vegetation or staining was exhibited at the site. All records available to us show that it has been vacant.

#### **6.b.i Enhanced Investigation Property**

In order to classify a Phase One property as an enhanced investigation property, the property must have been used in the past or is currently being used for the following purposes:

1. Any industrial use
2. As a garage
3. As a bulk liquid dispensing facility, including a gasoline outlet, or
4. Operation of a dry cleaning facility

The property is vacant and unoccupied and is not believed to have been used for any of the above purposes. In light of this, an enhanced investigation is not applicable.

#### **6.b.ii Polychlorinated Biphenyls (PCBs)**

Generally, two potential sources of PCB's are transformers and fluorescent light ballasts. The property is vacant and unoccupied, hence none of these two PCB sources were observed.

A review of the Ontario Ministry of the Environment's *Ontario Inventory of PCB Storage Sites (2003)* indicated that this property was not registered as a licensed PCB storage facility.



### **6.b.iii Asbestos**

There is a possibility that asbestos material may be found in the following construction materials:

- sprayed asbestos for fireproofing
- texture coat
- hard plaster
- ceiling tiles
- vinyl floor tiles
- mechanical insulation
- asbestos cement sheets

As mentioned previously, the subject property is vacant and unoccupied and thus no building was present. None of the above materials were found to be present on the subject property.

### **6.b.vi Underground Storage Tanks**

There is no evidence of underground storage tanks on the subject property. No fill or vent tubes were detected.

### **6.b.vii Above Ground Storage Tanks**

There were no above ground storage tanks observed during our visit.

### **6.b.vi Chemical Storage**

There was no evidence of bulk storage of chemicals on the property.

### **6.b.ix Waste Disposal**

Due to the fact that the property is vacant, there is currently no waste to dispose off. There was no evidence of hazardous waste having been stored unsafely, or disposed off, on the property.

## **7.0 REVIEW AND EVALUATION OF INFORMATION**

### **7.i Site Ownership History**

The site ownership was developed from a review of the records for (Part of Block 124, Plan 43M745, Designate as Parts 1 and 2 on Reference Plan 43R35476) in Mississauga, Ontario. The land title search documents are provided in Appendix D.

The search of the land title showed that the current owner is The Corporation of The City of Mississauga. The records for the ownership were traced as far back as October 1, 1987. There were no records available beyond that date. A summary of the site ownership is shown below in Table 1:



<b>Table 1: Summary of Site Ownership</b>				
<b>Lot 29 and 30</b>				
Registration No.	Type	Date	Grantor	Grantee
PR2472923	Transfer	December 12, 2013	The Erin Mills Congregation of the United Church of Canada	The Corporation of The City of Mississauga
LT810132	Transfer Easement	October 20, 1987	-	Mississauga Hydro-Electric Commission
LT80404496	Notice	October 1, 1987	-	The Corporation of The City of Mississauga The Regional Municipality of Peel

## **7.ii Potential Contaminating Activity**

### **7.ii.a Phase One Property**

The potential contaminating activities within the subject property are as follows:

- a. A spill of hydraulic oil has occurred within the Phase One Property.
- b. The Phase One Property used to be a farm, hence pesticides may have been used.

### **7.ii.b Remaining Phase One Study Area**

The potential contaminating activities within the remaining Phase One Study area are as follows:

- a. Storage and/or handling of hazardous waste products at various properties within the study area located to the north, east and west of the Phase One Property.
- b. A property located to the northeast of the Phase One Property contains an underground fuel storage tank.
- c. Spills of gasoline have occurred within the Phase One Study area to the northeast of the Phase One Property.



### **7.iii Areas of Potential Environmental Concern**

Based on our site visit and research into the land use of the subject property and surrounding properties, there was evidence found, during our research of factors that might pose an environmental risk. The subject property and some of the surrounding properties are of potential environmental concern. In particular, the following environmental items and properties are of concern:

#### **1. Subject Property:**

##### **A) Spill:**

- (i) A spill of 50 litres of hydraulic oil has occurred in 2015 at the western edge of the site.

The spilled hydraulic oil had made contact with the subject property. In this regard, it may have infiltrated into the soil within the subject property. At this time, records indicating the spill was cleaned were not available.

##### **B) Pesticides:**

- (i) The subject property used to be a farm and pesticides may have been used.

The pesticides that may have been used at the subject property may have infiltrated into the soil within the subject property.

#### **2. Surrounding Properties:**

##### **A) Waste Generation Code:**

- (i) The property at 2686 The Collegeway, located northeast of the subject property is registered as a waste generator under Ontario Regulation 347. This regulation states that any property that produced collected, handled, or stored regulated waste has to be registered. The type of waste generated, handled and/or stored include pathological wastes.
- (ii) The property at 3521 Loyalist Drive, located northwest of the subject property is registered as a waste generator under Ontario Regulation 347. The type of waste generated, handled and/or stored include organic and inorganic laboratory chemicals.

There is a potential environmental risk from a spill and/or a leak of any of the chemicals from the items mentioned above that may migrate to the subject property.

##### **B) Underground Storage Tanks:**

- (i) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property contains underground fuel storage tanks.



There is a potential environmental risk from a spill and/or a leak of fuel from the above storage tank that may migrate to the subject property.

C) Spills in Surrounding Properties:

- (i) The property at 3425 Winston Churchill Boulevard, located northeast of the subject property is a site where spills of 30 litres and 140 litres of gasoline have occurred in 1995 and 1996, respectively.

It is possible that the spilled gasoline at the site may have migrated onto the Phase One Property.

D) Pesticides:

- (i) The surrounding properties used to be farms at some time in the past and may have used pesticides.

It is possible that pesticides may have migrated into the subject property from the surrounding properties.

Based on the above potential environmental concerns, Table 2 below summarizes the Areas of Potential Environmental Concern (APEC):

Table 2: Summary of Areas of Potential Environmental Concern					
Area of Potential Environmental Concern (APEC)	Location of APEC	Potentially Contaminating Activities (PCA)	PCA Onsite or Offsite?	Potential Contaminants of Concern	Potential Media Impacted
Phase One Property (APEC 1)	Western portion of the property	Spill of hydraulic oil	Onsite	TPH (F1-F4), VOCs, PAHs	Soil and Groundwater
Phase One Property (APEC 2)	North, south, east, west and central portion of the property	Potential use of pesticides in the past	Onsite	Pesticides	Soil and Groundwater
Activities north and west of the Phase One Property (APEC 3)	North, east and west sections of the property	Storage and handling of hazardous materials	Offsite	TPHs (F1 - F4), VOCs, PAHs and General Metal and Inorganic Parameters	Soil and Groundwater
Activities north and east of the Phase One Property (APEC 4)	North and east section of the property	Underground fuel storage tank	Offsite	TPHs (F1 - F4), VOCs and PAHs	Soil and Groundwater
Activities north and east of the Phase One Property (APEC 5)	North and east section of the Property	Spills of gasoline chemicals	Offsite	TPHs (F1 - F4), VOCs and PAHs	Soil and Groundwater
Activities north, east and west of the Phase One Property (APEC 6)	North, east and west section of the Property	Potential use of pesticides in the past	Offsite	Pesticides	Soil and Groundwater



#### **7.iv Phase One ESA Conceptual Site Model**

The potential contaminating activities and areas of potential environmental concerns are presented in detail in Sections 7.ii and 7.iii. These are shown in the Phase One ESA Conceptual Site Model, Figure 6.

The Phase One property currently is vacant and unoccupied. A spill of hydraulic oil has occurred at the west edge of the subject property. The spilled hydraulic oil had made contact with the subject property. In this regard, it may have infiltrated into the soil within the subject property. At this time, records indicating the spill was cleaned were not available. Furthermore, the Phase One Property used to be a farm. Pesticides may have been used during that time. Therefore, pesticides may have infiltrated into the soil within the subject property. As a result, these may cause a potential environmental concern.

The neighboring properties within the Phase One Study area are residential and commercial. There are various properties within the Phase One Study area, located to the north, east and west of the subject property registered as a waste generator under Ontario Regulation 347. A property located to the northeast of the subject property contains underground fuel storage tanks. Also, spills of gasoline have occurred within the Phase One Study area at a site located northeast of the subject property. In addition the surrounding sites used to be farms in the past. Therefore, it is possible that pesticides may have been used at these sites. There is a potential environmental risk from a spill and/or a leak of chemicals from these properties that may migrate to the subject property.

Based on maps and satellite images reviewed, the nearest water body is an unnamed River located approximately 3.3 km east of the property. No areas of natural significance were observed within the Phase One Property or the Phase One Study area.

In general, surficial geology in the areas have been mapped as: clay to silt-textured till (derived from glaciolacustrine deposits or shale) (Surficial geology, Ministry of Northern Development and Mines, 2013).

To prepare this Phase One Conceptual Site Model, site reconnaissance was carried out. All available information provided to Patriot Engineering Ltd was also reviewed. Therefore, the accuracy of the Conceptual Site Model is dependant on the accuracy of this information.

### **8.0 RECOMMENDATIONS**

A Phase Two ESA is recommended. The Phase Two ESA should consist of a series of boreholes drilled at strategic locations throughout this property. Soil samples and groundwater samples, if groundwater is encountered, should be analysed for General Metal and Inorganic parameters, Total Petroleum Hydrocarbons (TPH F1 to F4), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Volatile Organic Compounds (VOC's), Polycyclic Aromatic Hydrocarbons (PAHs) and pesticides.





## 9.0 STATEMENT OF QUALIFICATIONS

### Mr. Milkias Woldegiorgis, P.Eng.

Mr. Milkias Woldegiorgis is licensed as a Professional Engineer with the Professional Engineers of Ontario (PEO). He has been involved in the completion of several Phase One and Phase Two ESAs, as well as, chemical testing and sampling of soil and groundwater.

### Mr. Larry Galimanis, P.Eng, Principal/Consulting Engineer

Mr. Larry Galimanis is the President of Patriot Engineering Ltd. He is licensed as a Professional Engineer with the PEO, and also designated as a Consulting Engineer. He has over 30 years of experience in the engineering profession, including multiple projects involving environmental site assessments and remediation work.

## 10.0 DISCLAIMER

Every effort has been made to ensure that the information contained in this report is accurate. Patriot Engineering Ltd. has exercised professional judgement in collecting and analyzing the information and in formulating recommendations based on the results of the study. The mandate at Patriot Engineering Ltd. is to perform the given tasks within the guidelines prescribed by the client with the quality and due diligence expected within the profession. No other warranty or representation, expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report. This report is intended for use by our client the City of Mississauga. Patriot Engineering Ltd. hereby disclaims any liability to any other person or party for any loss, damage, expenses, fines or penalties which may arise or result from the use of any information or recommendations contained within the report.

Should you have any questions, please do not hesitate to contact our office.

Sincerely,  
**PATRIOT ENGINEERING LTD.**

Milkias Woldegiorgis, P. Eng.  
Geotechnical Engineer

Larry Galimanis, P.Eng.  
Principal/Consulting Engineer





## **11.0 REFERENCES**

Maps, <http://www.google.ca>

Ministry of Northern Development and Mines, Surficial Geology Google Earth Layer, 2013)

Polk's Halton/Peel Region Criss-Cross Directories, 2000

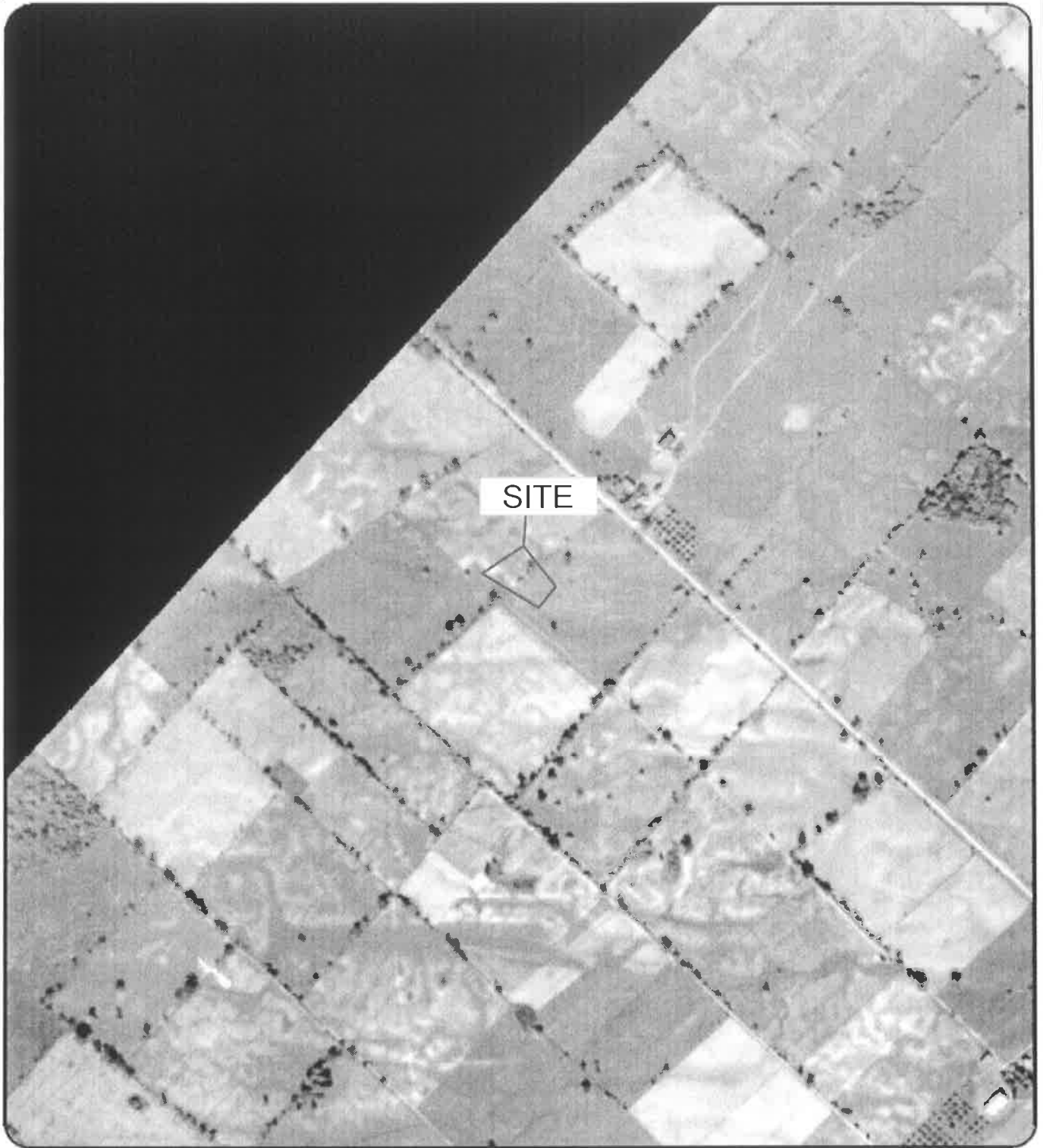


Phase One Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario

February 17, 2021

Project No.: 41108

Figure 1: Location map for subject  
property at The Collegeway and Loyalist Drive  
Mississauga, Ontario

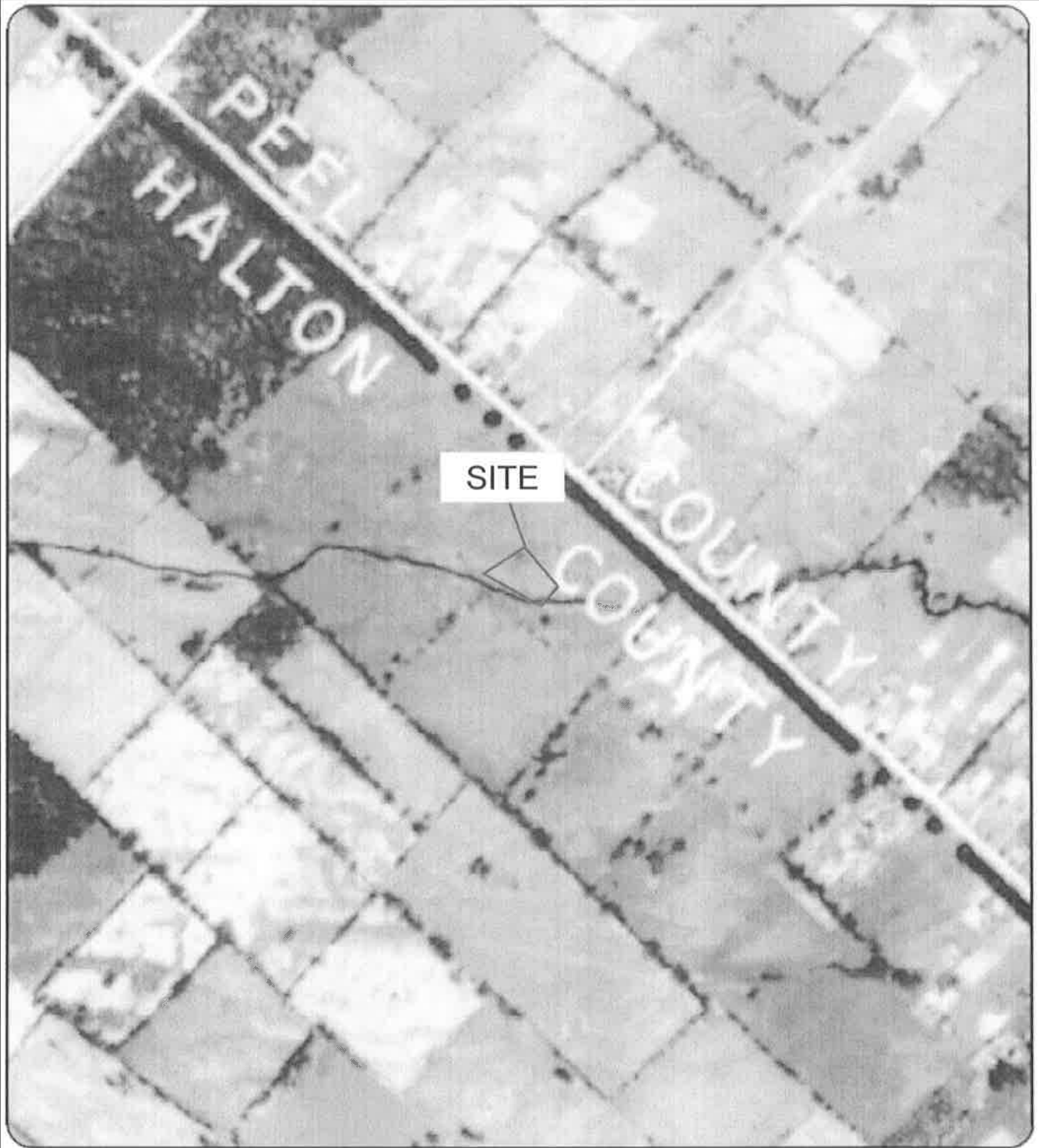


Phase One Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario

February 17, 2021

Project No.: 41108

Figure 2: Aerial Photograph from  
1934 showing subject property  
and adjacent areas



Phase One Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario

February 17, 2021

Project No.: 41108

Figure 3: Aerial Photograph from  
1954 showing subject property  
and adjacent areas



Phase One Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario

February 17, 2021

Project No.: 41108

Figure 4: Aerial Photograph from  
1974 showing subject property  
and adjacent areas





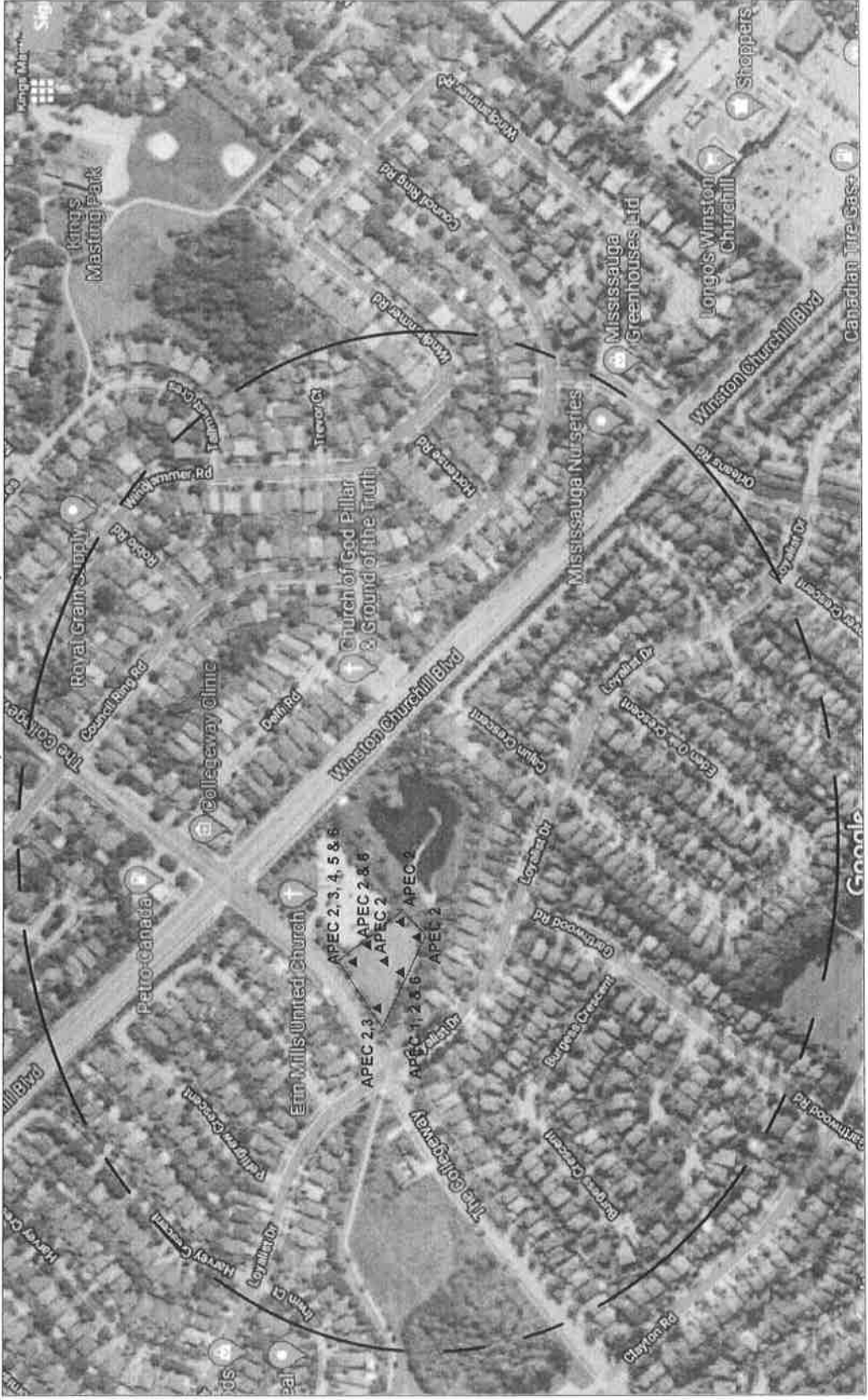
Phase One Environmental Site Assessment  
The Collegeway and Loyalist Drive  
Mississauga, Ontario

February 17, 2021

Project No.: 41108

Figure 5: Aerial Photograph from  
1988 showing subject property  
and adjacent areas

**FIGURE 6: CONCEPTUAL SITE MODEL**  
**PHASE ONE ESA**  
**THE COLLEGEWAY AND LOYALIST DRIVE, MISSISSAUGA, ONTARIO**



**LEGEND**

- PHASE ONE STUDY AREA
- PHASE ONE PROPERTY
- AREAS OF POTENTIAL ENVIRONMENTAL CONCERN (APEC)

Drawn By	Name	Date
Checked By	M.W.	Feb' 17, 2020
Revisions	L.G.	Feb' 17, 2020
Scale	N.S.T.	



PATRIOT ENGINEERING LTD.		
Consulting Engineers		
Project: 41108	Figure: 6	



## **APPENDIX A**

### **SITE PHOTOGRAPHS THE COLLEGEWAY AND LOYALIST DRIVE MISSISSAUGA, ONTARIO**



**Photograph 1: View of the subject property**



**Photograph 2: View east along The Collegeway**



**Photograph 3: View west along The Collegeway**



**Photograph 4: View east of the subject property**



**Photograph 5: View west of the subject property**



**Photograph 6: View south of the subject property**

## **APPENDIX B**

**FIRE INSURANCE PLAN DOCUMENTS  
THE COLLEGEWAY AND LOYALIST DRIVE  
MISSISSAUGA, ONTARIO**



An SCM Company

175 Commerce Valley Drive W  
Markham, Ontario L3T 7Z3

T: 905-882-6300  
W: [www.optaintel.ca](http://www.optaintel.ca)

Report Completed By:  
**Midori**

Site Address:

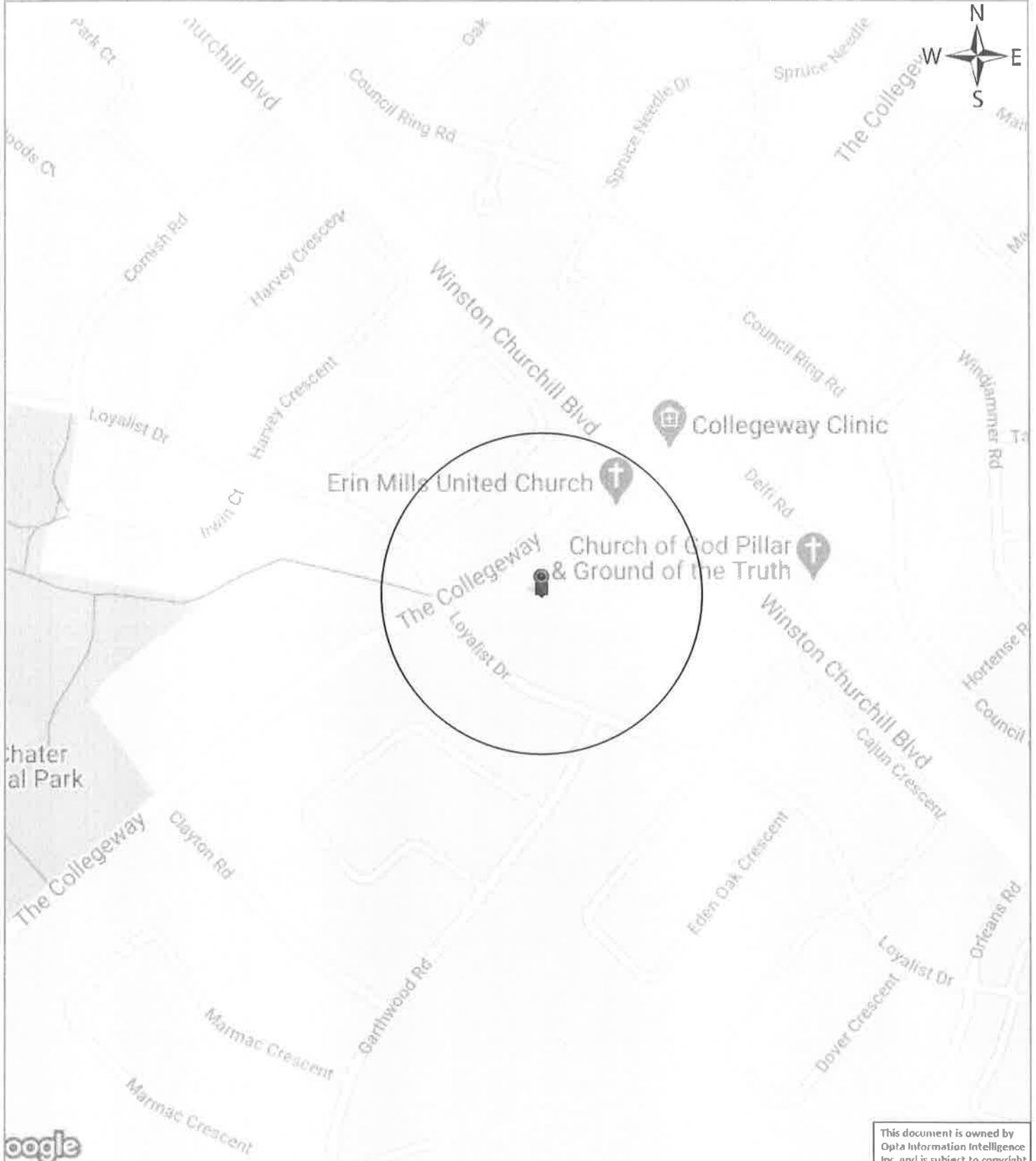
**3010 The Collegeway, Mississauga, ON**

Project No:  
**21021600032**  
Opta Order ID:

**86219**

Requested by:  
**Eleanor Goolab  
ERIS**

Date Completed:  
**2/22/2021 7:44:13 AM**



## Opta Historical Environmental Services Enviroscan<sup>TM</sup> Terms and Conditions

### Report

The documents (hereinafter referred to as the "Documents") to be released as part of the report (hereinafter referred to as the "Report") to be delivered to the purchaser as set out above are documents in Opta's records relating to the described property (hereinafter referred to as the "Property"). Opta makes no representations or warranties respecting the Documents whatsoever, including, without limitation, with respect to the completeness, accuracy or usefulness of the Documents, and does not represent or warrant that these are the only plans and reports prepared in association with the Property or in Opta's possession at the time of Report delivery to the purchaser. The Documents are current as of the date(s) indicated on them. Interpretation of the Documents, if any, is by inference based upon the information which is apparent and obvious on the face of the Documents only. Opta does not represent, warrant or guarantee that interpretations other than those referred to do not exist from other sources. The Report will be prepared for use by the purchaser of the services as shown above hereof only.

### Disclaimer

Opta disclaims responsibility for any losses or damages of any kind whatsoever, whether consequential or other, however caused, incurred or suffered, arising directly or indirectly as a result of the services (which services include, but are not limited to, the preparation of the Report provided hereunder), including but not limited to, any losses or damages arising directly or indirectly from any breach of contract, fundamental or otherwise, from reliance on Opta Reports or from any tortious acts or omissions of Opta's agents, employees or representatives.

### Entire Agreement

The parties hereto acknowledge and agree to be bound by the terms and conditions hereof. The request form constitutes the entire agreement between the parties pertaining to the subject matter hereof and supersedes all prior and contemporaneous agreements, negotiations and discussions, whether oral or written, and there are no representations or warranties, or other agreements between the parties in connection with the subject matter hereof except as specifically set forth herein. No supplement, modification, waiver, or termination of the request shall be binding, unless confirmed in writing by the parties hereto.

### Governing Document

In the event of any conflicts or inconsistencies between the provisions hereof and the Reports, the rights and obligations of the parties shall be deemed to be governed by the request form, which shall be the paramount document.

### Law

This agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein.



Page: 4  
Project Name: Phase One ESA

## ENVIROSCAN Report

### Report Index

Project #: 21021600032  
P.O. #: 41108

Requested by:  
Eleanor Goolab  
Date Completed: 02/22/2021 07:44:13



#### Page      Report Title

5      (1998) GENERAL ACCIDENT Report - 1998 UNITED CHURCH OF CANADA (ERIN MILLS UNITED CHURCH)  
3010 College Way Mississauga ON L0L0L0 (distance = 0 metres\*)



**GENERAL ACCIDENT Report - 1998 UNITED  
CHURCH OF CANADA (ERIN MILLS UNITED  
CHURCH) 3010 College Way Mississauga ON  
L0L0L0**

Requested by:  
Eleanor Goolab

Date Completed: 02/22/2021 07:44:13



OPTA INFORMATION INTELLIGENCE

**GENERAL ACCIDENT Report - 1998  
UNITED CHURCH OF CANADA (ERIN  
MILLS UNITED CHURCH) 3010 College  
Way Mississauga ON L0L0L0**





MARSH &  
MCLENNAN



General Accident

## THE GENERAL INSURANCE PLAN FOR THE UNITED CHURCH OF CANADA

### CONFIDENTIAL

NOTE: The sole purpose of this report is to provide insurance pricing and underwriting information about the particular insured and location named below. Only the person requesting this survey will receive a copy of the report, and IAO / CRRS asks that it be kept strictly confidential. This report does not guarantee compliance with any standards or with any federal, provincial or municipal codes, ordinances or regulations. Tests of fire protection equipment have not been conducted or witnessed during this inspection.

Insured: United Church of Canada (Erin Mills United Church) Insurer: General Accident Assurance Company of Canada  
Location Surveyed: 3010 College Way Policy / Reference #: \_\_\_\_\_  
Mississauga, Ontario Surveyed By: P. C. Tomlinson  
Postal Code: L4T 0L0 Date of Survey: November 2, 1998  
Person Contacted: Janis Hems - Secretary Telephone #: 905 820-9466  
Name of Pastoral Charge: Rev. Harry Oussdren Telephone #: 905 820-9466

### GENERAL INFORMATION

Seating Capacity: Pews 15 Chairs 270 Average attendance: 250  
How many days is the building used each week? 7 Hours of operation: 8:30 AM to 4:30 PM, 5 days a week  
Is there an Organ? ☐ No ☒ Yes (give details re: manufacture, type, age, number of stops / ranks, general condition, value if known) Electric organ with two stops in good condition purchased in 1992, its value is unknown to contact.

Are church representatives present when the church is open? ☐ No ☒ Yes  
Is building locked when not in use? ☐ No ☒ Yes  
Are repairs to the building performed by employees and/or members of the congregation?  
☐ No ☒ Yes If yes, what type of repairs: Cosmetic repairs only - major work is contracted.  
Are they qualified? ☐ No ☒ Yes  
Is there a manse? ☐ No ☒ Yes  
Is there a cemetery ☒ No ☐ Yes (describe size, location, and supervision) \_\_\_\_\_

Are there any high valued religious artifacts such as: fine arts, paintings, stained glass, statuary, tapestries, etc.?  
☒ No ☐ Yes Describe \_\_\_\_\_

Are there any religious artifacts that are irreplaceable? ☒ No ☐ Yes (Brief description): \_\_\_\_\_

Use of candles / incense etc. during service ☐ Never ☒ Weekly ☐ Monthly ☐ Less than monthly

IAO / CRRS reports, prepared in compliance with commonly accepted risk control standards existing at the time services are rendered, are developed from an inspection of the premises and / or from data supplied by or on behalf of the Purchaser. IAO / CRRS does not purport to list all hazards. While changes and modifications, referred to in the reports are designed to upgrade protection and loss prevention of the premises, IAO / CRRS assumes no responsibility for management and control of these activities. IAO / CRRS will not be responsible to the Purchaser for any losses or damages, whether consequential or other, however caused, incurred or suffered as a result of the services being provided.

## BUILDING

Year Built: 1992  
Building Renovated: ☐ Yes ☒ No 19  
Ground Floor Area: 536.4 m'. Basement Area: 508.9 m'. Total Area: 1,045.3 m'  
Building Condition: ☒ Good ☐ Fair ☐ Poor  
Wall Construction: Non-Combustible \_\_\_\_\_% Solid Masonry 80% C.B.B.F.  
Brick Vanner \_\_\_\_\_% Wood Frame 20%  
Load Bearing: Describe Brick bearing walls and partitions  
Roof Type: ☒ Flat ☐ Sloped ☒ Peaked ☐ Other  
Roof Construction: ☒ Wood Joist ☐ Concrete ☐ Steel Deck ☐ I ☐ II ☐ Other  
Roof Covering: ☐ Tar & Gravel ☐ Metal ☒ Asphalt Shingles ☐ Copper ☐ Lead ☐ Other  
Resurfaced: ☐ Yes ☒ No ☐ Partial Year \_\_\_\_\_ Comments \_\_\_\_\_  
Steeple: ☐ Yes ☒ No Proper lightning protection: ☐ No ☒ Yes, Describe N/A  
Are Church and Outbuildings Protected by:  
i) An approved Lightning protection System? ☐ Yes ☒ No  
ii) A qualified Lightning protection maintenance contract? ☐ Yes ☐ No  
iii) Date of last inspection? \_\_\_\_\_  
Floor Construction: Concrete 100% Concrete on Metal Pan \_\_\_\_\_%  
Wood Joist \_\_\_\_\_% ☐ Other \_\_\_\_\_%  
Vertical Openings: ☐ None ☒ Stairs ☒ Elevator ☐ Other  
Proper Protection ☒ Yes ☐ No ☐ Not Applicable  
Horizontal Separations: Major Partition Construction ☒ Not Applicable ☐ Frame ☐ Other  
☐ Concrete Block ☐ Other: \_\_\_\_\_  
Proper Opening Protection ☐ Yes ☐ No ☒ Not Applicable  
Combustible Concealed Spaces: ☐ Yes ☒ No ☐ Not Applicable  
Proper Protection ☐ Yes ☒ No ☐ Not Applicable  
Interior Finish: Walls: Combustible \_\_\_\_\_% 90 Non-Combustible 10%  
Ceilings: Combustible \_\_\_\_\_% 90 Non-Combustible 10%

## HEATING

Forced warm air: 90% ☐ Electric ☒ Gas ☐ Oil ☐ Other  
Suspended unit heater: \_\_\_\_\_% ☐ Electric ☐ Gas ☐ Oil ☐ Other  
Portable Heaters: \_\_\_\_\_% ☐ Electric ☐ Gas ☐ Oil ☐ Other  
Electric baseboard units: 10%  
Hot water/steam: \_\_\_\_\_% ☐ Electric ☐ Gas ☐ Oil ☐ Other  
Boiler ☐ Yes ☒ No Age and Make \_\_\_\_\_ ☒ N/A  
Date of last boiler inspection \_\_\_\_\_  
Other: \_\_\_\_\_% ☐ Electric ☐ Gas ☐ Oil ☐ Other  
Appliance enclosed in a non-combustible room: ☐ Yes ☒ No ☐ Not required  
Combustible materials stored in the room: ☐ Yes ☐ No ☒ Not applicable  
Fuel Tanks: ☒ None ☐ Inside ☐ Outside above ground ☐ Outside below ground  
Fill vent and piping outdoors ☐ Yes ☐ No  
Chimney: ☒ Masonry ☐ ULC Factory Built ☐ Unlabelled pre-fab ☒ Other Type "B" gas vent  
☒ Standard ☐ Non-Standard  
Installation appears safe: ☒ Yes ☐ No  
Installation replaced: ☒ Yes ☐ No 19 \_\_\_\_\_%

## ELECTRICAL

Type: ☒ Conduit ☒ BX ☐ Non-Metallic ☐ Other  
Overcurrent protection: ☒ Circuit breakers ☐ Type P fuses ☐ Type D fuses ☐ Other  
Condition: ☒ Good ☐ Fair ☐ Poor  
Remarks: No unusual or unsafe conditions noted  
Installation appears safe: ☒ Yes ☐ No Installation replaced: ☐ Yes ☒ No 19 \_\_\_\_\_%  
Remarks: \_\_\_\_\_  
Partial Changes / Extensions: ☒ No ☐ Yes  
Emergency Power Generator: ☐ Diesel ☐ Oil ☐ Gas ☐ Other N/A

## COMMON HAZARDS

Extent of Exposure	None	Slight	Moderate	Severe	Remarks
Smoking	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: Smoking prohibited in the building
Heating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: Standard equipment
Electrical Services	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: In good condition
Housekeeping	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: Good

## EXTENDED COVERAGE

	Extent of Exposure				
	None	Slight	Moderate	Severe	
Windstorm	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: <u>No unusual conditions</u>
Lightning	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: <u>No unusual conditions</u>
Building Impact	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: <u>Limited exposure</u>
Other	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Remarks: _____

## WATER DAMAGE

Evidence of corrosion: ☐ No ☒ Yes If yes, describe \_\_\_\_\_

Window & Skylight openings adequately sealed: ☒ Yes ☐ No

Damage Exposure from Air Conditioning equipment: ☐ Yes ☒ No ☐ N/A

Roof covering materials adequate: ☒ Yes ☐ No Date of most recent repairs: \_\_\_\_\_ ☒ Undetermined

Inside and or roof storage tank(s) or process equipment: ☐ Yes ☒ No

If yes, satisfactorily controlled: ☐ Yes ☐ No ☒ N/A

## FLOOD

Distance to nearest body of water: N/A Non Determined

Evidence of water damage: ☒ No ☐ Yes

Describe: \_\_\_\_\_

History of Flooding: ☐ Yes ☒ No ☐ Undetermined

## SEWER BACK-UP

Any protection devices in place: ☒ No ☐ Yes

Describe: \_\_\_\_\_

History of Sewer Back-up: ☐ Yes ☒ No ☐ Undetermined

NOTE: For Water Damage, Flood and Sewer Back-up sections  
Historical Information confirmed by: Janis Hems  
Years Employed: 6

## UNDERGROUND STORAGE TANKS

Are there any under ground storage tanks? ☐ Yes ☒ No ☐ Cannot be confirmed by contact.

No.	Age	Capacity (L)	Contents	Construction	Cathodic Protection
1					
2					
3					
4					
5					

Do the Underground Storage Tanks conform with current provincial codes? ☐ Yes (As per contact) ☒ N/A

## KITCHEN

Interior Finish

- Walls Drywall
- Ceilings "
- Floors Vinyl Tile on concrete

Finish of walls near cooking appliances: ☐ None ☒ Non-combustible ☐ Combustible

Cleanliness: ☒ Good ☐ Fair ☐ Poor

Pest Control Program: ☒ No ☐ Yes

## COOKING APPLIANCES AND EXHAUST INSTALLATION

Appliance Type	Number	Fuel				Automatic shut-off		Hoods		Protection		
		Electric	Nat. Gas	Prop. Gas	Charcoal	Yes	No	Yes	No	Fixed System	Automatic Sprinklers	None
Oven												
Grill / Griddle												
Deep Fat Fryer												
Stove / Range	2	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Char Broiler												
Other												

### Exhaust System Cleaning N/A

Element	Weekly	Monthly	Other	Name of Company	Clean at time of inspection	
					Yes	No
Filter(s)						
Hood(s)						
Duct(s)						

Exhaust Ducts: ☐ Discharges directly to outside ☐ Passes through combustible materials  
☐ Extends through the roof ☐ Protected by a fixed extinguishing system

Year of installation: N/A

Comment: Kitchen equipment consists of two domestic stoves household type, two refrigerators, and 1 microwave oven. All equipment is in good condition.

## FIRE PROTECTION

### Public

F.U.S Protection Class: 2

Responding Fire Department: Mississauga

☒ Full Time ☐ Volunteer ☐ Composite

Distance to Fire Department: 1 km. Roads: ☒ Paved ☐ Unpaved

Accessible Year-round: ☐ No ☒ Yes Difficult access for Fire Dept: ☒ No ☐ Yes

No. of Hydrants: 2 within 155m. within 156m.-305m. over 305m. ☐ None

### Private

#### Are the following adequate?

Portable Extinguishers: ☐ No ☒ Yes If yes, number of 6 Date last maintained Oct./98  
Security Guard: ☐ No ☐ Yes ☒ N/A  
Standpipe / Inside Hose: ☐ No ☐ Yes ☒ N/A  
Smoke Detection System: ☒ No ☐ Yes ☐ N/A  
Fire Detection System: ☒ No ☐ Yes ☐ N/A

Connected to :

☐ ULC Central Station ☐ ULC Monitoring Station  
☒ Unlisted Service ☐ Local Only  
☐ Fire/Police Department ☐ Other

#### Automatic Sprinkler Protection:

Sprinkler system

☒ None ☐ Partial ☐ Full Premises  
☐ Wet ☐ Dry ☐ Preaction ☐ Deluge

System tested at time of survey:

☐ Yes ☐ No  
☐ ULC Central Station ☐ ULC Monitoring Station  
☐ Unlisted Service ☐ Local Only  
☐ Fire/Police Department ☐ Other

Connected to :

When was the system last tested? By Whom?

**FIRE PROTECTION Cont'd**

Private

**Fixed Extinguishing Systems: (Cooking Appliances & Exhaust Systems)**

Type of Installation ☐ Co<sub>2</sub> ☐ Dry Chemical ☒ Wet chemical ☐ Other N/A  
Emergency manual operation: ☐ Yes ☒ No  
System approved by: ☐ ULC ☒ UL ☐ CSA  
Manufacturer: \_\_\_\_\_  
Maintenance Contract: ☐ Yes ☒ No Company: \_\_\_\_\_ Telephone: \_\_\_\_\_  
Expiry date: \_\_\_\_\_  
Inspection: ☐ Annual ☒ Semi Annual Certificate: ☐ Yes ☒ No

**Other Protection:**

Automatic sprinklers: ☐ Yes ☒ No ☐ At ceiling ☐ In hoods ☐ In exhaust ducts  
Extinguishers(40-B,C) a) In kitchen areas: ☐ Yes ☒ No ☐ Co<sub>2</sub> ☐ Dry Chemical  
b) In other areas: ☒ Yes ☐ No Type: Dry Chemical  
ULC labelled grease extraction system: ☐ Yes ☒ No  
Manufacturer: \_\_\_\_\_ Model #: \_\_\_\_\_  
Ventilating equipment appears adequate: ☒ Yes ☐ No

**ELECTRONIC DATA PROCESSING**

☐ Mini System ☒ PC Stand Alone ☐ None  
Is all equipment in one room: ☐ Yes ☒ No Connected to central location: ☐ Yes ☒ No  
Age: + 5 years Approximate Value: \$500.00  
Equipment is: ☒ Owned ☐ Leased  
Basic Protection satisfactory: ☒ Yes ☐ No Surge Protection: ☒ Yes ☐ No  
Data properly backed up and stored: ☒ Yes ☐ No  
Separate location: ☒ Yes ☐ No

**COLLAPSE**

Heavy Snowbelt Area: ☐ Yes ☒ No  
Evident Water Ponding: ☐ Yes ☒ No  
Unusual Roof Loading (ie. equipment): ☐ Yes ☒ No  
Changes in Roof Elevation: ☒ Yes ☐ No  
Evident Sagging: ☐ Yes ☒ No  
☐ Walls ☐ Floors ☐ Roof ☐ Porch / Awning  
Earthquake Zone: 0

**EXPOSURE TO PROPERTY**

	Distance	Height	Construction	Occupancy	Opening in Facing Wall	
					Yes	No
Front	m.	Sto.	O			
Rear	m.	Sto.	P			
Left	m.	Sto.	E			
Right	m.	Sto.	N			

Describe partition wall between insured and other tenants: \_\_\_\_\_

## CRIME & VANDALISM

### Neighbourhood

Crime Experience: ☒ Low ☐ Moderate ☐ High  
☒ Residential ☐ Commercial ☐ Industrial ☐ Rural ☐ Isolated  
 Appears to be: ☒ Stable Changing via: ☐ Expansion/growth ☐ Renovation ☐ Deterioration

### General Protection

Effective exterior lighting ☒ Yes ☐ No Effective interior lighting ☒ Yes ☐ No  
 Premises fully fenced ☐ Yes ☒ No Regular police patrols ☒ Yes ☐ No  
 Watchman / security guard services: ☒ None ☐ For building

### Security System

Premises alarm system in use: ☒ Yes ☐ No ☐ N/A Extent of protection: ☒ Perimeter ☒ Partial Space / area ☐ Not determined  
 Monitored by: ☐ ULC Monitoring Station ☒ Unlisted Service ☐ Local alarm  
 Line security: ☐ Dedicated line ☒ Digital Dialer ☐ Other

Are crime & vandalism incidents logged at the church ☐ Yes ☒ No

Steps taken to reduce crime / vandalism: ☐ Yes ☒ No  
 or additional steps taken as there have been no incidents.

Describe: No logging of incidents

Target items: 1 TV / VCR

Describe target areas Basement - Lybrary

DOOR	How Many	CONSTRUCTION						KINDS OF LOCKS									
		Wood	Metal	Metal Covered	Glass	Bars on Glass Doors	IF ANY PANEL	Single Cylinder Dead Lock	Double Cylinder Dead Lock	Spring Lock	Panic Bar	Slide Bolt	Padiack	Cross Bar	Wired To Alarm System?		
							Plain Glass	Wired Glass					Inside	Outside	Yes	No	
Front	3				<input checked="" type="checkbox"/>										<input checked="" type="checkbox"/>		
Side	2				<input checked="" type="checkbox"/>										<input checked="" type="checkbox"/>		
Rear	1		<input checked="" type="checkbox"/>												<input checked="" type="checkbox"/>		
Roof																	

Windows	How Many	TYPE OF WINDOW		BURGLARY SCREENS			BURGLARY BARS				Condition of bars and screens	Wired To Alarm System?
		Fixed	Movable	Inside	Outside	Property Secured	Inside	Outside	Spacing	Property Secured		
Front	16	<input checked="" type="checkbox"/>										<input checked="" type="checkbox"/>
Side	52	<input checked="" type="checkbox"/>										<input checked="" type="checkbox"/>
Rear												
Basement												
Transoms												
Skylight												
Other Openings												

### Audio/Visual System

P.A. System: ☒ Yes ☐ No Est. purchase price: \$ unknown  
 TV Monitors: ☐ No ☒ Yes How Many 1 Est. purchase price: \$ 500.00  
 VCR's: ☐ No ☒ Yes How Many 1 Est. purchase price: \$ 350.00  
 Video Cameras: ☒ No ☐ Yes How Many \_\_\_\_\_ Est. purchase price: \$ \_\_\_\_\_  
 Other similar AV equipment (describe & estimate purchase price): N/A

Note: Where possible obtain price from buyer

Above equipment locked away when not in use: ☐ No ☒ Yes (Describe below)

Above equipment ever removed from building or loaned to anyone: ☒ No ☐ Yes

Comments: TV / VCR is a combination unit and is kept locked away at night. The P.A. system has all moveable components including microphones kept in locked cupboard.



## GENERAL REMARKS

This Church is located in a residential neighbourhood of Mississauga, near Winston Churchill Boulevard and Eglinton Avenue West. The building is not very old and is consequently in good condition, clean and well maintained. The Insured was very co-operative, is responsible and appears interested in loss control. Housekeeping is good and the supply of portable fire extinguishers is updated. Other fire protection equipment including the fire alarm system receive regular care and maintenance on as needed basis.

Considering the value of the target type articles is low, the protection provided is adequate

☐ None made at this time

LCTS.528.0495

RECOMMENDATIONS

Lined area for recommendations.

☒ None made at this time

## **APPENDIX C**

### **ECOLOG ERIS REPORT THE COLLEGEWAY AND LOYALIST DRIVE MISSISSAUGA, ONTARIO**

**ERIS**  
ENVIRONMENTAL RISK INFORMATION SERVICES



# DATABASE REPORT

**Project Property:**

*Phase 1 ESA  
The Collegeway & Loyalist Dr  
Mississauga ON L5L 4X9*

**Project No:**

**Report Type:**

*Quote - Custom-Build Your Own Report*

**Order No:**

*21020300040*

**Requested by:**

*Patriot Engineering Ltd.*

**Date Completed:**

*February 7, 2021*

**Environmental Risk Information Services**

A division of Glacier Media Inc.

1.866.517.5204 | [info@erisinfo.com](mailto:info@erisinfo.com) | [erisinfo.com](http://erisinfo.com)

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## Executive Summary

### Property Information:

**Project Property:** Phase 1 ESA  
The Collegeway & Loyalist Dr Mississauga ON L5L 4X9

**Project No:**

### Order Information:

**Order No:** 21020300040  
**Date Requested:** February 3, 2021  
**Requested by:** Patriot Engineering Ltd.  
**Report Type:** Quote - Custom-Build Your Own Report

### Historical/Products:

**Aerial Photographs** Aerials - National Collection

## Executive Summary: Report Summary

<b>Database</b>	<b>Name</b>	<b>Searched</b>	<b>Project Property</b>	<b>Boundary to 0.25km</b>	<b>Total</b>
AAGR	<b>Abandoned Aggregate Inventory</b>	Y	0	0	0
AGR	<b>Aggregate Inventory</b>	Y	0	0	0
AMIS	<b>Abandoned Mine Information System</b>	Y	0	0	0
ANDR	<b>Anderson's Waste Disposal Sites</b>	Y	0	0	0
AST	<b>Aboveground Storage Tanks</b>	Y	0	0	0
AUWR	<b>Automobile Wrecking &amp; Supplies</b>	Y	0	0	0
BORE	<b>Borehole</b>	Y	0	0	0
CA	<b>Certificates of Approval</b>	Y	0	0	0
CDRY	<b>Dry Cleaning Facilities</b>	Y	0	0	0
CFOT	<b>Commercial Fuel Oil Tanks</b>	Y	0	0	0
CHEM	<b>Chemical Manufacturers and Distributors</b>	Y	0	0	0
CHM	<b>Chemical Register</b>	Y	0	0	0
CNG	<b>Compressed Natural Gas Stations</b>	Y	0	0	0
COAL	<b>Inventory of Coal Gasification Plants and Coal Tar Sites</b>	Y	0	0	0
CONV	<b>Compliance and Convictions</b>	Y	0	0	0
CPU	<b>Certificates of Property Use</b>	Y	0	0	0
DRL	<b>Drill Hole Database</b>	Y	0	0	0
DTNK	<b>Delisted Fuel Tanks</b>	Y	0	0	0
EASR	<b>Environmental Activity and Sector Registry</b>	Y	0	0	0
EBR	<b>Environmental Registry</b>	Y	0	0	0
ECA	<b>Environmental Compliance Approval</b>	Y	0	1	1
EEM	<b>Environmental Effects Monitoring</b>	Y	0	0	0
EHS	<b>ERIS Historical Searches</b>	Y	1	0	1
EIIS	<b>Environmental Issues Inventory System</b>	Y	0	0	0
EMHE	<b>Emergency Management Historical Event</b>	Y	0	0	0
EPAR	<b>Environmental Penalty Annual Report</b>	Y	0	0	0
EXP	<b>List of Expired Fuels Safety Facilities</b>	Y	0	4	4
FCON	<b>Federal Convictions</b>	Y	0	0	0
FCS	<b>Contaminated Sites on Federal Land</b>	Y	0	0	0
FOFT	<b>Fisheries &amp; Oceans Fuel Tanks</b>	Y	0	0	0
FRST	<b>Federal Identification Registry for Storage Tank Systems (FIRSTS)</b>	Y	0	0	0
FST	<b>Fuel Storage Tank</b>	Y	0	8	8
FSTH	<b>Fuel Storage Tank - Historic</b>	Y	0	1	1
GEN	<b>Ontario Regulation 347 Waste Generators Summary</b>	Y	0	16	16
GHG	<b>Greenhouse Gas Emissions from Large Facilities</b>	Y	0	0	0
HINC	<b>TSSA Historic Incidents</b>	Y	0	1	1

<i>Database</i>	<i>Name</i>	<i>Searched</i>	<i>Project Property</i>	<i>Boundary to 0.25km</i>	<i>Total</i>
IAFT	<i>Indian &amp; Northern Affairs Fuel Tanks</i>	Y	0	0	0
INC	<i>Fuel Oil Spills and Leaks</i>	Y	0	3	3
LIMO	<i>Landfill Inventory Management Ontario</i>	Y	0	0	0
MINE	<i>Canadian Mine Locations</i>	Y	0	0	0
MNR	<i>Mineral Occurrences</i>	Y	0	0	0
NATE	<i>National Analysis of Trends in Emergencies System (NATES)</i>	Y	0	0	0
NCPL	<i>Non-Compliance Reports</i>	Y	0	0	0
NDFT	<i>National Defense &amp; Canadian Forces Fuel Tanks</i>	Y	0	0	0
NDSP	<i>National Defense &amp; Canadian Forces Spills</i>	Y	0	0	0
NDWD	<i>National Defence &amp; Canadian Forces Waste Disposal Sites</i>	Y	0	0	0
NEBI	<i>National Energy Board Pipeline Incidents</i>	Y	0	0	0
NEBP	<i>National Energy Board Wells</i>	Y	0	0	0
NEES	<i>National Environmental Emergencies System (NEES)</i>	Y	0	0	0
NPCB	<i>National PCB Inventory</i>	Y	0	0	0
NPRI	<i>National Pollutant Release Inventory</i>	Y	0	0	0
OGWE	<i>Oil and Gas Wells</i>	Y	0	0	0
OOGW	<i>Ontario Oil and Gas Wells</i>	Y	0	0	0
OPCB	<i>Inventory of PCB Storage Sites</i>	Y	0	0	0
ORD	<i>Orders</i>	Y	0	0	0
PAP	<i>Canadian Pulp and Paper</i>	Y	0	0	0
PCFT	<i>Parks Canada Fuel Storage Tanks</i>	Y	0	0	0
PES	<i>Pesticide Register</i>	Y	0	0	0
PINC	<i>Pipeline Incidents</i>	Y	0	5	5
PRT	<i>Private and Retail Fuel Storage Tanks</i>	Y	0	1	1
PTTW	<i>Permit to Take Water</i>	Y	0	0	0
REC	<i>Ontario Regulation 347 Waste Receivers Summary</i>	Y	0	0	0
RSC	<i>Record of Site Condition</i>	Y	0	0	0
RST	<i>Retail Fuel Storage Tanks</i>	Y	0	0	0
SCT	<i>Scott's Manufacturing Directory</i>	Y	0	0	0
SPL	<i>Ontario Spills</i>	Y	1	8	9
SRDS	<i>Wastewater Discharger Registration Database</i>	Y	0	0	0
TANK	<i>Anderson's Storage Tanks</i>	Y	0	0	0
TCFT	<i>Transport Canada Fuel Storage Tanks</i>	Y	0	0	0
VAR	<i>Variances for Abandonment of Underground Storage Tanks</i>	Y	0	0	0
WDS	<i>Waste Disposal Sites - MOE CA Inventory</i>	Y	0	0	0
WDSH	<i>Waste Disposal Sites - MOE 1991 Historical Approval Inventory</i>	Y	0	0	0
WWIS	<i>Water Well Information System</i>	Y	0	6	6
<b>Total:</b>			2	54	56



## Executive Summary: Site Report Summary - Project Property

<i>Map Key</i>	<i>DB</i>	<i>Company/Site Name</i>	<i>Address</i>	<i>Dir/Dist (m)</i>	<i>Elev diff (m)</i>	<i>Page Number</i>
<u>1</u>	SPL	Emterra Environmental	3010 The Collegeway Mississauga ON	SW/0.0	0.00	<u>22</u>
<u>2</u>	EHS		3010 The Collegeway Mississauga ON	SW/0.0	0.00	<u>22</u>

## Executive Summary: Site Report Summary - Surrounding Properties

Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev Diff (m)	Page Number
<u>3</u>	WWIS		ON <i>Well ID: 7225159</i>	NE/0.5	0.00	<u>22</u>
<u>4</u>	WWIS		3234 WINSTON CHURCHILL BLVD. Mississauga ON <i>Well ID: 7136494</i>	ESE/29.2	-1.03	<u>23</u>
<u>5</u>	WWIS		ON <i>Well ID: 7278341</i>	E/31.3	-0.97	<u>30</u>
<u>6</u>	WWIS		ON <i>Well ID: 7286585</i>	ESE/71.4	-1.10	<u>30</u>
<u>7</u>	SPL		behind 3395 Loyalist Drive, Mississauga Mississauga ON L5L 4Y1	SE/83.5	-0.71	<u>31</u>
<u>8</u>	WWIS		THE COLLEGEWAY & WINSTON CHURCHILL BLVD. NW CORNER Mississauga ON <i>Well ID: 7287391</i>	NNE/96.9	0.00	<u>31</u>
<u>8</u>	WWIS		THE COLLEGEWAY MISSISSAUGA ON <i>Well ID: 7312086</i>	NNE/96.9	0.00	<u>34</u>
<u>9</u>	ECA	The Corporation of the City of Mississauga	Part Blk 18 & 19, Plan 43R-m674 Mississauga ON L5B 2T4	SSE/145.3	0.00	<u>36</u>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON	NE/166.8	0.00	<u>36</u>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>37</u>
<u>10</u>	GEN	Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	NE/166.8	0.00	<u>37</u>
<u>10</u>	GEN	The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	NE/166.8	0.00	<u>37</u>

<i>Map Key</i>	<i>DB</i>	<i>Company/Site Name</i>	<i>Address</i>	<i>Dir/Dist (m)</i>	<i>Elev Diff (m)</i>	<i>Page Number</i>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>38</u>
<u>10</u>	GEN	The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	NE/166.8	0.00	<u>38</u>
<u>10</u>	GEN	Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	NE/166.8	0.00	<u>38</u>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>38</u>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>39</u>
<u>10</u>	GEN	Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	NE/166.8	0.00	<u>39</u>
<u>10</u>	GEN	The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	NE/166.8	0.00	<u>39</u>
<u>10</u>	GEN	The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>40</u>
<u>10</u>	GEN	The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	NE/166.8	0.00	<u>40</u>
<u>10</u>	GEN	Collegeway Urgent Care	2686 The Collegeway, Unit 103 Mississauga ON L5L 2M9	NE/166.8	0.00	<u>40</u>
<u>11</u>	SPL	The Corporation of the City of Mississauga	3372 Delfi Rd Mississauga ON L5L 1W5	ENE/171.3	-1.03	<u>40</u>
<u>12</u>	SPL	SUNOCO	3425 WINSTON CHURCHILL BLVD. SERVICE STATION MISSISSAUGA CITY ON L5L 3R5	NNE/179.4	0.00	<u>41</u>
<u>12</u>	PRT	SUNOCO INC	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	NNE/179.4	0.00	<u>41</u>

<i>Map Key</i>	<i>DB</i>	<i>Company/Site Name</i>	<i>Address</i>	<i>Dir/Dist (m)</i>	<i>Elev Diff (m)</i>	<i>Page Number</i>
<u>12</u>	SPL	SUNOCO	3425 WINSTON CHURCHILL DRIVE. SERVICE STATION MISSISSAUGA CITY ON L5L 3R5	NNE/179.4	0.00	<u>42</u>
<u>12</u>	FSTH	SRAA SERVICES INC O/A GAS STN	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	NNE/179.4	0.00	<u>42</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>43</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>43</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>44</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>44</u>
<u>12</u>	GEN	Suncor Energy Products Partnership	3425 Winston Churchill Blvd Mississauga ON L5L 3R5	NNE/179.4	0.00	<u>45</u>
<u>12</u>	EXP	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>45</u>
<u>12</u>	EXP	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>45</u>
<u>12</u>	EXP	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>46</u>
<u>12</u>	EXP	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>46</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA	NNE/179.4	0.00	<u>46</u>

Map Key	DB	Company/Site Name	Address	Dir/Dist (m)	Elev Diff (m)	Page Number
			ON			
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>47</u>
<u>12</u>	FST		3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	NNE/179.4	0.00	<u>48</u>
<u>12</u>	FST	SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	NNE/179.4	0.00	<u>48</u>
<u>13</u>	PINC	ENBRIDGE GAS INC	3348 DELFI RD,,MISSISSAUGA,ON,L5L 1S2,CA ON	E/195.3	-2.00	<u>49</u>
<u>14</u>	INC		2680 THE COLLEGEWAY, MISSISSAUGA ON L5L 2M9	NE/198.3	-0.78	<u>49</u>
<u>15</u>	INC		2711 SPRUCE NEEDLE CRT., MISSISSAUGA ON L5L 1N2	N/205.5	0.00	<u>50</u>
<u>16</u>	GEN	Home Alone Property Management Ltd.	3521 Loyalist Drive Mississauga ON L5L 4W5	WNW/219.6	0.25	<u>50</u>
<u>17</u>	SPL	Enbridge Gas Distribution Inc.	3341 Winstonchurchill Blvd Mississauga ON	E/220.3	-2.56	<u>51</u>
<u>17</u>	PINC	ST LAWRENCE PLACE C/O HARBOUR PLANT RETIREMENT LODGES	3341 WINSTON CHURCHILL BLVD,, MISSISSAUGA,ON,L5L 2W3,CA ON	E/220.3	-2.56	<u>51</u>
<u>18</u>	PINC	PIPELINE HIT 3"	3512 IRWIN COURT,,MISSISSAUGA,ON, L5L 4W5,CA ON	WNW/224.6	0.04	<u>52</u>
<u>19</u>	SPL	The Regional Municipality of Peel	Intersection of Council Ring Rd and The Collegeway Mississauga ON	NE/235.8	0.00	<u>52</u>

<i>Map Key</i>	<i>DB</i>	<i>Company/Site Name</i>	<i>Address</i>	<i>Dir/Dist (m)</i>	<i>Elev Diff (m)</i>	<i>Page Number</i>
<u>20</u>	SPL	Enbridge Gas Distribution Inc.	3055 Eden Oak Cres, Miss. Mississauga ON	SE/242.3	-1.53	<u>53</u>
<u>20</u>	PINC	ENBRIDGE GAS INC	3055 EDEN OAK CRES,,MISSISSAUGA, ON,L5L 5V2,CA ON	SE/242.3	-1.53	<u>53</u>
<u>21</u>	INC		2660 The Collegeway, Mississauga ON L5L 2M9	NE/243.3	-1.07	<u>54</u>
<u>22</u>	HINC		3067 Eden Oak Cres MISSISSAUGA ON L5L 5V2	SE/247.3	-1.00	<u>54</u>
<u>23</u>	SPL	Enbridge Gas Distribution Inc.	South-west corner of Loyalist Dr. and Irwin Court Mississauga ON	WNW/249.7	1.00	<u>55</u>
<u>23</u>	PINC	PIPELINE HIT - 3"	LOYALIST DRIVE AND IRWIN COURT,, MISSISSAUGA,ON,,CA ON	WNW/249.7	1.00	<u>55</u>

## Executive Summary: Summary By Data Source

### ECA - Environmental Compliance Approval

A search of the ECA database, dated Oct 2011- Dec 31, 2020 has found that there are 1 ECA site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
The Corporation of the City of Mississauga	Part Blk 18 & 19, Plan 43R-m674 Mississauga ON L5B 2T4	145.3	<u>9</u>

### EHS - ERIS Historical Searches

A search of the EHS database, dated 1999-Oct 31, 2020 has found that there are 1 EHS site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
	3010 The Collegeway Mississauga ON	0.0	<u>2</u>

### EXP - List of Expired Fuels Safety Facilities

A search of the EXP database, dated Jul 31, 2020 has found that there are 4 EXP site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
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**FST - Fuel Storage Tank**

A search of the FST database, dated Jul 31, 2020 has found that there are 8 FST site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>
SUNCOR ENERGY PRODUCTS PARTNERSHIP	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	179.4	<u>12</u>



## **FSTH - Fuel Storage Tank - Historic**

A search of the FSTH database, dated Pre-Jan 2010\* has found that there are 1 FSTH site(s) within approximately 0.25 kilometers of the project property.

<b><u>Site</u></b>	<b><u>Address</u></b>	<b><u>Distance (m)</u></b>	<b><u>Map Key</u></b>
SRAA SERVICES INC O/A GAS STN	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	179.4	<u>12</u>

## **GEN - Ontario Regulation 347 Waste Generators Summary**

A search of the GEN database, dated 1986-Jul 31, 2020 has found that there are 16 GEN site(s) within approximately 0.25 kilometers of the project property.

<b><u>Site</u></b>	<b><u>Address</u></b>	<b><u>Distance (m)</u></b>	<b><u>Map Key</u></b>
Collegeway Urgent Care	2686 The Collegeway, Unit 103 Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	166.8	<u>10</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	166.8	<u>10</u>
Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	166.8	<u>10</u>
Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	166.8	<u>10</u>

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	166.8	<u>10</u>
Collegeway Urgent Care	2686 The Collegeway Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	166.8	<u>10</u>
The Collegeway Animal Hospital	2686 The Collegeway Unit 101 Mississauga ON	166.8	<u>10</u>
The Collegeway Dental Office	2686 The Collegeway Mississauga ON L5L2M9	166.8	<u>10</u>
Suncor Energy Products Partnership	3425 Winston Churchill Blvd Mississauga ON L5L 3R5	179.4	<u>12</u>
Home Alone Property Management Ltd.	3521 Loyalist Drive Mississauga ON L5L 4W5	219.6	<u>16</u>

### **HINC - TSSA Historic Incidents**

A search of the HINC database, dated 2006-June 2009\* has found that there are 1 HINC site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
	3067 Eden Oak Cres MISSISSAUGA ON L5L 5V2	247.3	<u>22</u>

## **INC - Fuel Oil Spills and Leaks**

A search of the INC database, dated Jul 31, 2020 has found that there are 3 INC site(s) within approximately 0.25 kilometers of the project property.

<b><u>Site</u></b>	<b><u>Address</u></b>	<b><u>Distance (m)</u></b>	<b><u>Map Key</u></b>
	2680 THE COLLEGEWAY, MISSISSAUGA ON L5L 2M9	198.3	<u>14</u>
	2711 SPRUCE NEEDLE CRT., MISSISSAUGA ON L5L 1N2	205.5	<u>15</u>
	2660 The Collegeway, Mississauga ON L5L 2M9	243.3	<u>21</u>

## **PINC - Pipeline Incidents**

A search of the PINC database, dated Oct 31, 2020 has found that there are 5 PINC site(s) within approximately 0.25 kilometers of the project property.

<b><u>Site</u></b>	<b><u>Address</u></b>	<b><u>Distance (m)</u></b>	<b><u>Map Key</u></b>
ENBRIDGE GAS INC	3348 DELFI RD,,MISSISSAUGA,ON,L5L 1S2, CA ON	195.3	<u>13</u>
ST LAWRENCE PLACE C/O HARBOUR PLANT RETIREMENT LODGES	3341 WINSTON CHURCHILL BLVD., MISSISSAUGA,ON,L5L 2W3,CA ON	220.3	<u>17</u>
PIPELINE HIT 3"	3512 IRWIN COURT,,MISSISSAUGA,ON,L5L 4W5,CA ON	224.6	<u>18</u>
ENBRIDGE GAS INC	3055 EDEN OAK CRES,,MISSISSAUGA,ON, L5L 5V2,CA ON	242.3	<u>20</u>
PIPELINE HIT - 3"	LOYALIST DRIVE AND IRWIN COURT., MISSISSAUGA,ON,,CA ON	249.7	<u>23</u>

## **PRT - Private and Retail Fuel Storage Tanks**

A search of the PRT database, dated 1989-1996\* has found that there are 1 PRT site(s) within approximately 0.25 kilometers of the project property.

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
SUNOCO INC	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	179.4	<u>12</u>

## **SPL - Ontario Spills**

A search of the SPL database, dated 1988-Mar 2020; Jul 2020 - Aug 2020 has found that there are 9 SPL site(s) within approximately 0.25 kilometers of the project property.

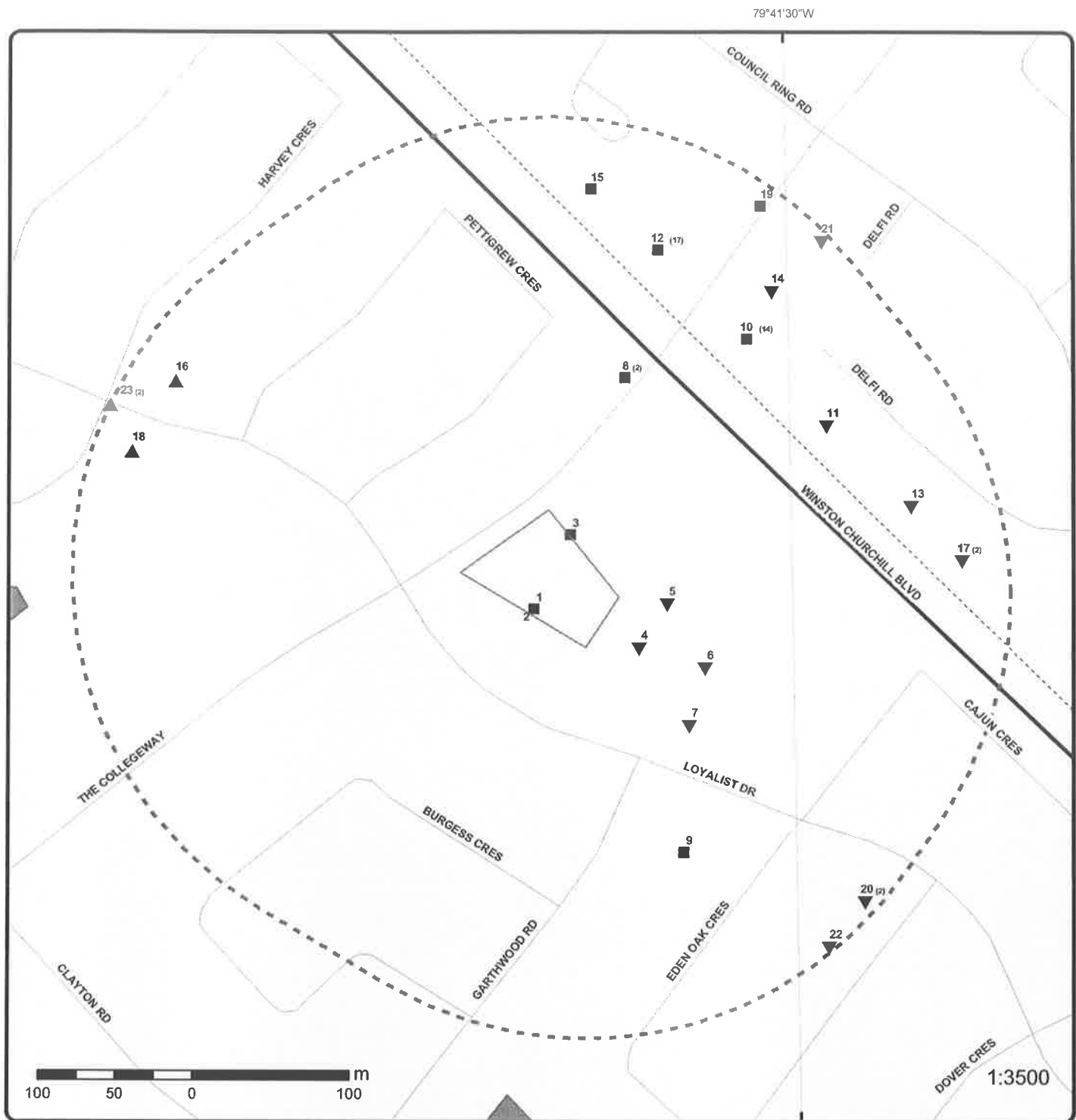
<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
Emterra Environmental	3010 The Collegeway Mississauga ON	0.0	<u>1</u>
	behind 3395 Loyalist Drive, Mississauga Mississauga ON L5L 4Y1	83.5	<u>7</u>
The Corporation of the City of Mississauga	3372 Delfi Rd Mississauga ON L5L 1W5	171.3	<u>11</u>
SUNOCO	3425 WINSTON CHURCHILL BLVD. SERVICE STATION MISSISSAUGA CITY ON L5L 3R5	179.4	<u>12</u>
SUNOCO	3425 WINSTON CHURCHILL DRIVE. SERVICE STATION MISSISSAUGA CITY ON L5L 3R5	179.4	<u>12</u>
Enbridge Gas Distribution Inc.	3341 Winstonchurchill Blvd Mississauga ON	220.3	<u>17</u>
The Regional Municipality of Peel	Intersection of Council Ring Rd and The Collegeway Mississauga ON	235.8	<u>19</u>
Enbridge Gas Distribution Inc.	3055 Eden Oak Cres, Miss. Mississauga ON	242.3	<u>20</u>

<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
Enbridge Gas Distribution Inc.	South-west corner of Loyalist Dr. and Irwin Court Mississauga ON	249.7	<u>23</u>

### **WWIS - Water Well Information System**

A search of the WWIS database, dated Apr 30, 2020 has found that there are 6 WWIS site(s) within approximately 0.25 kilometers of the project property.

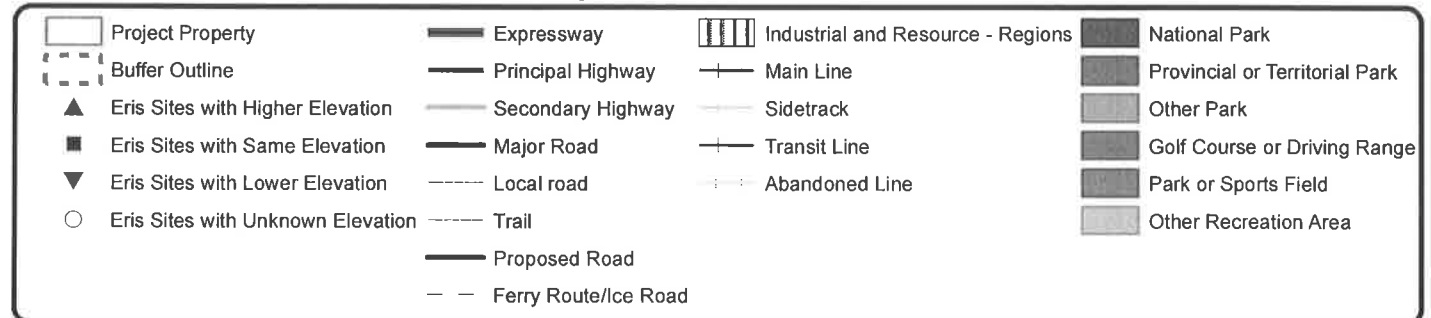
<u>Site</u>	<u>Address</u>	<u>Distance (m)</u>	<u>Map Key</u>
	ON <i>Well ID: 7225159</i>	0.5	<u>3</u>
	3234 WINSTON CHURCHILL BLVD. Mississauga ON <i>Well ID: 7136494</i>	29.2	<u>4</u>
	ON <i>Well ID: 7278341</i>	31.3	<u>5</u>
	ON <i>Well ID: 7286585</i>	71.4	<u>6</u>
	THE COLLEGEWAY & WINSTON CHURCHILL BLVD. NW CORNER Mississauga ON <i>Well ID: 7287391</i>	96.9	<u>8</u>
	THE COLLEGEWAY MISSISSAUGA ON <i>Well ID: 7312086</i>	96.9	<u>8</u>



## Map : 0.25 Kilometer Radius

Order Number: 21020300040

Address: The Collegeway & Loyalist Dr, Mississauga, ON



79°42'W

43°31'30"N

43°31'30"N



**Aerial** Year: 2015

**Address: The Collegeway & Loyalist Dr, Mississauga, ON**

Source: ESRI World Imagery

Order Number: 21020300040



© ERIS Information Limited Partnership

79°42'W

79°40'30"W

43°33'N

43°33'N

43°31'30"N

43°31'30"N



## Topographic Map

Address: The Collegeway & Loyalist Dr, ON

Source: ESRI World Topographic Map

Order Number: 21020300040



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## Detail Report

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>1</u>	1 of 1	SW/0.0	169.8 / 0.00	<b>Emterra Environmental 3010 The Collegeway Mississauga ON</b>	<b>SPL</b>
<div> <div> <b>Ref No:</b> 6122-A4TK39  <b>Site No:</b> NA  <b>Incident Dt:</b> 12/2/2015  <b>Year:</b>  <b>Incident Cause:</b>  <b>Incident Event:</b>  <b>Contaminant Code:</b> 15  <b>Contaminant Name:</b> HYDRAULIC OIL  <b>Contaminant Limit 1:</b>  <b>Contam Limit Freq 1:</b>  <b>Contaminant UN No 1:</b>  <b>Environment Impact:</b>  <b>Nature of Impact:</b>  <b>Receiving Medium:</b>  <b>Receiving Env:</b>  <b>MOE Response:</b> No  <b>Dt MOE Arvl on Scn:</b>  <b>MOE Reported Dt:</b> 12/2/2015  <b>Dt Document Closed:</b> 1/27/2016  <b>Incident Reason:</b> Equipment Failure  <b>Site Name:</b> Erin Mills United Church&lt;UNOFFICIAL&gt;  <b>Site County/District:</b>  <b>Site Geo Ref Meth:</b>  <b>Incident Summary:</b> Erin Mills United Church / Emterra: hyd fluid to pvmt, ctnd 50 L  <b>Contaminant Qty:</b> 50 L </div> <div> <b>Discharger Report:</b>  <b>Material Group:</b>  <b>Health/Env Conseq:</b>  <b>Client Type:</b>  <b>Sector Type:</b> Miscellaneous Industrial  <b>Agency Involved:</b>  <b>Nearest Watercourse:</b>  <b>Site Address:</b> 3010 The Collegeway  <b>Site District Office:</b>  <b>Site Postal Code:</b>  <b>Site Region:</b>    <b>Site Municipality:</b> Mississauga  <b>Site Lot:</b>  <b>Site Conc:</b>  <b>Northing:</b> 4820538  <b>Easting:</b> 605632  <b>Site Geo Ref Accu:</b>  <b>Site Map Datum:</b>  <b>SAC Action Class:</b> Land Spills  <b>Source Type:</b> </div> </div>					
<u>2</u>	1 of 1	SW/0.0	169.8 / 0.00	<b>3010 The Collegeway Mississauga ON</b>	<b>EHS</b>
<div> <div> <b>Order No:</b> 20130925030  <b>Status:</b> C  <b>Report Type:</b> Custom Report  <b>Report Date:</b> 04-OCT-13  <b>Date Received:</b> 25-SEP-13  <b>Previous Site Name:</b>  <b>Lot/Building Size:</b>  <b>Additional Info Ordered:</b> Fire Insur. Maps and/or Site Plans </div> <div> <b>Nearest Intersection:</b>  <b>Municipality:</b> 3010 The Collegeway, Mississauga, ON  <b>Client Prov/State:</b> ON  <b>Search Radius (km):</b> .25  <b>X:</b> -79.693756  <b>Y:</b> 43.529414 </div> </div>					
<u>3</u>	1 of 1	NE/0.5	169.8 / 0.00	<b>ON</b>	<b>WWIS</b>
<div> <div> <b>Well ID:</b> 7225159  <b>Construction Date:</b>  <b>Primary Water Use:</b>  <b>Sec. Water Use:</b>  <b>Final Well Status:</b>  <b>Water Type:</b> </div> <div> <b>Data Entry Status:</b> Yes  <b>Data Src:</b>  <b>Date Received:</b> 8/6/2014  <b>Selected Flag:</b> Yes  <b>Abandonment Rec:</b>  <b>Contractor:</b> 7464 </div> </div>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
<b>Casing Material:</b>				<b>Form Version:</b>	8
<b>Audit No:</b>	C23326			<b>Owner:</b>	
<b>Tag:</b>	A154567			<b>Street Name:</b>	
<b>Construction Method:</b>				<b>County:</b>	PEEL
<b>Elevation (m):</b>				<b>Municipality:</b>	MISSISSAUGA CITY (TRAFALGAR)
<b>Elevation Reliability:</b>				<b>Site Info:</b>	
<b>Depth to Bedrock:</b>				<b>Lot:</b>	
<b>Well Depth:</b>				<b>Concession:</b>	
<b>Overburden/Bedrock:</b>				<b>Concession Name:</b>	
<b>Pump Rate:</b>				<b>Easting NAD83:</b>	
<b>Static Water Level:</b>				<b>Northing NAD83:</b>	
<b>Flowing (Y/N):</b>				<b>Zone:</b>	
<b>Flow Rate:</b>				<b>UTM Reliability:</b>	
<b>Clear/Cloudy:</b>					
<b>PDF URL (Map):</b>					

#### Bore Hole Information

<b>Bore Hole ID:</b>	1005027414	<b>Elevation:</b>	170.149948
<b>DP2BR:</b>		<b>Elevrc:</b>	
<b>Spatial Status:</b>		<b>Zone:</b>	17
<b>Code OB:</b>		<b>East83:</b>	605575
<b>Code OB Desc:</b>		<b>North83:</b>	4820484
<b>Open Hole:</b>		<b>Org CS:</b>	UTM83
<b>Cluster Kind:</b>		<b>UTMRC:</b>	4
<b>Date Completed:</b>	10/25/2013	<b>UTMRC Desc:</b>	margin of error : 30 m - 100 m
<b>Remarks:</b>		<b>Location Method:</b>	wwr
<b>Elevrc Desc:</b>			
<b>Location Source Date:</b>			
<b>Improvement Location Source:</b>			
<b>Improvement Location Method:</b>			
<b>Source Revision Comment:</b>			
<b>Supplier Comment:</b>			

<b>4</b>	<b>1 of 1</b>	<b>ESE/29.2</b>	<b>168.8 / -1.03</b>	<b>3234 WINSTON CHURCHILL BLVD. Mississauga ON</b>	<b>WWIS</b>
<hr/>					
<b>Well ID:</b>	7136494	<b>Data Entry Status:</b>			
<b>Construction Date:</b>		<b>Data Src:</b>			
<b>Primary Water Use:</b>	Test Hole	<b>Date Received:</b>	12/21/2009		
<b>Sec. Water Use:</b>		<b>Selected Flag:</b>	Yes		
<b>Final Well Status:</b>	Test Hole	<b>Abandonment Rec:</b>			
<b>Water Type:</b>		<b>Contractor:</b>	6988		
<b>Casing Material:</b>		<b>Form Version:</b>	5		
<b>Audit No:</b>	M04129	<b>Owner:</b>			
<b>Tag:</b>	A087089	<b>Street Name:</b>	3234 WINSTON CHURCHILL BLVD.		
<b>Construction Method:</b>		<b>County:</b>	PEEL		
<b>Elevation (m):</b>		<b>Municipality:</b>	MISSISSAUGA CITY		
<b>Elevation Reliability:</b>		<b>Site Info:</b>			
<b>Depth to Bedrock:</b>		<b>Lot:</b>			
<b>Well Depth:</b>		<b>Concession:</b>			
<b>Overburden/Bedrock:</b>		<b>Concession Name:</b>			
<b>Pump Rate:</b>		<b>Easting NAD83:</b>			
<b>Static Water Level:</b>		<b>Northing NAD83:</b>			
<b>Flowing (Y/N):</b>		<b>Zone:</b>			
<b>Flow Rate:</b>		<b>UTM Reliability:</b>			
<b>Clear/Cloudy:</b>					

**PDF URL (Map):** [https://d2khazk8e83rdv.cloudfront.net/moe\\_mapping/downloads/2Water/Wells\\_pdfs/713\7136494.pdf](https://d2khazk8e83rdv.cloudfront.net/moe_mapping/downloads/2Water/Wells_pdfs/713\7136494.pdf)

#### Bore Hole Information

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
Bore Hole ID:	1003234588			Elevation:	165.677062
DP2BR:				Elevrc:	
Spatial Status:				Zone:	17
Code OB:				East83:	605696
Code OB Desc:				North83:	4820378
Open Hole:				Org CS:	UTM83
Cluster Kind:	This is a record from cluster log sheet			UTMRC:	3
Date Completed:	11/27/2009			UTMRC Desc:	margin of error : 10 - 30 m
Remarks:				Location Method:	wwr
Elevrc Desc:					
Location Source Date:					
Improvement Location Source:					
Improvement Location Method:					
Source Revision Comment:					
Supplier Comment:					
 <u>Annular Space/Abandonment</u>					
<u>Sealing Record</u>					
Plug ID:	1003234592				
Layer:					
Plug From:					
Plug To:					
Plug Depth UOM:					
 <u>Method of Construction &amp; Well</u>					
<u>Use</u>					
Method Construction ID:	1003234591				
Method Construction Code:					
Method Construction:					
Other Method Construction:	BORING				
 <u>Pipe Information</u>					
Pipe ID:	1003234593				
Casing No:	0				
Comment:					
Alt Name:					
 <u>Construction Record - Casing</u>					
Casing ID:	1003234595				
Layer:					
Material:	5				
Open Hole or Material:	PLASTIC				
Depth From:					
Depth To:	4.3				
Casing Diameter:					
Casing Diameter UOM:					
Casing Depth UOM:	m				
 <u>Construction Record - Screen</u>					
Screen ID:	1003234594				
Layer:					
Slot:					
Screen Top Depth:	4.3				
Screen End Depth:	5.9				
Screen Material:					
Screen Depth UOM:	m				
Screen Diameter UOM:					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
Screen Diameter:					
<u>Results of Well Yield Testing</u>					
Pump Test ID:	1003234596				
Pump Set At:					
Static Level:					
Final Level After Pumping:					
Recommended Pump Depth:					
Pumping Rate:					
Flowing Rate:					
Recommended Pump Rate:					
Levels UOM:					
Rate UOM:					
Water State After Test Code:					
Water State After Test:					
Pumping Test Method:					
Pumping Duration HR:					
Pumping Duration MIN:					
Flowing:					
<u>Hole Diameter</u>					
Hole ID:	1003234590				
Diameter:	10				
Depth From:					
Depth To:	5.9				
Hole Depth UOM:	m				
Hole Diameter UOM:	cm				
<u>Bore Hole Information</u>					
Bore Hole ID:	1003234597			Elevation:	165.534286
DP2BR:				Elevrc:	
Spatial Status:				Zone:	17
Code OB:				East83:	605619
Code OB Desc:				North83:	4820411
Open Hole:				Org CS:	UTM83
Cluster Kind:	This is a record from cluster log sheet			UTMRC:	3
Date Completed:	11/27/2009			UTMRC Desc:	margin of error : 10 - 30 m
Remarks:				Location Method:	wwr
Elevrc Desc:					
Location Source Date:					
Improvement Location Source:					
Improvement Location Method:					
Source Revision Comment:					
Supplier Comment:					
<u>Annular Space/Abandonment</u>					
<u>Sealing Record</u>					
Plug ID:	1003234601				
Layer:					
Plug From:					
Plug To:					
Plug Depth UOM:					
<u>Method of Construction &amp; Well</u>					
<u>Use</u>					
Method Construction ID:	1003234600				
Method Construction Code:					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Method Construction:</b>					
<b>Other Method Construction:</b>		BORING			
<b><u>Pipe Information</u></b>					
<b>Pipe ID:</b>		1003234602			
<b>Casing No:</b>		0			
<b>Comment:</b>					
<b>Alt Name:</b>					
<b><u>Construction Record - Casing</u></b>					
<b>Casing ID:</b>		1003234604			
<b>Layer:</b>					
<b>Material:</b>		5			
<b>Open Hole or Material:</b>		PLASTIC			
<b>Depth From:</b>					
<b>Depth To:</b>		4			
<b>Casing Diameter:</b>					
<b>Casing Diameter UOM:</b>					
<b>Casing Depth UOM:</b>		m			
<b><u>Construction Record - Screen</u></b>					
<b>Screen ID:</b>		1003234603			
<b>Layer:</b>					
<b>Slot:</b>					
<b>Screen Top Depth:</b>		4			
<b>Screen End Depth:</b>		5.5			
<b>Screen Material:</b>					
<b>Screen Depth UOM:</b>		m			
<b>Screen Diameter UOM:</b>					
<b>Screen Diameter:</b>					
<b><u>Results of Well Yield Testing</u></b>					
<b>Pump Test ID:</b>		1003234605			
<b>Pump Set At:</b>					
<b>Static Level:</b>					
<b>Final Level After Pumping:</b>					
<b>Recommended Pump Depth:</b>					
<b>Pumping Rate:</b>					
<b>Flowing Rate:</b>					
<b>Recommended Pump Rate:</b>					
<b>Levels UOM:</b>					
<b>Rate UOM:</b>					
<b>Water State After Test Code:</b>					
<b>Water State After Test:</b>					
<b>Pumping Test Method:</b>					
<b>Pumping Duration HR:</b>					
<b>Pumping Duration MIN:</b>					
<b>Flowing:</b>					
<b><u>Hole Diameter</u></b>					
<b>Hole ID:</b>		1003234599			
<b>Diameter:</b>		10			
<b>Depth From:</b>					
<b>Depth To:</b>		5.5			
<b>Hole Depth UOM:</b>		m			
<b>Hole Diameter UOM:</b>		cm			

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b><u>Bore Hole Information</u></b>					
Bore Hole ID:	1002901185			Elevation:	163.969558
DP2BR:				Elevrc:	
Spatial Status:				Zone:	17
Code OB:				East83:	605687
Code OB Desc:				North83:	4820470
Open Hole:	No			Org CS:	UTM83
Cluster Kind:				UTMRC:	4
Date Completed:	11/26/2009			UTMRC Desc:	margin of error : 30 m - 100 m
Remarks:				Location Method:	wwr
Elevrc Desc:					
Location Source Date:					
Improvement Location Source:					
Improvement Location Method:					
Source Revision Comment:					
Supplier Comment:					
<b><u>Overburden and Bedrock</u></b>					
<b><u>Materials Interval</u></b>					
Formation ID:	1003234607				
Layer:	1				
Color:	6				
General Color:	BROWN				
Mat1:	28				
Most Common Material:	SAND				
Mat2:	06				
Mat2 Desc:	SILT				
Mat3:					
Mat3 Desc:					
Formation Top Depth:	0				
Formation End Depth:	6.1				
Formation End Depth UOM:	m				
<b><u>Annular Space/Abandonment</u></b>					
<b><u>Sealing Record</u></b>					
Plug ID:	1003234609				
Layer:	1				
Plug From:	0				
Plug To:	3.9				
Plug Depth UOM:	m				
<b><u>Method of Construction &amp; Well</u></b>					
<b><u>Use</u></b>					
Method Construction ID:	1003234613				
Method Construction Code:	6				
Method Construction:	Boring				
Other Method Construction:					
<b><u>Pipe Information</u></b>					
Pipe ID:	1003234606				
Casing No:	0				
Comment:					
Alt Name:					
<b><u>Construction Record - Casing</u></b>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
<b>Casing ID:</b>		1003234610			
<b>Layer:</b>		1			
<b>Material:</b>		5			
<b>Open Hole or Material:</b>		PLASTIC			
<b>Depth From:</b>		0			
<b>Depth To:</b>		4.6			
<b>Casing Diameter:</b>		5.1			
<b>Casing Diameter UOM:</b>		cm			
<b>Casing Depth UOM:</b>		m			
 <b><u>Construction Record - Screen</u></b>					
<b>Screen ID:</b>		1003234611			
<b>Layer:</b>		1			
<b>Slot:</b>		10			
<b>Screen Top Depth:</b>		4.6			
<b>Screen End Depth:</b>		6.1			
<b>Screen Material:</b>		5			
<b>Screen Depth UOM:</b>		m			
<b>Screen Diameter UOM:</b>		cm			
<b>Screen Diameter:</b>		6			
 <b><u>Hole Diameter</u></b>					
<b>Hole ID:</b>		1003234608			
<b>Diameter:</b>		10			
<b>Depth From:</b>		0			
<b>Depth To:</b>		6.1			
<b>Hole Depth UOM:</b>		m			
<b>Hole Diameter UOM:</b>		cm			
 <b><u>Bore Hole Information</u></b>					
<b>Bore Hole ID:</b>	1003234579			<b>Elevation:</b>	163.969558
<b>DP2BR:</b>				<b>Elevrc:</b>	
<b>Spatial Status:</b>				<b>Zone:</b>	17
<b>Code OB:</b>				<b>East83:</b>	605687
<b>Code OB Desc:</b>				<b>North83:</b>	4820470
<b>Open Hole:</b>				<b>Org CS:</b>	UTM83
<b>Cluster Kind:</b>	This is a record from cluster log sheet			<b>UTMRC:</b>	3
<b>Date Completed:</b>	11/26/2009			<b>UTMRC Desc:</b>	margin of error : 10 - 30 m
<b>Remarks:</b>				<b>Location Method:</b>	wwr
<b>Elevrc Desc:</b>					
<b>Location Source Date:</b>					
<b>Improvement Location Source:</b>					
<b>Improvement Location Method:</b>					
<b>Source Revision Comment:</b>					
<b>Supplier Comment:</b>					
 <b><u>Annular Space/Abandonment</u></b>					
<b><u>Sealing Record</u></b>					
<b>Plug ID:</b>		1003234583			
<b>Layer:</b>					
<b>Plug From:</b>					
<b>Plug To:</b>					
<b>Plug Depth UOM:</b>					
 <b><u>Method of Construction &amp; Well</u></b>					
<b><u>Use</u></b>					
<b>Method Construction ID:</b>		1003234582			

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Method Construction Code:</b>					
<b>Method Construction:</b>					
<b>Other Method Construction:</b>		BORING			
<b><u>Pipe Information</u></b>					
<b>Pipe ID:</b>		1003234584			
<b>Casing No:</b>		0			
<b>Comment:</b>					
<b>Alt Name:</b>					
<b><u>Construction Record - Casing</u></b>					
<b>Casing ID:</b>		1003234586			
<b>Layer:</b>					
<b>Material:</b>		5			
<b>Open Hole or Material:</b>		PLASTIC			
<b>Depth From:</b>					
<b>Depth To:</b>		4.6			
<b>Casing Diameter:</b>					
<b>Casing Diameter UOM:</b>					
<b>Casing Depth UOM:</b>		m			
<b><u>Construction Record - Screen</u></b>					
<b>Screen ID:</b>		1003234585			
<b>Layer:</b>					
<b>Slot:</b>					
<b>Screen Top Depth:</b>		4.6			
<b>Screen End Depth:</b>		6.1			
<b>Screen Material:</b>					
<b>Screen Depth UOM:</b>		m			
<b>Screen Diameter UOM:</b>					
<b>Screen Diameter:</b>					
<b><u>Results of Well Yield Testing</u></b>					
<b>Pump Test ID:</b>		1003234587			
<b>Pump Set At:</b>					
<b>Static Level:</b>					
<b>Final Level After Pumping:</b>					
<b>Recommended Pump Depth:</b>					
<b>Pumping Rate:</b>					
<b>Flowing Rate:</b>					
<b>Recommended Pump Rate:</b>					
<b>Levels UOM:</b>					
<b>Rate UOM:</b>					
<b>Water State After Test Code:</b>					
<b>Water State After Test:</b>					
<b>Pumping Test Method:</b>					
<b>Pumping Duration HR:</b>					
<b>Pumping Duration MIN:</b>					
<b>Flowing:</b>					
<b><u>Hole Diameter</u></b>					
<b>Hole ID:</b>		1003234581			
<b>Diameter:</b>		10			
<b>Depth From:</b>					
<b>Depth To:</b>		6.1			
<b>Hole Depth UOM:</b>		m			
<b>Hole Diameter UOM:</b>		cm			



Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>5</u>	1 of 1	E/31.3	168.9 / -0.97	ON	WWIS
<div> <div> Well ID: 7278341  Construction Date:  Primary Water Use:  Sec. Water Use:  Final Well Status:  Water Type:  Casing Material:  Audit No: C35866  Tag: A201273  Construction Method:  Elevation (m):  Elevation Reliability:  Depth to Bedrock:  Well Depth:  Overburden/Bedrock:  Pump Rate:  Static Water Level:  Flowing (Y/N):  Flow Rate:  Clear/Cloudy:   PDF URL (Map): </div> <div> Data Entry Status: Yes  Data Src:  Date Received: 12/29/2016  Selected Flag: Yes  Abandonment Rec:  Contractor: 6926  Form Version: 8  Owner:  Street Name:  County: PEEL  Municipality: MISSISSAUGA CITY (TRAFALGAR)  Site Info:  Lot:  Concession:  Concession Name:  Easting NAD83:  Northing NAD83:  Zone:  UTM Reliability: </div> </div>					
<u>Bore Hole Information</u>					
<div> <div> Bore Hole ID: 1006325362  DP2BR:  Spatial Status:  Code OB:  Code OB Desc:  Open Hole:  Cluster Kind:  Date Completed: 9/15/2016  Remarks:  Elevrc Desc:  Location Source Date:  Improvement Location Source:  Improvement Location Method:  Source Revision Comment:  Supplier Comment: </div> <div> Elevation: 164.903259  Elevrc:  Zone: 17  East83: 605637  North83: 4820439  Org CS: UTM83  UTMRC: 4  UTMRC Desc: margin of error : 30 m - 100 m  Location Method: wwr </div> </div>					
<u>6</u>	1 of 1	ESE/71.4	168.8 / -1.10	ON	WWIS
<div> <div> Well ID: 7286585  Construction Date:  Primary Water Use:  Sec. Water Use:  Final Well Status:  Water Type:  Casing Material:  Audit No: C37034  Tag: A201273  Construction Method:  Elevation (m):  Elevation Reliability:  Depth to Bedrock:  Well Depth:  Overburden/Bedrock: </div> <div> Data Entry Status: Yes  Data Src:  Date Received: 5/15/2017  Selected Flag: Yes  Abandonment Rec:  Contractor: 6926  Form Version: 8  Owner:  Street Name:  County: PEEL  Municipality: MISSISSAUGA CITY (TRAFALGAR)  Site Info:  Lot:  Concession:  Concession Name: </div> </div>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Pump Rate:</b> <b>Static Water Level:</b> <b>Flowing (Y/N):</b> <b>Flow Rate:</b> <b>Clear/Cloudy:</b>  <b>PDF URL (Map):</b>					
<b>Easting NAD83:</b> <b>Northing NAD83:</b> <b>Zone:</b> <b>UTM Reliability:</b>					
<b>Bore Hole Information</b>					
<b>Bore Hole ID:</b> 1006444859 <b>DP2BR:</b> <b>Spatial Status:</b> <b>Code OB:</b> <b>Code OB Desc:</b> <b>Open Hole:</b> <b>Cluster Kind:</b> <b>Date Completed:</b> 3/4/2017 <b>Remarks:</b> <b>Elevrc Desc:</b> <b>Location Source Date:</b> <b>Improvement Location Source:</b> <b>Improvement Location Method:</b> <b>Source Revision Comment:</b> <b>Supplier Comment:</b>					
<b>Elevation:</b> 164.185287 <b>Elevrc:</b> <b>Zone:</b> 17 <b>East83:</b> 605661 <b>North83:</b> 4820398 <b>Org CS:</b> UTM83 <b>UTMRC:</b> 4 <b>UTMRC Desc:</b> margin of error : 30 m - 100 m <b>Location Method:</b> wwr					
<u>7</u>	1 of 1	SE/83.5	169.1 / -0.71	behind 3395 Loyalist Drive, Mississauga Mississauga ON L5L 4Y1	SPL
<b>Ref No:</b> 4213-8SZRGJ <b>Site No:</b> <b>Incident Dt:</b> 27-MAR-12 <b>Year:</b> <b>Incident Cause:</b> <b>Incident Event:</b> <b>Contaminant Code:</b> <b>Contaminant Name:</b> <b>Contaminant Limit 1:</b> <b>Contam Limit Freq 1:</b> <b>Contaminant UN No 1:</b> <b>Environment Impact:</b> <b>Nature of Impact:</b> <b>Receiving Medium:</b> Sewage - Municipal/Private and Commercial <b>Receiving Env:</b> <b>MOE Response:</b> <b>Dt MOE Arvl on Scn:</b> <b>MOE Reported Dt:</b> 03-APR-12 <b>Dt Document Closed:</b> <b>Incident Reason:</b> <b>Site Name:</b> Loyalist Creek<UNOFFICIAL> <b>Site County/District:</b> <b>Site Geo Ref Meth:</b> <b>Incident Summary:</b> 25 L oil to Loyalist Creek, cleaning <b>Contaminant Qty:</b>					
<b>Discharger Report:</b> <b>Material Group:</b> <b>Health/Env Conseq:</b> <b>Client Type:</b> <b>Sector Type:</b> <b>Agency Involved:</b> <b>Nearest Watercourse:</b> <b>Site Address:</b> behind 3395 Loyalist Drive, Mississauga <b>Site District Office:</b> <b>Site Postal Code:</b> <b>Site Region:</b> <b>Site Municipality:</b> Mississauga <b>Site Lot:</b> <b>Site Conc:</b> <b>Northing:</b> <b>Easting:</b> <b>Site Geo Ref Accu:</b> <b>Site Map Datum:</b> <b>SAC Action Class:</b> Watercourse Spills <b>Source Type:</b>					
<u>8</u>	1 of 2	NNE/96.9	169.8 / 0.00	THE COLLEGEWAY & WINSTON CHURCHILL BLVD. NW CORNER Mississauga ON	WWIS
<b>Well ID:</b> 7287391 <b>Construction Date:</b> <b>Primary Water Use:</b> Monitoring  <b>Data Entry Status:</b> <b>Data Src:</b> <b>Date Received:</b> 5/29/2017					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Sec. Water Use:</b>				<b>Selected Flag:</b>	Yes
<b>Final Well Status:</b>	Observation Wells			<b>Abandonment Rec:</b>	
<b>Water Type:</b>				<b>Contractor:</b>	7472
<b>Casing Material:</b>				<b>Form Version:</b>	7
<b>Audit No:</b>	Z259497			<b>Owner:</b>	
<b>Tag:</b>	A222943			<b>Street Name:</b>	THE COLLEGEWAY & WINSTON CHURCHILL BLVD. NW CORNER PEEL
<b>Construction Method:</b>				<b>County:</b>	MISSISSAUGA CITY (TRAFALGAR)
<b>Elevation (m):</b>				<b>Municipality:</b>	
<b>Elevation Reliability:</b>				<b>Site Info:</b>	
<b>Depth to Bedrock:</b>				<b>Lot:</b>	
<b>Well Depth:</b>				<b>Concession:</b>	
<b>Overburden/Bedrock:</b>				<b>Concession Name:</b>	
<b>Pump Rate:</b>				<b>Easting NAD83:</b>	
<b>Static Water Level:</b>				<b>Northing NAD83:</b>	
<b>Flowing (Y/N):</b>				<b>Zone:</b>	
<b>Flow Rate:</b>				<b>UTM Reliability:</b>	
<b>Clear/Cloudy:</b>					
<b>PDF URL (Map):</b>					

#### Bore Hole Information

<b>Bore Hole ID:</b>	1006491888	<b>Elevation:</b>	170.608596
<b>DP2BR:</b>		<b>Elevrc:</b>	
<b>Spatial Status:</b>		<b>Zone:</b>	17
<b>Code OB:</b>		<b>East83:</b>	605610
<b>Code OB Desc:</b>		<b>North83:</b>	4820584
<b>Open Hole:</b>		<b>Org CS:</b>	UTM83
<b>Cluster Kind:</b>		<b>UTMRC:</b>	4
<b>Date Completed:</b>	4/5/2017	<b>UTMRC Desc:</b>	margin of error : 30 m - 100 m
<b>Remarks:</b>		<b>Location Method:</b>	wwr
<b>Elevrc Desc:</b>			
<b>Location Source Date:</b>			
<b>Improvement Location Source:</b>			
<b>Improvement Location Method:</b>			
<b>Source Revision Comment:</b>			
<b>Supplier Comment:</b>			

#### Overburden and Bedrock

##### Materials Interval

<b>Formation ID:</b>	1006769308
<b>Layer:</b>	2
<b>Color:</b>	6
<b>General Color:</b>	BROWN
<b>Mat1:</b>	12
<b>Most Common Material:</b>	STONES
<b>Mat2:</b>	28
<b>Mat2 Desc:</b>	SAND
<b>Mat3:</b>	73
<b>Mat3 Desc:</b>	HARD
<b>Formation Top Depth:</b>	1
<b>Formation End Depth:</b>	6
<b>Formation End Depth UOM:</b>	ft

#### Overburden and Bedrock

##### Materials Interval

<b>Formation ID:</b>	1006769309
<b>Layer:</b>	3
<b>Color:</b>	2
<b>General Color:</b>	GREY

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
Mat1:		17			
Most Common Material:		SHALE			
Mat2:		05			
Mat2 Desc:		CLAY			
Mat3:		73			
Mat3 Desc:		HARD			
Formation Top Depth:		6			
Formation End Depth:		20			
Formation End Depth UOM:		ft			
<u>Overburden and Bedrock Materials Interval</u>					
Formation ID:		1006769307			
Layer:		1			
Color:		8			
General Color:		BLACK			
Mat1:		12			
Most Common Material:		STONES			
Mat2:					
Mat2 Desc:					
Mat3:		73			
Mat3 Desc:		HARD			
Formation Top Depth:		0			
Formation End Depth:		1			
Formation End Depth UOM:		ft			
<u>Annular Space/Abandonment Sealing Record</u>					
Plug ID:		1006769317			
Layer:		2			
Plug From:		9			
Plug To:		20			
Plug Depth UOM:		ft			
<u>Annular Space/Abandonment Sealing Record</u>					
Plug ID:		1006769316			
Layer:		1			
Plug From:		0			
Plug To:		9			
Plug Depth UOM:		ft			
<u>Method of Construction &amp; Well Use</u>					
Method Construction ID:		1006769315			
Method Construction Code:		6			
Method Construction:		Boring			
Other Method Construction:					
<u>Pipe Information</u>					
Pipe ID:		1006769306			
Casing No:		0			
Comment:					
Alt Name:					
<u>Construction Record - Casing</u>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
Casing ID:		1006769312			
Layer:		1			
Material:		5			
Open Hole or Material:		PLASTIC			
Depth From:		0			
Depth To:		10			
Casing Diameter:		2			
Casing Diameter UOM:		inch			
Casing Depth UOM:		ft			
 <u>Construction Record - Screen</u>					
Screen ID:		1006769313			
Layer:		1			
Slot:		10			
Screen Top Depth:		10			
Screen End Depth:		20			
Screen Material:		5			
Screen Depth UOM:		ft			
Screen Diameter UOM:		inch			
Screen Diameter:		2.5			
 <u>Water Details</u>					
Water ID:		1006769311			
Layer:					
Kind Code:					
Kind:					
Water Found Depth:					
Water Found Depth UOM:		ft			
 <u>Hole Diameter</u>					
Hole ID:		1006769310			
Diameter:		6			
Depth From:		0			
Depth To:		20			
Hole Depth UOM:		ft			
Hole Diameter UOM:		inch			
<hr/>					
8	2 of 2	NNE/96.9	169.8 / 0.00	THE COLLEGEWAY MISSISSAUGA ON	WWIS
Well ID:	7312086			Data Entry Status:	
Construction Date:				Data Src:	
Primary Water Use:				Date Received:	6/7/2018
Sec. Water Use:				Selected Flag:	Yes
Final Well Status:	0			Abandonment Rec:	Yes
Water Type:				Contractor:	7472
Casing Material:				Form Version:	7
Audit No:	Z277243			Owner:	
Tag:				Street Name:	THE COLLEGEWAY
Construction Method:				County:	PEEL
Elevation (m):				Municipality:	MISSISSAUGA CITY (TRAFALGAR)
Elevation Reliability:				Site Info:	
Depth to Bedrock:				Lot:	
Well Depth:				Concession:	
Overburden/Bedrock:				Concession Name:	
Pump Rate:				Easting NAD83:	
Static Water Level:				Northing NAD83:	
Flowing (Y/N):				Zone:	

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
Flow Rate:					UTM Reliability:
Clear/Cloudy:					
PDF URL (Map):					
<u>Bore Hole Information</u>					
Bore Hole ID:	1007086019			Elevation:	
DP2BR:				Elevrc:	
Spatial Status:				Zone:	17
Code OB:				East83:	605610
Code OB Desc:				North83:	4820584
Open Hole:				Org CS:	UTM83
Cluster Kind:				UTMRC:	4
Date Completed:	2/20/2018			UTMRC Desc:	margin of error : 30 m - 100 m
Remarks:				Location Method:	wwr
Elevrc Desc:					
Location Source Date:					
Improvement Location Source:					
Improvement Location Method:					
Source Revision Comment:					
Supplier Comment:					
<u>Annular Space/Abandonment</u>					
<u>Sealing Record</u>					
Plug ID:	1007169779				
Layer:	1				
Plug From:					
Plug To:					
Plug Depth UOM:	ft				
<u>Method of Construction &amp; Well</u>					
<u>Use</u>					
Method Construction ID:	1007169778				
Method Construction Code:					
Method Construction:					
Other Method Construction:					
<u>Pipe Information</u>					
Pipe ID:	1007169771				
Casing No:	0				
Comment:					
Alt Name:					
<u>Construction Record - Casing</u>					
Casing ID:	1007169776				
Layer:					
Material:					
Open Hole or Material:					
Depth From:					
Depth To:					
Casing Diameter:					
Casing Diameter UOM:	inch				
Casing Depth UOM:	ft				
<u>Construction Record - Screen</u>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
Screen ID:		1007169777			
Layer:					
Slot:					
Screen Top Depth:					
Screen End Depth:					
Screen Material:					
Screen Depth UOM:		ft			
Screen Diameter UOM:		inch			
Screen Diameter:					
 <u>Water Details</u>					
Water ID:		1007169775			
Layer:					
Kind Code:					
Kind:					
Water Found Depth:					
Water Found Depth UOM:		ft			
 <u>Hole Diameter</u>					
Hole ID:		1007169774			
Diameter:		2.5			
Depth From:		4			
Depth To:		20			
Hole Depth UOM:		ft			
Hole Diameter UOM:		inch			
 <u>Hole Diameter</u>					
Hole ID:		1007169773			
Diameter:		6			
Depth From:		0			
Depth To:		4			
Hole Depth UOM:		ft			
Hole Diameter UOM:		inch			
<hr/>					
<u>9</u>	1 of 1	SSE/145.3	169.8 / 0.00	The Corporation of the City of Mississauga Part Blk 18 & 19, Plan 43R-m674 Mississauga ON L5B 2T4	ECA
Approval No:	2093-8EXP5F			MOE District:	Halton-Peel
Approval Date:	2011-06-21			City:	
Status:	Approved			Longitude:	-79.6926
Record Type:	ECA			Latitude:	43.528
Link Source:	IDS			Geometry X:	
SWP Area Name:	Credit Valley			Geometry Y:	
Approval Type:	ECA-MUNICIPAL AND PRIVATE SEWAGE WORKS				
Project Type:	MUNICIPAL AND PRIVATE SEWAGE WORKS				
Address:	Part Blk 18 & 19, Plan 43R-m674				
Full Address:					
Full PDF Link:	<a href="https://www.accessenvironment.ene.gov.on.ca/instruments/9748-8ALP3E-14.pdf">https://www.accessenvironment.ene.gov.on.ca/instruments/9748-8ALP3E-14.pdf</a>				
<hr/>					
<u>10</u>	1 of 14	NE/166.8	169.8 / 0.00	The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON	GEN
Generator No:	ON7523266			PO Box No:	
Status:				Country:	
Approval Years:	2013			Choice of Contact:	
Contam. Facility:				Co Admin:	

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
MHSW Facility: SIC Code: SIC Description:	621110	OFFICES OF PHYSICIANS		Phone No Admin:	
<u>Detail(s)</u>					
Waste Class: Waste Class Desc:	312	PATHOLOGICAL WASTES			
<hr/>					
<u>10</u>	2 of 14	NE/166.8	169.8 / 0.00	The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	GEN
Generator No: Status: Approval Years: Contam. Facility: MHSW Facility: SIC Code: SIC Description:	ON7523266  2016 No No 621110	OFFICES OF PHYSICIANS		PO Box No: Country: Choice of Contact: Co Admin: Phone No Admin:	Canada CO_OFFICIAL Elham Attia 905-607-4007 Ext.
<u>Detail(s)</u>					
Waste Class: Waste Class Desc:	312	PATHOLOGICAL WASTES			
<hr/>					
<u>10</u>	3 of 14	NE/166.8	169.8 / 0.00	Collegeway Urgent Care 2686 The Collegeway Mississauga ON L5L 2M9	GEN
Generator No: Status: Approval Years: Contam. Facility: MHSW Facility: SIC Code: SIC Description:	ON6549853  2016 No No 621110	OFFICES OF PHYSICIANS		PO Box No: Country: Choice of Contact: Co Admin: Phone No Admin:	Canada CO_OFFICIAL Reneen F Attisha 905-569-2000 Ext.
<u>Detail(s)</u>					
Waste Class: Waste Class Desc:	312	PATHOLOGICAL WASTES			
<hr/>					
<u>10</u>	4 of 14	NE/166.8	169.8 / 0.00	The Collegeway Dental Office 2686 The Collegeway Mississauga ON L5L2M9	GEN
Generator No: Status: Approval Years: Contam. Facility: MHSW Facility: SIC Code: SIC Description:	ON7783383  2016 No No 621210	OFFICES OF DENTISTS		PO Box No: Country: Choice of Contact: Co Admin: Phone No Admin:	Canada CO_OFFICIAL George Sam 905-6082000 Ext.
<u>Detail(s)</u>					
Waste Class: Waste Class Desc:	312	PATHOLOGICAL WASTES			



Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>10</u>	5 of 14	NE/166.8	169.8 / 0.00	<b>The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON L5L 2M9</b>	GEN
<b>Generator No:</b> ON7523266				<b>PO Box No:</b>	
<b>Status:</b>				<b>Country:</b> Canada	
<b>Approval Years:</b> 2015				<b>Choice of Contact:</b> CO_OFFICIAL	
<b>Contam. Facility:</b> No				<b>Co Admin:</b> Elham Attia	
<b>MHSW Facility:</b> No				<b>Phone No Admin:</b> 905-607-4007 Ext.	
<b>SIC Code:</b> 621110					
<b>SIC Description:</b> OFFICES OF PHYSICIANS					
<u>Detail(s)</u>					
<b>Waste Class:</b> 312					
<b>Waste Class Desc:</b> PATHOLOGICAL WASTES					
<u>10</u>	6 of 14	NE/166.8	169.8 / 0.00	<b>The Collegeway Dental Office 2686 The Collegeway Mississauga ON L5L2M9</b>	GEN
<b>Generator No:</b> ON7783383				<b>PO Box No:</b>	
<b>Status:</b>				<b>Country:</b> Canada	
<b>Approval Years:</b> 2015				<b>Choice of Contact:</b> CO_OFFICIAL	
<b>Contam. Facility:</b> No				<b>Co Admin:</b> George Sam	
<b>MHSW Facility:</b> No				<b>Phone No Admin:</b> 905-6082000 Ext.	
<b>SIC Code:</b> 621210					
<b>SIC Description:</b> OFFICES OF DENTISTS					
<u>Detail(s)</u>					
<b>Waste Class:</b> 312					
<b>Waste Class Desc:</b> PATHOLOGICAL WASTES					
<u>10</u>	7 of 14	NE/166.8	169.8 / 0.00	<b>Collegeway Urgent Care 2686 The Collegeway Mississauga ON L5L 2M9</b>	GEN
<b>Generator No:</b> ON6549853				<b>PO Box No:</b>	
<b>Status:</b>				<b>Country:</b> Canada	
<b>Approval Years:</b> 2015				<b>Choice of Contact:</b> CO_OFFICIAL	
<b>Contam. Facility:</b> No				<b>Co Admin:</b> Reneen F Attisha	
<b>MHSW Facility:</b> No				<b>Phone No Admin:</b> 905-569-2000 Ext.	
<b>SIC Code:</b> 621110					
<b>SIC Description:</b> OFFICES OF PHYSICIANS					
<u>Detail(s)</u>					
<b>Waste Class:</b> 312					
<b>Waste Class Desc:</b> PATHOLOGICAL WASTES					
<u>10</u>	8 of 14	NE/166.8	169.8 / 0.00	<b>The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON L5L 2M9</b>	GEN
<b>Generator No:</b> ON7523266				<b>PO Box No:</b>	
<b>Status:</b>				<b>Country:</b> Canada	
<b>Approval Years:</b> 2014				<b>Choice of Contact:</b> CO_OFFICIAL	
<b>Contam. Facility:</b> No				<b>Co Admin:</b> Elham Attia	
<b>MHSW Facility:</b> No				<b>Phone No Admin:</b> 905-607-4007 Ext.	

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
SIC Code:	621110				
SIC Description:		OFFICES OF PHYSICIANS			
<u>Detail(s)</u>					
Waste Class:	312				
Waste Class Desc:		PATHOLOGICAL WASTES			
<b>10</b>	<b>9 of 14</b>	<b>NE/166.8</b>	<b>169.8 / 0.00</b>	<b>The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON L5L 2M9</b>	<b>GEN</b>
Generator No:	ON7523266			PO Box No:	
Status:	Registered			Country:	Canada
Approval Years:	As of Dec 2018			Choice of Contact:	
Contam. Facility:				Co Admin:	
MHSW Facility:				Phone No Admin:	
SIC Code:					
SIC Description:					
<u>Detail(s)</u>					
Waste Class:	312 P				
Waste Class Desc:		Pathological wastes			
<b>10</b>	<b>10 of 14</b>	<b>NE/166.8</b>	<b>169.8 / 0.00</b>	<b>Collegeway Urgent Care 2686 The Collegeway Mississauga ON L5L 2M9</b>	<b>GEN</b>
Generator No:	ON6549853			PO Box No:	
Status:	Registered			Country:	Canada
Approval Years:	As of Dec 2018			Choice of Contact:	
Contam. Facility:				Co Admin:	
MHSW Facility:				Phone No Admin:	
SIC Code:					
SIC Description:					
<u>Detail(s)</u>					
Waste Class:	312 P				
Waste Class Desc:		Pathological wastes			
<b>10</b>	<b>11 of 14</b>	<b>NE/166.8</b>	<b>169.8 / 0.00</b>	<b>The Collegeway Dental Office 2686 The Collegeway Mississauga ON L5L2M9</b>	<b>GEN</b>
Generator No:	ON7783383			PO Box No:	
Status:	Registered			Country:	Canada
Approval Years:	As of Dec 2018			Choice of Contact:	
Contam. Facility:				Co Admin:	
MHSW Facility:				Phone No Admin:	
SIC Code:					
SIC Description:					
<u>Detail(s)</u>					
Waste Class:	312 P				
Waste Class Desc:		Pathological wastes			

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>10</u>	12 of 14	NE/166.8	169.8 / 0.00	The Collegeway Animal Hospital 2686 The Collegeway Unit 101 Mississauga ON L5L 2M9	GEN
Generator No: ON7523266 Status: Registered Approval Years: As of Jul 2020 Contam. Facility: MHSW Facility: SIC Code: SIC Description:		PO Box No: Country: Canada Choice of Contact: Co Admin: Phone No Admin:			
<u>Detail(s)</u>					
Waste Class:		312 P			
Waste Class Desc:		Pathological wastes			
<u>10</u>	13 of 14	NE/166.8	169.8 / 0.00	The Collegeway Dental Office 2686 The Collegeway Mississauga ON L5L2M9	GEN
Generator No: ON7783383 Status: Registered Approval Years: As of Jul 2020 Contam. Facility: MHSW Facility: SIC Code: SIC Description:		PO Box No: Country: Canada Choice of Contact: Co Admin: Phone No Admin:			
<u>Detail(s)</u>					
Waste Class:		312 P			
Waste Class Desc:		Pathological wastes			
<u>10</u>	14 of 14	NE/166.8	169.8 / 0.00	Collegeway Urgent Care 2686 The Collegeway, Unit 103 Mississauga ON L5L 2M9	GEN
Generator No: ON6549853 Status: Registered Approval Years: As of Jul 2020 Contam. Facility: MHSW Facility: SIC Code: SIC Description:		PO Box No: Country: Canada Choice of Contact: Co Admin: Phone No Admin:			
<u>Detail(s)</u>					
Waste Class:		312 P			
Waste Class Desc:		Pathological wastes			
<u>11</u>	1 of 1	ENE/171.3	168.8 / -1.03	The Corporation of the City of Mississauga 3372 Delfi Rd Mississauga ON L5L 1W5	SPL
Ref No: 8775-B62Q6G Site No: 0129-B64FSN Incident Dt: 2018/10/30 Year: Incident Cause: Incident Event: Overflow/Surcharge		Discharger Report: Material Group: Health/Env Conseq: 2 - Minor Environment Client Type: Municipal Government Sector Type: Miscellaneous Communal Agency Involved:			

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	
<b>Contaminant Code:</b>	43			<b>Nearest Watercourse:</b>	
<b>Contaminant Name:</b>	SEDIMENT(SUSPENDED SOLIDS/ SAND/ SILT)			<b>Site Address:</b>	3372 Delfi Rd
<b>Contaminant Limit 1:</b>				<b>Site District Office:</b>	Halton-Peel
<b>Contam Limit Freq 1:</b>				<b>Site Postal Code:</b>	L5L 1W5
<b>Contaminant UN No 1:</b>	n/a			<b>Site Region:</b>	Central
<b>Environment Impact:</b>				<b>Site Municipality:</b>	Mississauga
<b>Nature of Impact:</b>				<b>Site Lot:</b>	
<b>Receiving Medium:</b>				<b>Site Conc:</b>	NA
<b>Receiving Env:</b>	Land; Surface Water			<b>Northing:</b>	NA
<b>MOE Response:</b>	No			<b>Easting:</b>	NA
<b>Dt MOE Arvl on Scn:</b>				<b>Site Geo Ref Accu:</b>	NA
<b>MOE Reported Dt:</b>	2018/10/30			<b>Site Map Datum:</b>	NA
<b>Dt Document Closed:</b>	2018/12/07			<b>SAC Action Class:</b>	Watercourse Spills
<b>Incident Reason:</b>	Equipment Failure			<b>Source Type:</b>	Water Supply
<b>Site Name:</b>	3372 Delfi Road				
<b>Site County/District:</b>	Regional Municipality of Peel				
<b>Site Geo Ref Meth:</b>	NA				
<b>Incident Summary:</b>	watermain break to SS, Loyalist Creek				
<b>Contaminant Qty:</b>	0 other - see incident description				
<b>12</b>	<b>1 of 17</b>	<b>NNE/179.4</b>	<b>169.8 / 0.00</b>	<b>SUNOCO</b> <b>3425 WINSTON CHURCHILL BLVD. SERVICE</b> <b>STATION</b> <b>MISSISSAUGA CITY ON L5L 3R5</b>	<b>SPL</b>
<b>Ref No:</b>	117017			<b>Discharger Report:</b>	
<b>Site No:</b>				<b>Material Group:</b>	
<b>Incident Dt:</b>	8/10/1995			<b>Health/Env Conseq:</b>	
<b>Year:</b>				<b>Client Type:</b>	
<b>Incident Cause:</b>	VALVE/FITTING LEAK OR FAILURE			<b>Sector Type:</b>	
<b>Incident Event:</b>				<b>Agency Involved:</b>	
<b>Contaminant Code:</b>				<b>Nearest Watercourse:</b>	
<b>Contaminant Name:</b>				<b>Site Address:</b>	
<b>Contaminant Limit 1:</b>				<b>Site District Office:</b>	
<b>Contam Limit Freq 1:</b>				<b>Site Postal Code:</b>	
<b>Contaminant UN No 1:</b>				<b>Site Region:</b>	
<b>Environment Impact:</b>	NOT ANTICIPATED			<b>Site Municipality:</b>	21102
<b>Nature of Impact:</b>				<b>Site Lot:</b>	
<b>Receiving Medium:</b>	LAND			<b>Site Conc:</b>	
<b>Receiving Env:</b>				<b>Northing:</b>	
<b>MOE Response:</b>				<b>Easting:</b>	
<b>Dt MOE Arvl on Scn:</b>				<b>Site Geo Ref Accu:</b>	
<b>MOE Reported Dt:</b>	8/10/1995			<b>Site Map Datum:</b>	
<b>Dt Document Closed:</b>				<b>SAC Action Class:</b>	
<b>Incident Reason:</b>	EQUIPMENT FAILURE			<b>Source Type:</b>	
<b>Site Name:</b>					
<b>Site County/District:</b>					
<b>Site Geo Ref Meth:</b>					
<b>Incident Summary:</b>	SUNOCO: 30 L GASOLINE TO GROUND				
<b>Contaminant Qty:</b>					
<b>12</b>	<b>2 of 17</b>	<b>NNE/179.4</b>	<b>169.8 / 0.00</b>	<b>SUNOCO INC</b> <b>3425 WINSTON CHURCHILL BLVD</b> <b>MISSISSAUGA ON L5L 3R5</b>	<b>PRT</b>
<b>Location ID:</b>	9286				
<b>Type:</b>	retail				
<b>Expiry Date:</b>	1995-05-31				
<b>Capacity (L):</b>	26271				
<b>Licence #:</b>	0076409234				

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>12</u>	3 of 17	NNE/179.4	169.8 / 0.00	SUNOCO 3425 WINSTON CHURCHILL DRIVE. SERVICE STATION MISSISSAUGA CITY ON L5L 3R5	SPL
<div> <div> Ref No: 126355  Site No:  Incident Dt: 5/13/1996  Year:  Incident Cause: VALVE/FITTING LEAK OR FAILURE  Incident Event:  Contaminant Code:  Contaminant Name:  Contaminant Limit 1:  Contam Limit Freq 1:  Contaminant UN No 1:  Environment Impact: POSSIBLE  Nature of Impact: Water course or lake  Receiving Medium: LAND / WATER  Receiving Env:  MOE Response:  Dt MOE Arvl on Scn:  MOE Reported Dt: 5/13/1996  Dt Document Closed:  Incident Reason: ERROR  Site Name:  Site County/District:  Site Geo Ref Meth:  Incident Summary:  Contaminant Qty: </div> <div> Discharger Report:  Material Group:  Health/Env Conseq:  Client Type:  Sector Type:  Agency Involved:  Nearest Watercourse:  Site Address:  Site District Office:  Site Postal Code:  Site Region:  Site Municipality: 21102  Site Lot:  Site Conc:  Northing:  Easting: FD, POLICE &amp; PEEL REG.  Site Geo Ref Accu:  Site Map Datum:  SAC Action Class:  Source Type: </div> </div>					
<u>12</u>	4 of 17	NNE/179.4	169.8 / 0.00	SRAA SERVICES INC O/A GAS STN 3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	FSTH
<div> License Issue Date: 8/3/2006  Tank Status: Licensed  Tank Status As Of: August 2007  Operation Type: Retail Fuel Outlet  Facility Type: Gasoline Station - Self Serve </div> <div> --Details--  Status: Active  Year of Installation: 1994  Corrosion Protection:  Capacity: 36000  Tank Fuel Type: Liquid Fuel Single Wall UST - Gasoline </div> <div> Status: Active  Year of Installation: 1994  Corrosion Protection:  Capacity: 36000  Tank Fuel Type: Liquid Fuel Single Wall UST - Gasoline </div> <div> Status: Active  Year of Installation: 1994  Corrosion Protection:  Capacity: 36000  Tank Fuel Type: Liquid Fuel Single Wall UST - Gasoline </div> <div> Status: Active </div>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Year of Installation:</b>		1994			
<b>Corrosion Protection:</b>					
<b>Capacity:</b>		36000			
<b>Tank Fuel Type:</b>		Liquid Fuel Single Wall UST - Gasoline			

<u>12</u>	5 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
Instance No:		10861492		Manufacturer:	
Status:				Serial No:	
Cont Name:				Ulc Standard:	
Instance Type:		FS Liquid Fuel Tank		Quantity:	
Item:		FS LIQUID FUEL TANK		Unit of Measure:	
Item Description:		FS Liquid Fuel Tank		Fuel Type:	
Tank Type:		Single Wall UST		Fuel Type2:	
Install Date:		5/14/2009		Fuel Type3:	
Install Year:		1994		Piping Steel:	
Years in Service:				Piping Galvanized:	
Model:		NULL		Tanks Single Wall St:	
Description:				Piping Underground:	
Capacity:		36000		Num Underground:	
Tank Material:		Fiberglass (FRP)		Panam Related:	
Corrosion Protect:				Panam Venue:	
Overfill Protect:					
Facility Type:		FS Liquid Fuel Tank			
Parent Facility Type:		FS Gasoline Station - Self Serve			
Facility Location:					
Device Installed Location:		3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA			

#### Fuel Storage Tank Details

**Owner Account Name:** SUNCOR ENERGY PRODUCTS PARTNERSHIP

<u>12</u>	6 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
Instance No:		10861474		Manufacturer:	
Status:				Serial No:	
Cont Name:				Ulc Standard:	
Instance Type:		FS Liquid Fuel Tank		Quantity:	
Item:		FS LIQUID FUEL TANK		Unit of Measure:	
Item Description:		FS Liquid Fuel Tank		Fuel Type: Gasoline	
Tank Type:		Single Wall UST		Fuel Type2: NULL	
Install Date:		5/14/2009		Fuel Type3: NULL	
Install Year:		1994		Piping Steel:	
Years in Service:				Piping Galvanized:	
Model:		NULL		Tanks Single Wall St:	
Description:				Piping Underground:	
Capacity:		36000		Num Underground:	
Tank Material:		Fiberglass (FRP)		Panam Related:	
Corrosion Protect:				Panam Venue:	
Overfill Protect:					
Facility Type:		FS Liquid Fuel Tank			
Parent Facility Type:		FS Gasoline Station - Self Serve			
Facility Location:					
Device Installed Location:		3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA			

#### Fuel Storage Tank Details

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
Owner Account Name:		SUNCOR ENERGY PRODUCTS PARTNERSHIP			

<u>12</u>	7 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
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<b>Instance No:</b>	10861483	<b>Manufacturer:</b>	
<b>Status:</b>		<b>Serial No:</b>	
<b>Cont Name:</b>		<b>Ulc Standard:</b>	
<b>Instance Type:</b>	FS Liquid Fuel Tank	<b>Quantity:</b>	
<b>Item:</b>	FS LIQUID FUEL TANK	<b>Unit of Measure:</b>	
<b>Item Description:</b>	FS Liquid Fuel Tank	<b>Fuel Type:</b>	Gasoline
<b>Tank Type:</b>	Single Wall UST	<b>Fuel Type2:</b>	NULL
<b>Install Date:</b>	5/14/2009	<b>Fuel Type3:</b>	NULL
<b>Install Year:</b>	1994	<b>Piping Steel:</b>	
<b>Years in Service:</b>		<b>Piping Galvanized:</b>	
<b>Model:</b>	NULL	<b>Tanks Single Wall St:</b>	
<b>Description:</b>		<b>Piping Underground:</b>	
<b>Capacity:</b>	36000	<b>Num Underground:</b>	
<b>Tank Material:</b>	Fiberglass (FRP)	<b>Panam Related:</b>	
<b>Corrosion Protect:</b>		<b>Panam Venue:</b>	
<b>Overfill Protect:</b>			
<b>Facility Type:</b>	FS Liquid Fuel Tank		
<b>Parent Facility Type:</b>	FS Gasoline Station - Self Serve		
<b>Facility Location:</b>			
<b>Device Installed Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		

#### Fuel Storage Tank Details

**Owner Account Name:** SUNCOR ENERGY PRODUCTS PARTNERSHIP

<u>12</u>	8 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
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<b>Instance No:</b>	10861501	<b>Manufacturer:</b>	
<b>Status:</b>		<b>Serial No:</b>	
<b>Cont Name:</b>		<b>Ulc Standard:</b>	
<b>Instance Type:</b>	FS Liquid Fuel Tank	<b>Quantity:</b>	
<b>Item:</b>	FS LIQUID FUEL TANK	<b>Unit of Measure:</b>	
<b>Item Description:</b>	FS Liquid Fuel Tank	<b>Fuel Type:</b>	Gasoline
<b>Tank Type:</b>	Single Wall UST	<b>Fuel Type2:</b>	NULL
<b>Install Date:</b>	5/14/2009	<b>Fuel Type3:</b>	NULL
<b>Install Year:</b>	1994	<b>Piping Steel:</b>	
<b>Years in Service:</b>		<b>Piping Galvanized:</b>	
<b>Model:</b>	NULL	<b>Tanks Single Wall St:</b>	
<b>Description:</b>		<b>Piping Underground:</b>	
<b>Capacity:</b>	36000	<b>Num Underground:</b>	
<b>Tank Material:</b>	Fiberglass (FRP)	<b>Panam Related:</b>	
<b>Corrosion Protect:</b>		<b>Panam Venue:</b>	
<b>Overfill Protect:</b>			
<b>Facility Type:</b>	FS Liquid Fuel Tank		
<b>Parent Facility Type:</b>	FS Gasoline Station - Self Serve		
<b>Facility Location:</b>			
<b>Device Installed Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		

#### Fuel Storage Tank Details

**Owner Account Name:** SUNCOR ENERGY PRODUCTS PARTNERSHIP

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>12</u>	9 of 17	NNE/179.4	169.8 / 0.00	Suncor Energy Products Partnership 3425 Winston Churchill Blvd Mississauga ON L5L 3R5	GEN
Generator No:		ON5149493	PO Box No:		
Status:		Registered	Country:		Canada
Approval Years:		As of Jul 2020	Choice of Contact:		
Contam. Facility:			Co Admin:		
MHSW Facility:			Phone No Admin:		
SIC Code:					
SIC Description:					
<u>Detail(s)</u>					
Waste Class:		221 L			
Waste Class Desc:		Light fuels			
Waste Class:		251 L			
Waste Class Desc:		Waste oils/sludges (petroleum based)			
<u>12</u>	10 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	EXP
Instance No:		10861483	Model:		NULL
Status:		Inactive	Quantity:		1
Instance ID:			Unit of Measure:		EA
Instance Type:			Fuel Type2:		NULL
Instance Creation Dt:		7/19/2000 8:15:15 PM	Fuel Type3:		NULL
Instance Install Dt:		5/14/2009	Piping Steel:		
Item:			Piping Galvanized:		
Item Description:		FS Liquid Fuel Tank	Tank Single Wall St:		
Facility Type:		FS LIQUID FUEL TANK	Piping Underground:		
Overfill Prot Type:		NULL	Tank Underground:		
Creation Date:		7/5/2009 1:21:40 AM	Panam Related:		NULL
Expired Date:			Panam Venue Nm:		NULL
Manufacturer:		NULL			
Source:		FS Liquid Fuel Tank			
Description:		2009VBS			
Serial No:		NULL			
Ulc Standard:		NULL			
Facility Location:		3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA			
<u>12</u>	11 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	EXP
Instance No:		10861501	Model:		NULL
Status:		Inactive	Quantity:		1
Instance ID:			Unit of Measure:		EA
Instance Type:			Fuel Type2:		NULL
Instance Creation Dt:		7/19/2000 8:15:15 PM	Fuel Type3:		NULL
Instance Install Dt:		5/14/2009	Piping Steel:		
Item:			Piping Galvanized:		
Item Description:		FS Liquid Fuel Tank	Tank Single Wall St:		
Facility Type:		FS LIQUID FUEL TANK	Piping Underground:		
Overfill Prot Type:		NULL	Tank Underground:		
Creation Date:		7/5/2009 1:21:40 AM	Panam Related:		NULL
Expired Date:			Panam Venue Nm:		NULL



Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Manufacturer:</b> NULL <b>Source:</b> FS Liquid Fuel Tank <b>Description:</b> 2009VBS <b>Serial No:</b> NULL <b>Ulc Standard:</b> NULL <b>Facility Location:</b> 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA					
<u>12</u>	12 of 17	NNE/179.4	169.8 / 0.00	<b>SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON</b>	EXP
<b>Instance No:</b> 10861474 <b>Status:</b> Inactive <b>Instance ID:</b> <b>Instance Type:</b> <b>Instance Creation Dt:</b> 7/19/2000 8:15:15 PM <b>Instance Install Dt:</b> 5/14/2009 <b>Item:</b> <b>Item Description:</b> FS Liquid Fuel Tank <b>Facility Type:</b> FS LIQUID FUEL TANK <b>Overfill Prot Type:</b> NULL <b>Creation Date:</b> 7/5/2009 1:21:41 AM <b>Expired Date:</b> <b>Manufacturer:</b> NULL <b>Source:</b> FS Liquid Fuel Tank <b>Description:</b> 2009VBSSUNOCO SITE - ELECTRONIC LEAK DETECTION ON STP SYSTEM = RED JACKET <b>Serial No:</b> NULL <b>Ulc Standard:</b> NULL <b>Facility Location:</b> 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA					
<b>Model:</b> NULL <b>Quantity:</b> 1 <b>Unit of Measure:</b> EA <b>Fuel Type2:</b> NULL <b>Fuel Type3:</b> NULL <b>Piping Steel:</b> <b>Piping Galvanized:</b> <b>Tank Single Wall St:</b> <b>Piping Underground:</b> <b>Tank Underground:</b> <b>Panam Related:</b> NULL <b>Panam Venue Nm:</b> NULL					
<u>12</u>	13 of 17	NNE/179.4	169.8 / 0.00	<b>SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON</b>	EXP
<b>Instance No:</b> 10861492 <b>Status:</b> Inactive <b>Instance ID:</b> <b>Instance Type:</b> <b>Instance Creation Dt:</b> 7/19/2000 8:15:15 PM <b>Instance Install Dt:</b> 5/14/2009 <b>Item:</b> <b>Item Description:</b> FS Liquid Fuel Tank <b>Facility Type:</b> FS LIQUID FUEL TANK <b>Overfill Prot Type:</b> NULL <b>Creation Date:</b> 7/5/2009 1:21:39 AM <b>Expired Date:</b> <b>Manufacturer:</b> NULL <b>Source:</b> FS Liquid Fuel Tank <b>Description:</b> 2009VBS <b>Serial No:</b> NULL <b>Ulc Standard:</b> NULL <b>Facility Location:</b> 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA					
<b>Model:</b> NULL <b>Quantity:</b> 1 <b>Unit of Measure:</b> EA <b>Fuel Type2:</b> NULL <b>Fuel Type3:</b> NULL <b>Piping Steel:</b> <b>Piping Galvanized:</b> <b>Tank Single Wall St:</b> <b>Piping Underground:</b> <b>Tank Underground:</b> <b>Panam Related:</b> NULL <b>Panam Venue Nm:</b> NULL					
<u>12</u>	14 of 17	NNE/179.4	169.8 / 0.00	<b>SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA</b>	FST

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
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ON

<b>Instance No:</b>	64876951	<b>Manufacturer:</b>	NULL
<b>Status:</b>	Active	<b>Serial No:</b>	S615
<b>Cont Name:</b>		<b>Ulc Standard:</b>	NULL
<b>Instance Type:</b>		<b>Quantity:</b>	1
<b>Item:</b>	FS LIQUID FUEL TANK	<b>Unit of Measure:</b>	EA
<b>Item Description:</b>	FS Liquid Fuel Tank	<b>Fuel Type:</b>	Gasoline
<b>Tank Type:</b>	Double Wall UST	<b>Fuel Type2:</b>	NULL
<b>Install Date:</b>	3/14/2019 8:06:17 AM	<b>Fuel Type3:</b>	NULL
<b>Install Year:</b>	2019	<b>Piping Steel:</b>	
<b>Years in Service:</b>	NULL	<b>Piping Galvanized:</b>	
<b>Model:</b>	NULL	<b>Tanks Single Wall St:</b>	
<b>Description:</b>		<b>Piping Underground:</b>	
<b>Capacity:</b>	50000	<b>Num Underground:</b>	
<b>Tank Material:</b>	Fiberglass (FRP)	<b>Panam Related:</b>	NULL
<b>Corrosion Protect:</b>		<b>Panam Venue:</b>	NULL
<b>Overfill Protect:</b>			
<b>Facility Type:</b>	FS Liquid Fuel Tank		
<b>Parent Facility Type:</b>			
<b>Facility Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		
<b>Device Installed Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		

#### Fuel Storage Tank Details

**Owner Account Name:** SUNCOR ENERGY PRODUCTS PARTNERSHIP

#### Liquid Fuel Tank Details

**Overfill Protection:** Gravity  
**Owner Account Name:** SUNCOR ENERGY PRODUCTS PARTNERSHIP

12	15 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
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<b>Instance No:</b>	64876953	<b>Manufacturer:</b>	NULL
<b>Status:</b>	Active	<b>Serial No:</b>	S615
<b>Cont Name:</b>		<b>Ulc Standard:</b>	NULL
<b>Instance Type:</b>		<b>Quantity:</b>	1
<b>Item:</b>	FS LIQUID FUEL TANK	<b>Unit of Measure:</b>	EA
<b>Item Description:</b>	FS Liquid Fuel Tank	<b>Fuel Type:</b>	Gasoline
<b>Tank Type:</b>	Double Wall UST	<b>Fuel Type2:</b>	NULL
<b>Install Date:</b>	3/14/2019 8:06:17 AM	<b>Fuel Type3:</b>	NULL
<b>Install Year:</b>	2019	<b>Piping Steel:</b>	
<b>Years in Service:</b>	NULL	<b>Piping Galvanized:</b>	
<b>Model:</b>	NULL	<b>Tanks Single Wall St:</b>	
<b>Description:</b>		<b>Piping Underground:</b>	
<b>Capacity:</b>	50000	<b>Num Underground:</b>	
<b>Tank Material:</b>	Fiberglass (FRP)	<b>Panam Related:</b>	NULL
<b>Corrosion Protect:</b>		<b>Panam Venue:</b>	NULL
<b>Overfill Protect:</b>			
<b>Facility Type:</b>	FS Liquid Fuel Tank		
<b>Parent Facility Type:</b>			
<b>Facility Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		
<b>Device Installed Location:</b>	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		

#### Fuel Storage Tank Details

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
Owner Account Name:		SUNCOR ENERGY PRODUCTS PARTNERSHIP			

#### Liquid Fuel Tank Details

Overfill Protection: Gravity  
Owner Account Name: SUNCOR ENERGY PRODUCTS PARTNERSHIP

<u>12</u>	16 of 17	NNE/179.4	169.8 / 0.00	3425 WINSTON CHURCHILL BLVD MISSISSAUGA ON L5L 3R5	FST
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Instance No:	9768881	Manufacturer:	
Status:	Active	Serial No:	
Cont Name:		Ulc Standard:	
Instance Type:		Quantity:	
Item:	FS GASOLINE STATION - SELF SERVE	Unit of Measure:	
Item Description:		Fuel Type:	
Tank Type:		Fuel Type2:	
Install Date:		Fuel Type3:	
Install Year:		Piping Steel:	0
Years in Service:		Piping Galvanized:	0
Model:		Tanks Single Wall St:	0
Description:		Piping Underground:	3
Capacity:		Num Underground:	3
Tank Material:		Panam Related:	
Corrosion Protect:		Panam Venue:	
Overfill Protect:			
Facility Type:			
Parent Facility Type:			
Facility Location:			
Device Installed Location:			

<u>12</u>	17 of 17	NNE/179.4	169.8 / 0.00	SUNCOR ENERGY PRODUCTS PARTNERSHIP 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA 3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA ON	FST
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Instance No:	64876952	Manufacturer:	NULL
Status:	Active	Serial No:	S615
Cont Name:		Ulc Standard:	NULL
Instance Type:		Quantity:	1
Item:	FS LIQUID FUEL TANK	Unit of Measure:	EA
Item Description:	FS Liquid Fuel Tank	Fuel Type:	Gasoline
Tank Type:	Double Wall UST	Fuel Type2:	NULL
Install Date:	3/14/2019 8:06:17 AM	Fuel Type3:	NULL
Install Year:	2019	Piping Steel:	
Years in Service:	NULL	Piping Galvanized:	
Model:	NULL	Tanks Single Wall St:	
Description:		Piping Underground:	
Capacity:	50000	Num Underground:	
Tank Material:	Fiberglass (FRP)	Panam Related:	NULL
Corrosion Protect:		Panam Venue:	NULL
Overfill Protect:			
Facility Type:	FS Liquid Fuel Tank		
Parent Facility Type:			
Facility Location:	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		
Device Installed Location:	3425 WINSTON CHURCHILL BLVD MISSISSAUGA L5L 3R5 ON CA		

#### Fuel Storage Tank Details

Owner Account Name: SUNCOR ENERGY PRODUCTS PARTNERSHIP

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>Liquid Fuel Tank Details</u>					
Overfill Protection:	Gravity				
Owner Account Name:	SUNCOR ENERGY PRODUCTS PARTNERSHIP				
<u>13</u>	1 of 1	E/195.3	167.8 / -2.00	ENBRIDGE GAS INC 3348 DELFI RD,,MISSISSAUGA,ON,L5L 1S2,CA ON	PINC
Incident ID:				Fuel Category:	
Incident No:		2594464		Health Impact:	
Incident Reported Dt:		5/30/2019		Environment Impact:	
Type:		FS-Pipeline Incident		Property Damage:	
Status Code:				Service Interrupt:	
Customer Acct Name:		ENBRIDGE GAS INC		Enforce Policy:	
Incident Address:		3348 DELFI RD,,MISSISSAUGA,ON,L5L 1S2,CA		Public Relation:	
Tank Status:		Pipeline Damage Reason Est		Pipeline System:	
Task No:				Depth:	
Spills Action Centre:				Pipe Material:	
Fuel Type:				PSIG:	
Fuel Occurrence Tp:				Attribute Category:	
Date of Occurrence:				Regulator Location:	
Occurrence Start Dt:				Method Details:	
Operation Type:					
Pipeline Type:					
Regulator Type:					
Summary:					
Reported By:					
Affiliation:					
Occurrence Desc:					
Damage Reason:					
Notes:					
<u>14</u>	1 of 1	NE/198.3	169.1 / -0.78	2680 THE COLLEGEWAY, MISSISSAUGA ON L5L 2M9	INC
Incident No:		337050		Any Health Impact:	
Incident ID:		2488540		Any Enviro Impact:	
Instance No:				Service Interrupted:	
Status Code:		Causal Analysis Complete		Was Prop Damaged:	
Attribute Category:		FS-Incident		Reside App. Type:	
Context:				Commer App. Type:	
Date of Occurrence:				Indus App. Type:	
Time of Occurrence:				Institut App. Type:	
Incident Created On:				Venting Type:	
Instance Creation Dt:				Vent Conn Mater:	
Instance Install Dt:				Vent Chimney Mater:	
Occur Insp Start Date:				Pipeline Type:	Service / Riser Distribution Pipeline
Approx Quant Rel:				Pipeline Involved:	
Tank Capacity:				Pipe Material:	Plastic
Fuels Occur Type:				Depth Ground Cover:	
Fuel Type Involved:				Regulator Location:	Outside
Enforcement Policy:				Regulator Type:	Service Regulator (up to 60 psi intake)
Prc Escalation Req:				Operation Pressure:	IP
Tank Material Type:				Liquid Prop Make:	
Tank Storage Type:				Liquid Prop Model:	
Tank Location Type:				Liquid Prop Serial No:	
Pump Flow Rate Cap:				Liquid Prop Notes:	
Task No:				Equipment Type:	
Notes:				Equipment Model:	
Drainage System:				Serial No:	

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<div> <div> Sub Surface Contam.:  Aff Prop Use Water:  Contam. Migrated:  Contact Natural Env:  Incident Location:  Occurrence Narrative:  Operation Type Involved:  Item:  Item Description:  Device Installed Location: </div> <div> Cylinder Capacity:  Cylinder Cap Units:  Cylinder Mat Type:  Near Body of Water:  2680 THE COLLEGEWAY, MISSISSAUGA - 1/2" PIPELINE HIT </div> </div>					
15	1 of 1	N/205.5	169.8 / 0.00	2711 SPRUCE NEEDLE CRT., MISSISSAUGA ON L5L 1N2	INC
<div> <div> Incident No: 213638  Incident ID: 2364662  Instance No:  Status Code: Causal Analysis Complete  Attribute Category: FS-Incident  Context:  Date of Occurrence:  Time of Occurrence:  Incident Created On:  Instance Creation Dt:  Instance Install Dt:  Occur Insp Start Date:  Approx Quant Rel:  Tank Capacity:  Fuels Occur Type:  Fuel Type Involved:  Enforcement Policy:  Prc Escalation Req:  Tank Material Type:  Tank Storage Type:  Tank Location Type:  Pump Flow Rate Cap:  Task No:  Notes:  Drainage System:  Sub Surface Contam.:  Aff Prop Use Water:  Contam. Migrated:  Contact Natural Env:  Incident Location:  Occurrence Narrative:  Operation Type Involved:  Item:  Item Description:  Device Installed Location: </div> <div> Any Health Impact:  Any Enviro Impact:  Service Interrupted:  Was Prop Damaged:  Reside App. Type:  Commer App. Type:  Indus App. Type:  Institut App. Type:  Venting Type:  Vent Conn Mater:  Vent Chimney Mater:  Pipeline Type: Service / Riser Distribution Pipeline  Pipeline Involved:  Pipe Material: Plastic  Depth Ground Cover:  Regulator Location: Outside  Regulator Type: Service Regulator (up to 60 psi intake)  Operation Pressure: IP  Liquid Prop Make:  Liquid Prop Model:  Liquid Prop Serial No:  Liquid Prop Notes:  Equipment Type:  Equipment Model:  Serial No:  Cylinder Capacity:  Cylinder Cap Units:  Cylinder Mat Type:  Near Body of Water:  2711 SPRUCE NEEDLE CRT., MISSISSAUGA - 1/2" PIPELINE HIT </div> </div>					
16	1 of 1	WNW/219.6	170.1 / 0.25	Home Alone Property Management Ltd. 3521 Loyalist Drive Mississauga ON L5L 4W5	GEN
<div> <div> Generator No: ON9135556  Status:  Approval Years: 2010  Contam. Facility:  MHSW Facility:  SIC Code: 531310  SIC Description: Real Estate Property Managers </div> <div> PO Box No:  Country:  Choice of Contact:  Co Admin:  Phone No Admin: </div> </div>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<u>Detail(s)</u>					
Waste Class:	148				
Waste Class Desc:	INORGANIC LABORATORY CHEMICALS				
Waste Class:	263				
Waste Class Desc:	ORGANIC LABORATORY CHEMICALS				
<u>17</u>	1 of 2	E/220.3	167.3 / -2.56	Enbridge Gas Distribution Inc. 3341 Winstonchurchill Blvd Mississauga ON	SPL
Ref No:	6236-9VBF75			Discharger Report:	
Site No:	NA			Material Group:	
Incident Dt:	4/3/2015			Health/Env Conseq:	
Year:				Client Type:	
Incident Cause:	Unknown / N/A			Sector Type:	
Incident Event:				Agency Involved:	
Contaminant Code:	35			Nearest Watercourse:	
Contaminant Name:	NATURAL GAS (METHANE)			Site Address:	3341 Winstonchurchill Blvd
Contaminant Limit 1:				Site District Office:	
Contam Limit Freq 1:				Site Postal Code:	
Contaminant UN No 1:				Site Region:	
Environment Impact:				Site Municipality:	Mississauga
Nature of Impact:	Air			Site Lot:	
Receiving Medium:				Site Conc:	
Receiving Env:				Northing:	
MOE Response:	N			Easting:	
Dt MOE Arvl on Scn:				Site Geo Ref Accu:	
MOE Reported Dt:	4/6/2015			Site Map Datum:	
Dt Document Closed:				SAC Action Class:	Air Spills - Gases and Vapours
Incident Reason:	Unknown / N/A			Source Type:	
Site Name:	Residence<UNOFFICIAL>				
Site County/District:					
Site Geo Ref Meth:					
Incident Summary:	TSSA, Enbridge, 0.5 line strike, Safe				
Contaminant Qty:	0 other - see incident description				
<u>17</u>	2 of 2	E/220.3	167.3 / -2.56	ST LAWRENCE PLACE C/O HARBOUR PLANT RETIREMENT LODGES 3341 WINSTON CHURCHILL BLVD., MISSISSAUGA, ON, L5L 2W3, CA ON	PINC
Incident ID:				Fuel Category:	Natural Gas
Incident No:	1610738			Health Impact:	
Incident Reported Dt:	4/6/2015			Environment Impact:	
Type:	FS-Pipeline Incident			Property Damage:	Yes
Status Code:				Service Interrupt:	
Customer Acct Name:	ST LAWRENCE PLACE C/O HARBOUR PLANT RETIREMENT LODGES			Enforce Policy:	Yes
Incident Address:	3341 WINSTON CHURCHILL BLVD., MISSISSAUGA, ON, L5L 2W3, CA			Public Relation:	
Tank Status:	Pipeline Damage Reason Est			Pipeline System:	
Task No:	5431918			Depth:	
Spills Action Centre:				Pipe Material:	
Fuel Type:				PSIG:	
Fuel Occurrence Tp:				Attribute Category:	FS-Perform P-line Inc Invest
Date of Occurrence:				Regulator Location:	
Occurrence Start Dt:	2015/04/28			Method Details:	E-mail
Operation Type:					
Pipeline Type:					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Regulator Type:</b> <b>Summary:</b> 3341 WINSTON CHURCHILL BLVD, MISSISSAUGA - PIPELINE HIT - 1/2" <b>Reported By:</b> Jason McArthur - ENBRIDGE <b>Affiliation:</b> <b>Occurrence Desc:</b> <b>Damage Reason:</b> Facility could not be found or located <b>Notes:</b>					
18	1 of 1	WNW/224.6	169.9 / 0.04	<b>PIPELINE HIT 3"</b> <b>3512 IRWIN COURT,,MISSISSAUGA,ON,L5L 4W5,</b> <b>CA</b> <b>ON</b>	PINC
<b>Incident ID:</b> <b>Incident No:</b> 979706 <b>Incident Reported Dt:</b> 12/18/2012 <b>Type:</b> FS-Pipeline Incident <b>Status Code:</b> <b>Customer Acct Name:</b> PIPELINE HIT 3" <b>Incident Address:</b> 3512 IRWIN COURT,,MISSISSAUGA,ON,L5L 4W5,CA <b>Tank Status:</b> Pipeline Damage Reason Est <b>Task No:</b> 4221782 <b>Spills Action Centre:</b> <b>Fuel Type:</b> <b>Fuel Occurrence Tp:</b> <b>Date of Occurrence:</b> <b>Occurrence Start Dt:</b> 2013/04/19 <b>Operation Type:</b> <b>Pipeline Type:</b> <b>Regulator Type:</b> <b>Summary:</b> 3512 IRWIN COURT, MISSISSAUGA - 3" PIPELINE HIT <b>Reported By:</b> Chris Blackburn - Enbridge <b>Affiliation:</b> <b>Occurrence Desc:</b> <b>Damage Reason:</b> Facility was not located or marked <b>Notes:</b>					
<b>Fuel Category:</b> Natural Gas <b>Health Impact:</b> <b>Environment Impact:</b> <b>Property Damage:</b> Yes <b>Service Interrupt:</b> <b>Enforce Policy:</b> Yes <b>Public Relation:</b> <b>Pipeline System:</b> <b>Depth:</b> <b>Pipe Material:</b> <b>PSIG:</b> <b>Attribute Category:</b> FS-Perform P-line Inc Invest <b>Regulator Location:</b> <b>Method Details:</b> E-mail					
19	1 of 1	NE/235.8	169.8 / 0.00	<b>The Regional Municipality of Peel</b> <b>Intersection of Council Ring Rd and The</b> <b>Collegeway</b> <b>Mississauga ON</b>	SPL
<b>Ref No:</b> 3560-APPN2C <b>Site No:</b> NA <b>Incident Dt:</b> 7/28/2017 <b>Year:</b> <b>Incident Cause:</b> <b>Incident Event:</b> Leak/Break <b>Contaminant Code:</b> 41 <b>Contaminant Name:</b> WATER/SEDIMENT <b>Contaminant Limit 1:</b> <b>Contam Limit Freq 1:</b> <b>Contaminant UN No 1:</b> n/a <b>Environment Impact:</b> <b>Nature of Impact:</b> <b>Receiving Medium:</b> <b>Receiving Env:</b> Land; Surface Water <b>MOE Response:</b> No <b>Dt MOE Arvl on Scn:</b> <b>MOE Reported Dt:</b> 7/28/2017					
<b>Discharger Report:</b> <b>Material Group:</b> <b>Health/Env Conseq:</b> 2 - Minor Environment <b>Client Type:</b> Municipal Government <b>Sector Type:</b> Miscellaneous Communal <b>Agency Involved:</b> <b>Nearest Watercourse:</b> <b>Site Address:</b> Intersection of Council Ring Rd and The Collegeway <b>Site District Office:</b> Halton-Peel <b>Site Postal Code:</b> <b>Site Region:</b> Central <b>Site Municipality:</b> Mississauga <b>Site Lot:</b> <b>Site Conc:</b> <b>Northing:</b> 4820693 <b>Easting:</b> 605697 <b>Site Geo Ref Accu:</b> <b>Site Map Datum:</b>					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
<b>Dt Document Closed:</b> <b>Incident Reason:</b> <b>Site Name:</b> <b>Site County/District:</b> <b>Site Geo Ref Meth:</b> <b>Incident Summary:</b> <b>Contaminant Qty:</b>	Other	watermain break site<UNOFFICIAL> Regional Municipality of Peel		<b>SAC Action Class:</b> <b>Source Type:</b> Watercourse Spills Valve/Fitting/Piping	
<hr/>					
<b>20</b>	<b>1 of 2</b>	<b>SE/242.3</b>	<b>168.3 / -1.53</b>	<b>Enbridge Gas Distribution Inc.</b> <b>3055 Eden Oak Cres, Miss.</b> <b>Mississauga ON</b>	<b>SPL</b>
<b>Ref No:</b> <b>Site No:</b> <b>Incident Dt:</b> <b>Year:</b> <b>Incident Cause:</b> <b>Incident Event:</b> <b>Contaminant Code:</b> <b>Contaminant Name:</b> <b>Contaminant Limit 1:</b> <b>Contam Limit Freq 1:</b> <b>Contaminant UN No 1:</b> <b>Environment Impact:</b> <b>Nature of Impact:</b> <b>Receiving Medium:</b> <b>Receiving Env:</b> <b>MOE Response:</b> <b>Dt MOE Arvl on Scn:</b> <b>MOE Reported Dt:</b> <b>Dt Document Closed:</b> <b>Incident Reason:</b> <b>Site Name:</b> <b>Site County/District:</b> <b>Site Geo Ref Meth:</b> <b>Incident Summary:</b> <b>Contaminant Qty:</b>	5024-BBWMBQ NA 5/6/2019  Leak/Break 35 NATURAL GAS (METHANE)  1075  Air No 5/6/2019 5/8/2019 Operator/Human Error 3055 Eden Oak Cres, Miss.<UNOFFICIAL> Regional Municipality of Peel  TSSA FSB Enbridge line strike, made safe. 1/2" IP plastic 0 ft³	<b>Discharger Report:</b> <b>Material Group:</b> <b>Health/Env Conseq:</b> <b>Client Type:</b> <b>Sector Type:</b> <b>Agency Involved:</b> <b>Nearest Watercourse:</b> <b>Site Address:</b> <b>Site District Office:</b> <b>Site Postal Code:</b> <b>Site Region:</b> <b>Site Municipality:</b> <b>Site Lot:</b> <b>Site Conc:</b> <b>Northing:</b> <b>Easting:</b> <b>Site Geo Ref Accu:</b> <b>Site Map Datum:</b> <b>SAC Action Class:</b> <b>Source Type:</b>	2 - Minor Environment Corporation Miscellaneous Industrial  3055 Eden Oak Cres, Miss. Halton-Peel  Central Mississauga  4820247.22 605786.82  Air Spills - Gases and Vapours Valve/Fitting/Piping		
<hr/>					
<b>20</b>	<b>2 of 2</b>	<b>SE/242.3</b>	<b>168.3 / -1.53</b>	<b>ENBRIDGE GAS INC</b> <b>3055 EDEN OAK CRES,,MISSISSAUGA,ON,L5L</b> <b>5V2,CA</b> <b>ON</b>	<b>PINC</b>
<b>Incident ID:</b> <b>Incident No:</b> <b>Incident Reported Dt:</b> <b>Type:</b> <b>Status Code:</b> <b>Customer Acct Name:</b> <b>Incident Address:</b>  <b>Tank Status:</b> <b>Task No:</b> <b>Spills Action Centre:</b> <b>Fuel Type:</b> <b>Fuel Occurrence Tp:</b> <b>Date of Occurrence:</b> <b>Occurrence Start Dt:</b> <b>Operation Type:</b> <b>Pipeline Type:</b> <b>Regulator Type:</b> <b>Summary:</b>	2573662 5/6/2019 FS-Pipeline Incident  ENBRIDGE GAS INC 3055 EDEN OAK CRES,,MISSISSAUGA,ON, L5L 5V2,CA Pipeline Damage Reason Est	<b>Fuel Category:</b> <b>Health Impact:</b> <b>Environment Impact:</b> <b>Property Damage:</b> <b>Service Interrupt:</b> <b>Enforce Policy:</b> <b>Public Relation:</b>  <b>Pipeline System:</b> <b>Depth:</b> <b>Pipe Material:</b> <b>PSIG:</b> <b>Attribute Category:</b> <b>Regulator Location:</b> <b>Method Details:</b>			



Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Reported By:</b> <b>Affiliation:</b> <b>Occurrence Desc:</b> <b>Damage Reason:</b> <b>Notes:</b>					
<u>21</u>	1 of 1	NE/243.3	168.8 / -1.07	2660 The Collegeway, Mississauga ON L5L 2M9	INC
<b>Incident No:</b> 411710 <b>Incident ID:</b> 2563404 <b>Instance No:</b> <b>Status Code:</b> Causal Analysis Complete <b>Attribute Category:</b> FS-Incident <b>Context:</b> <b>Date of Occurrence:</b> <b>Time of Occurrence:</b> <b>Incident Created On:</b> <b>Instance Creation Dt:</b> <b>Instance Install Dt:</b> <b>Occur Insp Start Date:</b> <b>Approx Quant Rel:</b> <b>Tank Capacity:</b> <b>Fuels Occur Type:</b> <b>Fuel Type Involved:</b> <b>Enforcement Policy:</b> <b>Prc Escalation Req:</b> <b>Tank Material Type:</b> <b>Tank Storage Type:</b> <b>Tank Location Type:</b> <b>Pump Flow Rate Cap:</b> <b>Task No:</b> <b>Notes:</b> <b>Drainage System:</b> <b>Sub Surface Contam.:</b> <b>Aff Prop Use Water:</b> <b>Contam. Migrated:</b> <b>Contact Natural Env:</b> <b>Incident Location:</b> 2660 The Collegeway, Mississauga - 1/2" Pipeline Hit <b>Occurrence Narrative:</b> <b>Operation Type Involved:</b> <b>Item:</b> <b>Item Description:</b> <b>Device Installed Location:</b>		<b>Any Health Impact:</b> <b>Any Enviro Impact:</b> <b>Service Interrupted:</b> <b>Was Prop Damaged:</b> <b>Reside App. Type:</b> <b>Commer App. Type:</b> <b>Indus App. Type:</b> <b>Institut App. Type:</b> <b>Venting Type:</b> <b>Vent Conn Mater:</b> <b>Vent Chimney Mater:</b> <b>Pipeline Type:</b> Service / Riser Distribution Pipeline <b>Pipeline Involved:</b> <b>Pipe Material:</b> Plastic <b>Depth Ground Cover:</b> <b>Regulator Location:</b> Outside <b>Regulator Type:</b> Service Regulator (up to 60 psi intake) <b>Operation Pressure:</b> IP <b>Liquid Prop Make:</b> <b>Liquid Prop Model:</b> <b>Liquid Prop Serial No:</b> <b>Liquid Prop Notes:</b> <b>Equipment Type:</b> <b>Equipment Model:</b> <b>Serial No:</b> <b>Cylinder Capacity:</b> <b>Cylinder Cap Units:</b> <b>Cylinder Mat Type:</b> <b>Near Body of Water:</b>			
<u>22</u>	1 of 1	SE/247.3	168.8 / -1.00	3067 Eden Oak Cres MISSISSAUGA ON L5L 5V2	HINC
<b>External File Num:</b> FS INC 0610-03426 <b>Fuel Occurrence Type:</b> Vapour Release <b>Date of Occurrence:</b> 10/27/2006 <b>Fuel Type Involved:</b> Natural Gas <b>Status Desc:</b> Completed - Causal Analysis(End) <b>Job Type Desc:</b> Incident/Near-Miss Occurrence (FS) <b>Oper. Type Involved:</b> Private Dwelling <b>Service Interruptions:</b> No <b>Property Damage:</b> No <b>Fuel Life Cycle Stage:</b> Utilization <b>Root Cause:</b> Root Cause: Equipment/Material/Component:Yes Procedures:No Maintenance:Yes Design:No Training:No Management:No Human Factors:No <b>Reported Details:</b> <b>Fuel Category:</b> Gaseous Fuel					

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<b>Occurrence Type:</b> <b>Affiliation:</b> <b>County Name:</b> <b>Approx. Quant. Rel:</b> <b>Nearby body of water:</b> <b>Enter Drainage Syst.:</b> <b>Approx. Quant. Unit:</b> <b>Environmental Impact:</b>		Near-miss Industry Stakeholder (Licensee/Registration/Certificate Holder, Facility Owner, etc.) Toronto			
<u>23</u>	1 of 2	WNW/249.7	170.8 / 1.00	<b>Enbridge Gas Distribution Inc.</b> <b>South-west corner of Loyalist Dr. and Irwin Court</b> <b>Mississauga ON</b>	<b>SPL</b>
<b>Ref No:</b> <b>Site No:</b> <b>Incident Dt:</b> <b>Year:</b> <b>Incident Cause:</b> <b>Incident Event:</b> <b>Contaminant Code:</b> <b>Contaminant Name:</b>  <b>Contaminant Limit 1:</b> <b>Contam Limit Freq 1:</b> <b>Contaminant UN No 1:</b> <b>Environment Impact:</b> <b>Nature of Impact:</b> <b>Receiving Medium:</b> <b>Receiving Env:</b> <b>MOE Response:</b> <b>Dt MOE Arvl on Scn:</b> <b>MOE Reported Dt:</b> <b>Dt Document Closed:</b>  <b>Incident Reason:</b> <b>Site Name:</b> <b>Site County/District:</b> <b>Site Geo Ref Meth:</b> <b>Incident Summary:</b> <b>Contaminant Qty:</b>		1436-92XLYC 13-DEC-12 Leak/Break 35 NATURAL GAS (METHANE)  Confirmed Air Pollution  Not MOE mandate 13-DEC-12 21-FEB-13  Operator/Human Error South-west corner of Loyalist Dr. and Irwin Court<UNOFFICIAL>  TSSA FSB: 3" line strike, not made safe other - see incident description			<b>Discharger Report:</b> <b>Material Group:</b> <b>Health/Env Conseq:</b> <b>Client Type:</b> <b>Sector Type:</b> <b>Agency Involved:</b> <b>Nearest Watercourse:</b> <b>Site Address:</b>  <b>Site District Office:</b> <b>Site Postal Code:</b> <b>Site Region:</b> <b>Site Municipality:</b> <b>Site Lot:</b> <b>Site Conc:</b> <b>Nothing:</b> <b>Easting:</b> <b>Site Geo Ref Accu:</b> <b>Site Map Datum:</b> <b>SAC Action Class:</b>  Pipeline/Components South-west corner of Loyalist Dr. and Irwin Court Mississauga TSSA - Fuel Safety Branch - Hydrocarbon Fuel Release/Spill
<u>23</u>	2 of 2	WNW/249.7	170.8 / 1.00	<b>PIPELINE HIT - 3"</b> <b>LOYALIST DRIVE AND IRWIN COURT,,</b> <b>MISSISSAUGA,ON,,CA</b> <b>ON</b>	<b>PINC</b>
<b>Incident ID:</b> <b>Incident No:</b> <b>Incident Reported Dt:</b> <b>Type:</b> <b>Status Code:</b> <b>Customer Acct Name:</b> <b>Incident Address:</b>  <b>Tank Status:</b> <b>Task No:</b> <b>Spills Action Centre:</b> <b>Fuel Type:</b> <b>Fuel Occurrence Tp:</b> <b>Date of Occurrence:</b> <b>Occurrence Start Dt:</b>		966936 12/13/2012 FS-Pipeline Incident PIPELINE HIT - 3" LOYALIST DRIVE AND IRWIN COURT,, MISSISSAUGA,ON,,CA Pipeline Damage Reason Est 4212037  2012/12/13			<b>Fuel Category:</b> <b>Health Impact:</b> <b>Environment Impact:</b> <b>Property Damage:</b> <b>Service Interrupt:</b> <b>Enforce Policy:</b> <b>Public Relation:</b>  <b>Pipeline System:</b> <b>Depth:</b> <b>Pipe Material:</b> <b>PSIG:</b> <b>Attribute Category:</b> <b>Regulator Location:</b> <b>Method Details:</b>  Natural Gas No Yes FS-Perform P-line Inc Invest E-mail

Map Key	Number of Records	Direction/ Distance (m)	Elev/Diff (m)	Site	DB
<hr/>					
<b>Operation Type:</b>					
<b>Pipeline Type:</b>					
<b>Regulator Type:</b>					
<b>Summary:</b>		LOYALIST DRIVE AND IRWIN COURT, MISSISSAUGA - PIPELINE HIT - 3"			
<b>Reported By:</b>		Peter Bettiol - Enbridge Gas			
<b>Affiliation:</b>					
<b>Occurrence Desc:</b>					
<b>Damage Reason:</b>		Facility marking or location not sufficient			
<b>Notes:</b>					

## Unplottable Summary

Total: **28** Unplottable sites

DB	Company Name/Site Name	Address	City	Postal
CA	R.M. OF PEEL	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	
CA	ERIN MILLS DEV. CORP.	LOYALIST DR.	MISSISSAUGA ON	
CA	ERIN MILLS DEV. CORP.	LOYALIST DR.	MISSISSAUGA ON	
CA	ERIN MILLS DEV. CORP.	WINSTON CHURCHILL BLVD.	MISSISSAUGA ON	
CA	MISSISSAUGA CITY CREDIT VALLEY RD.	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	
CA	THE ERIN MILLS DEVELOPMENT CORPORATION	WINSTON CHURCHILL BLVD. T86106	MISSISSAUGA CITY ON	
CA	THE ERIN MILLS DEVELOPMENT CORP.	STREET B/W.CHURCHILL BLVD/ST.A	MISSISSAUGA ON	
CA	WESTERTON INVESTMENT INC./SUBDIVISION	LOYALIST DR./CAJUN CRES.	MISSISSAUGA CITY ON	
CA	MISSISSAUGA CITY	PT. LOT 35, CONC. 1/DELFI RD.	MISSISSAUGA CITY ON	
CA	ERIN MILLS DEVELOPMENT CORP.	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	
CA	ERIN MILLS DEVELOPMENT CORP.	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	
CA	JAMES LUCAS PROPERTIES LTD.	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	
CA	MISSISSAUGA CITY	PT. LOT 35, CONC. 1/DELFI RD.	MISSISSAUGA CITY ON	
CA	WESTERTON INVESTMENT INC./SUBDIVISION	LOYALIST DR./CAJUN CRES.	MISSISSAUGA CITY ON	
CA	DROF BUILDINGS LTD.	WINSTON CHURCHILL BLVD. SUBD.	MISSISSAUGA CITY ON	
CA	ERIN MILLS DEVELOPMENT CORP.NGHB.205&206	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON	

CA	JAMES LUCAS PROPETIES LTD.	WINSTON CHURCHILL BLVD	MISSISSAUGA CITY ON
CA	DANIELS ANNEX CORPORATION	WINSTON CHURCHILL BLVD.	MISSISSAUGA CITY ON
EHS		Winston Churchill Blvd	Mississauga ON
GEN	CONSUMERS GAS COMPANY	SHERIDAN FEEDER STATION PART LOT 35, CONCESSION 1	MISSISSAUGA ON
PRT	U HAUL COMPANY OF ONTARIO	WINSTON CHURCHILL BLVD	MISSISSAUGA ON
SPL		Winston Churchill Blvd	Mississauga ON
SPL	UNION GAS LTD.	WINSTON CHURCHILL BL. PIPELINE/COMPRESSOR STATION	MISSISSAUGA CITY ON
SPL	Metrolinx	Winston Churchill Boulevard Southbound, South of Derry Road	Mississauga ON
SPL	Emterra Environmental	Tripoli Terrace, Eastridge Rd, Treviso Court, Treviso Terrace	Mississauga ON
SPL	CONSUMERS GAS	LISGARD STN. WINSTON CHURCHILL BLVD REGULATOR/COMPRESSOR STATION	MISSISSAUGA CITY ON
WWIS		lot 2	ON
WWIS		lot 2 con 1	ON

## Unplottable Report

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**Site:** R.M. OF PEEL  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

**Certificate #:** 7-0720-97-  
**Application Year:** 97  
**Issue Date:** 7/29/1997  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** ERIN MILLS DEV. CORP.  
LOYALIST DR. MISSISSAUGA ON

**Database:**  
CA

**Certificate #:** 7-0188-85-006  
**Application Year:** 85  
**Issue Date:** 4/4/85  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** ERIN MILLS DEV. CORP.  
LOYALIST DR. MISSISSAUGA ON

**Database:**  
CA

**Certificate #:** 3-0269-85-006  
**Application Year:** 85  
**Issue Date:** 4/4/85  
**Approval Type:** Municipal sewage  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** ERIN MILLS DEV. CORP.  
WINSTON CHURCHILL BLVD. MISSISSAUGA ON

**Database:**  
CA

**Certificate #:** 7-0649-85-006

Application Year: 85  
Issue Date: 8/6/85  
Approval Type: Municipal water  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** MISSISSAUGA CITY CREDIT VALLEY RD.  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0120-87-  
Application Year: 87  
Issue Date: 2/20/1987  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** THE ERIN MILLS DEVELOPMENT CORPORATION  
WINSTON CHURCHILL BLVD. T86106 MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0468-89-  
Application Year: 89  
Issue Date: 3/29/1989  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** THE ERIN MILLS DEVELOPMENT CORP.  
STREET B/W.CHURCHILL BLVD/ST.A MISSISSAUGA ON

**Database:**  
CA

Certificate #: 3-1779-98-  
Application Year: 98  
Issue Date: 12/9/1998  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** WESTERTON INVESTMENT INC./SUBDIVISION  
LOYALIST DR./CAJUN CRES. MISSISSAUGA CITY ON

**Database:**  
CA

**Certificate #:** 7-0380-90-  
**Application Year:** 90  
**Issue Date:** 3/27/1990  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** MISSISSAUGA CITY  
PT. LOT 35, CONC. 1/DELFI RD. MISSISSAUGA CITY ON

**Database:**  
CA

**Certificate #:** 7-0044-92-  
**Application Year:** 92  
**Issue Date:** 2/7/1992  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** ERIN MILLS DEVELOPMENT CORP.  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

**Certificate #:** 7-0826-89-  
**Application Year:** 89  
**Issue Date:** 6/7/1989  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**  
**Client City:**  
**Client Postal Code:**  
**Project Description:**  
**Contaminants:**  
**Emission Control:**

---

**Site:** ERIN MILLS DEVELOPMENT CORP.  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

**Certificate #:** 7-1837-88-  
**Application Year:** 88  
**Issue Date:** 10/30/1988  
**Approval Type:** Municipal water  
**Status:** Approved  
**Application Type:**  
**Client Name:**  
**Client Address:**



Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** JAMES LUCAS PROPERTIES LTD.  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 7-0592-86-  
Application Year: 86  
Issue Date: 6/13/1986  
Approval Type: Municipal water  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** MISSISSAUGA CITY  
PT. LOT 35, CONC. 1/DELFI RD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0052-92-  
Application Year: 92  
Issue Date: 2/7/1992  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** WESTERTON INVESTMENT INC./SUBDIVISION  
LOYALIST DR./CAJUN CRES. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0470-90-  
Application Year: 90  
Issue Date: 3/27/1990  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** DROF BUILDINGS LTD.  
WINSTON CHURCHILL BLVD. SUBD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-1336-89-  
Application Year: 89

Issue Date: 7/14/1989  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** ERIN MILLS DEVELOPMENT CORP.NGHB.205&206  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-1138-89-  
Application Year: 89  
Issue Date: 6/28/1989  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** JAMES LUCAS PROPETIES LTD.  
WINSTON CHURCHILL BLVD MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0752-86-  
Application Year: 86  
Issue Date: 6/13/1986  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

---

**Site:** DANIELS ANNEX CORPORATION  
WINSTON CHURCHILL BLVD. MISSISSAUGA CITY ON

**Database:**  
CA

Certificate #: 3-0606-88-  
Application Year: 88  
Issue Date: 5/5/1988  
Approval Type: Municipal sewage  
Status: Approved  
Application Type:  
Client Name:  
Client Address:  
Client City:  
Client Postal Code:  
Project Description:  
Contaminants:  
Emission Control:

**Site:****Winston Churchill Blvd Mississauga ON****Database:**  
**EHS**

**Order No:** 20130306016  
**Status:** C  
**Report Type:** Custom Report  
**Report Date:** 15-MAR-13  
**Date Received:** 06-MAR-13  
**Previous Site Name:**  
**Lot/Building Size:**  
**Additional Info Ordered:**

**Nearest Intersection:**  
**Municipality:**  
**Client Prov/State:** ON  
**Search Radius (km):** .25  
**X:** -79.69161  
**Y:** 1

**Site:****CONSUMERS GAS COMPANY  
SHERIDAN FEEDER STATION PART LOT 35, CONCESSION 1 MISSISSAUGA ON****Database:**  
**GEN**

**Generator No:** ON0060828  
**Status:**  
**Approval Years:** 95,96,97,98,99,00,01  
**Contam. Facility:**  
**MHSW Facility:**  
**SIC Code:** 4921  
**SIC Description:** GAS DISTIRB. SYS.

**PO Box No:**  
**Country:**  
**Choice of Contact:**  
**Co Admin:**  
**Phone No Admin:**

**Detail(s)**

**Waste Class:** 212  
**Waste Class Desc:** ALIPHATIC SOLVENTS

**Site:****U HAUL COMPANY OF ONTARIO  
WINSTON CHURCHILL BLVD MISSISSAUGA ON****Database:**  
**PRT**

**Location ID:** 9282  
**Type:** retail  
**Expiry Date:** 1995-02-28  
**Capacity (L):** 2000  
**Licence #:** 0033602001

**Site:****Winston Churchill Blvd Mississauga ON****Database:**  
**SPL**

**Ref No:** 8340-6Y3N2K  
**Site No:**  
**Incident Dt:**  
**Year:**  
**Incident Cause:** Other Transport Accident  
**Incident Event:**  
**Contaminant Code:** 13  
**Contaminant Name:** DIESEL FUEL  
**Contaminant Limit 1:**  
**Contam Limit Freq 1:**  
**Contaminant UN No 1:**  
**Environment Impact:** Confirmed  
**Nature of Impact:** Soil Contamination  
**Receiving Medium:** Land  
**Receiving Env:**  
**MOE Response:** No Field Response  
**Dt MOE Arvl on Scn:**  
**MOE Reported Dt:** 2/3/2007  
**Dt Document Closed:** 6/21/2007  
**Incident Reason:** Error- Operator error  
**Site Name:** Winston Churchill  
**Site County/District:**  
**Site Geo Ref Meth:**

**Discharger Report:**  
**Material Group:** Oil  
**Health/Env Conseq:**  
**Client Type:**  
**Sector Type:** Transport Truck  
**Agency Involved:**  
**Nearest Watercourse:**  
**Site Address:**  
**Site District Office:**  
**Site Postal Code:**  
**Site Region:**  
**Site Municipality:** Mississauga  
**Site Lot:**  
**Site Conc:**  
**Northing:** NA  
**Easting:** NA  
**Site Geo Ref Accu:**  
**Site Map Datum:**  
**SAC Action Class:**  
**Source Type:**

**Incident Summary:** TT: roll-over on QEW- 20 to 30L diesel to grnd & snow  
**Contaminant Qty:** 30 L

**Site:** UNION GAS LTD.  
WINSTON CHURCHILL BL. PIPELINE/COMPRESSOR STATION MISSISSAUGA CITY ON

**Database:**  
SPL

<b>Ref No:</b>	40087	<b>Discharger Report:</b>	
<b>Site No:</b>		<b>Material Group:</b>	
<b>Incident Dt:</b>	8/30/1990	<b>Health/Env Conseq:</b>	
<b>Year:</b>		<b>Client Type:</b>	
<b>Incident Cause:</b>	PIPE/HOSE LEAK	<b>Sector Type:</b>	
<b>Incident Event:</b>		<b>Agency Involved:</b>	
<b>Contaminant Code:</b>		<b>Nearest Watercourse:</b>	
<b>Contaminant Name:</b>		<b>Site Address:</b>	
<b>Contaminant Limit 1:</b>		<b>Site District Office:</b>	
<b>Contam Limit Freq 1:</b>		<b>Site Postal Code:</b>	
<b>Contaminant UN No 1:</b>		<b>Site Region:</b>	
<b>Environment Impact:</b>	POSSIBLE	<b>Site Municipality:</b>	21102
<b>Nature of Impact:</b>	Human health	<b>Site Lot:</b>	
<b>Receiving Medium:</b>	AIR	<b>Site Conc:</b>	
<b>Receiving Env:</b>		<b>Northing:</b>	
<b>MOE Response:</b>		<b>Easting:</b>	F.D.'S,
<b>Dt MOE Arvl on Scn:</b>		<b>Site Geo Ref Accu:</b>	
<b>MOE Reported Dt:</b>	8/30/1990	<b>Site Map Datum:</b>	
<b>Dt Document Closed:</b>		<b>SAC Action Class:</b>	
<b>Incident Reason:</b>	UNKNOWN	<b>Source Type:</b>	
<b>Site Name:</b>			
<b>Site County/District:</b>			
<b>Site Geo Ref Meth:</b>			
<b>Incident Summary:</b>	UNION GAS -MAJOR GAS-LINEBREAK, STRONG ODOURS THROUGHOUT MISSISSAUGA.		
<b>Contaminant Qty:</b>			

**Site:** Metrolinx  
Winston Churchill Boulevard Southbound, South of Derry Road Mississauga ON

**Database:**  
SPL

<b>Ref No:</b>	5287-ALSH5M	<b>Discharger Report:</b>	
<b>Site No:</b>		<b>Material Group:</b>	
<b>Incident Dt:</b>	4/26/2017	<b>Health/Env Conseq:</b>	2 - Minor Environment
<b>Year:</b>		<b>Client Type:</b>	Corporation
<b>Incident Cause:</b>		<b>Sector Type:</b>	Other
<b>Incident Event:</b>	Leak/Break	<b>Agency Involved:</b>	
<b>Contaminant Code:</b>	27	<b>Nearest Watercourse:</b>	
<b>Contaminant Name:</b>	COOLANT N.O.S.	<b>Site Address:</b>	Winston Churchill Boulevard Southbound, South of Derry Road Halton-Peel
<b>Contaminant Limit 1:</b>		<b>Site District Office:</b>	
<b>Contam Limit Freq 1:</b>	n/a	<b>Site Postal Code:</b>	
<b>Contaminant UN No 1:</b>	n/a	<b>Site Region:</b>	Central
<b>Environment Impact:</b>		<b>Site Municipality:</b>	Mississauga
<b>Nature of Impact:</b>		<b>Site Lot:</b>	
<b>Receiving Medium:</b>		<b>Site Conc:</b>	
<b>Receiving Env:</b>	Land	<b>Northing:</b>	4826604.8
<b>MOE Response:</b>		<b>Easting:</b>	599465.9
<b>Dt MOE Arvl on Scn:</b>		<b>Site Geo Ref Accu:</b>	
<b>MOE Reported Dt:</b>	4/26/2017	<b>Site Map Datum:</b>	
<b>Dt Document Closed:</b>		<b>SAC Action Class:</b>	
<b>Incident Reason:</b>	Equipment Failure	<b>Source Type:</b>	Other
<b>Site Name:</b>	Spill<UNOFFICIAL>		
<b>Site County/District:</b>	Regional Municipality of Peel		
<b>Site Geo Ref Meth:</b>			
<b>Incident Summary:</b>	Go Bus: 19L spill to road, cb, contained, cleaned		
<b>Contaminant Qty:</b>	19 L		

**Site:** Emterra Environmental  
Tripoli Terrace, Eastridge Rd, Treviso Court, Treviso Terrace Mississauga ON

**Database:**  
SPL

**Ref No:** 4223-B88SGQ  
**Site No:** NA  
**Incident Dt:** 2019/01/08  
**Year:**  
**Incident Cause:**  
**Incident Event:** Leak/Break  
**Contaminant Code:** 15  
**Contaminant Name:** HYDRAULIC OIL

**Contaminant Limit 1:**  
**Contam Limit Freq 1:** n/a  
**Contaminant UN No 1:** n/a  
**Environment Impact:**  
**Nature of Impact:**  
**Receiving Medium:**  
**Receiving Env:** Land; Surface Water  
**MOE Response:** No  
**Dt MOE Arvl on Scn:**  
**MOE Reported Dt:** 2019/01/08  
**Dt Document Closed:**  
**Incident Reason:** Equipment Failure  
**Site Name:** Multiple Streets<UNOFFICIAL>  
**Site County/District:** Regional Municipality of Peel  
**Site Geo Ref Meth:**  
**Incident Summary:** Region of Peel - Enterra truck spilled hydraulic oil to roadways  
**Contaminant Qty:** 1 other - see incident description

**Discharger Report:**  
**Material Group:**  
**Health/Env Conseq:** 2 - Minor Environment  
**Client Type:** Corporation  
**Sector Type:** Miscellaneous Industrial  
**Agency Involved:**  
**Nearest Watercourse:**  
**Site Address:** Tripoli Terrace, Eastridge Rd, Treviso Court,  
Treviso Terrace  
Halton-Peel  
**Site District Office:**  
**Site Postal Code:**  
**Site Region:** Central  
**Site Municipality:** Mississauga  
**Site Lot:**  
**Site Conc:**  
**Nothing:**  
**Easting:**  
**Site Geo Ref Accu:**  
**Site Map Datum:**  
**SAC Action Class:** Land Spills  
**Source Type:** Motor Vehicle

**Site:** CONSUMERS GAS  
LISGARD STN. WINSTON CHURCHILL BLVD REGULATOR/COMPRESSOR STATION MISSISSAUGA CITY ON

**Database:**  
SPL

**Ref No:** 141  
**Site No:**  
**Incident Dt:** 2/8/1988  
**Year:**  
**Incident Cause:** PROCESS UPSET  
**Incident Event:**  
**Contaminant Code:**  
**Contaminant Name:**  
**Contaminant Limit 1:**  
**Contam Limit Freq 1:**  
**Contaminant UN No 1:**  
**Environment Impact:** NOT ANTICIPATED  
**Nature of Impact:** OTHER  
**Receiving Medium:** AIR  
**Receiving Env:**  
**MOE Response:**  
**Dt MOE Arvl on Scn:**  
**MOE Reported Dt:** 2/8/1988  
**Dt Document Closed:**  
**Incident Reason:** OTHER  
**Site Name:**  
**Site County/District:**  
**Site Geo Ref Meth:**  
**Incident Summary:** SMALL GAS LEAK  
**Contaminant Qty:**

**Discharger Report:**  
**Material Group:**  
**Health/Env Conseq:**  
**Client Type:**  
**Sector Type:**  
**Agency Involved:**  
**Nearest Watercourse:**  
**Site Address:**  
**Site District Office:**  
**Site Postal Code:**  
**Site Region:**  
**Site Municipality:** 21102  
**Site Lot:**  
**Site Conc:**  
**Nothing:**  
**Easting:**  
**Site Geo Ref Accu:**  
**Site Map Datum:**  
**SAC Action Class:**  
**Source Type:**

**Site:**  
lot 2 ON

**Database:**  
WWIS

**Well ID:** 6713515  
**Construction Date:**  
**Primary Water Use:** Domestic  
**Sec. Water Use:**  
**Final Well Status:** Water Supply  
**Water Type:**

**Data Entry Status:**  
**Data Src:** 1  
**Date Received:** 10/3/2000  
**Selected Flag:** Yes  
**Abandonment Rec:**  
**Contractor:** 2663

Casing Material:  
Audit No: 220638  
Tag:  
Construction Method:  
Elevation (m):  
Elevation Reliability:  
Depth to Bedrock:  
Well Depth:  
Overburden/Bedrock:  
Pump Rate:  
Static Water Level:  
Flowing (Y/N):  
Flow Rate:  
Clear/Cloudy:

Form Version: 1  
Owner:  
Street Name:  
County: WELLINGTON  
Municipality: PEEL TOWNSHIP  
Site Info:  
Lot: 002  
Concession:  
Concession Name:  
Easting NAD83:  
Northing NAD83:  
Zone:  
UTM Reliability:

**Bore Hole Information**

Bore Hole ID: 10477348  
DP2BR:  
Spatial Status:  
Code OB: 0  
Code OB Desc: Overburden  
Open Hole:  
Cluster Kind:  
Date Completed: 9/25/2000  
Remarks:  
Elevrc Desc:  
Location Source Date:  
Improvement Location Source:  
Improvement Location Method:  
Source Revision Comment:  
Supplier Comment:

Elevation:  
Elevrc:  
Zone: 17  
East83:  
North83:  
Org CS:  
UTMRC: 9  
UTMRC Desc: unknown UTM  
Location Method: na

**Overburden and Bedrock**  
**Materials Interval**

Formation ID: 932662558  
Layer: 3  
Color:  
General Color:  
Mat1: 11  
Most Common Material: GRAVEL  
Mat2:  
Mat2 Desc:  
Mat3:  
Mat3 Desc:  
Formation Top Depth: 211  
Formation End Depth: 213  
Formation End Depth UOM: ft

**Overburden and Bedrock**  
**Materials Interval**

Formation ID: 932662556  
Layer: 1  
Color:  
General Color:  
Mat1: 02  
Most Common Material: TOPSOIL  
Mat2:  
Mat2 Desc:  
Mat3:  
Mat3 Desc:  
Formation Top Depth: 0  
Formation End Depth: 8  
Formation End Depth UOM: ft

Overburden and Bedrock  
Materials Interval

Formation ID: 932662557  
Layer: 2  
Color: 2  
General Color: GREY  
Mat1: 05  
Most Common Material: CLAY  
Mat2:  
Mat2 Desc:  
Mat3:  
Mat3 Desc:  
Formation Top Depth: 8  
Formation End Depth: 211  
Formation End Depth UOM: ft

Annular Space/Abandonment  
Sealing Record

Plug ID: 933211459  
Layer: 1  
Plug From: 0  
Plug To: 20  
Plug Depth UOM: ft

Method of Construction & Well  
Use

Method Construction ID: 966713515  
Method Construction Code: 4  
Method Construction: Rotary (Air)  
Other Method Construction:

Pipe Information

Pipe ID: 11025918  
Casing No: 1  
Comment:  
Alt Name:

Construction Record - Casing

Casing ID: 930777780  
Layer: 1  
Material: 1  
Open Hole or Material: STEEL  
Depth From:  
Depth To:  
Casing Diameter: 6  
Casing Diameter UOM: inch  
Casing Depth UOM: ft

Construction Record - Casing

Casing ID: 930777781  
Layer: 2  
Material:  
Open Hole or Material:  
Depth From:  
Depth To:  
Casing Diameter:  
Casing Diameter UOM: inch

Casing Depth UOM: ft

Results of Well Yield Testing

Pump Test ID: 996713515  
Pump Set At:  
Static Level: 33  
Final Level After Pumping: 35  
Recommended Pump Depth:  
Pumping Rate: 30  
Flowing Rate:  
Recommended Pump Rate:  
Levels UOM: ft  
Rate UOM: GPM  
Water State After Test Code: 1  
Water State After Test: CLEAR  
Pumping Test Method: 1  
Pumping Duration HR: 1  
Pumping Duration MIN:  
Flowing: No

Draw Down & Recovery

Pump Test Detail ID: 934355635  
Test Type: Draw Down  
Test Duration: 15  
Test Level: 35  
Test Level UOM: ft

Draw Down & Recovery

Pump Test Detail ID: 935133519  
Test Type: Draw Down  
Test Duration: 60  
Test Level: 35  
Test Level UOM: ft

Draw Down & Recovery

Pump Test Detail ID: 934620200  
Test Type: Draw Down  
Test Duration: 30  
Test Level: 35  
Test Level UOM: ft

Draw Down & Recovery

Pump Test Detail ID: 934872464  
Test Type: Draw Down  
Test Duration: 45  
Test Level: 35  
Test Level UOM: ft

Water Details

Water ID: 933968308  
Layer: 1  
Kind Code: 1  
Kind: FRESH  
Water Found Depth: 213  
Water Found Depth UOM: ft

Site:

Database:  
WWIS



lot 2 con 1 ON

Well ID: 4907749  
Construction Date:  
Primary Water Use: Not Used  
Sec. Water Use:  
Final Well Status: Abandoned-Supply  
Water Type:  
Casing Material:  
Audit No: 118232  
Tag:  
Construction Method:  
Elevation (m):  
Elevation Reliability:  
Depth to Bedrock:  
Well Depth:  
Overburden/Bedrock:  
Pump Rate:  
Static Water Level:  
Flowing (Y/N):  
Flow Rate:  
Clear/Cloudy:

Data Entry Status:  
Data Src: 1  
Date Received: 6/21/1993  
Selected Flag: Yes  
Abandonment Rec:  
Contractor: 4005  
Form Version: 1  
Owner:  
Street Name:  
County: PEEL  
Municipality: MISSISSAUGA CITY  
Site Info:  
Lot: 002  
Concession: 01  
Concession Name: DS S  
Easting NAD83:  
Northing NAD83:  
Zone:  
UTM Reliability:

Bore Hole Information

Bore Hole ID: 10322308  
DP2BR:  
Spatial Status:  
Code OB:  
Code OB Desc: No formation data  
Open Hole:  
Cluster Kind:  
Date Completed: 6/15/1993  
Remarks:  
Elevrc Desc:  
Location Source Date:  
Improvement Location Source:  
Improvement Location Method:  
Source Revision Comment:  
Supplier Comment:

Elevation:  
Elevrc:  
Zone: 17  
East83:  
North83:  
Org CS:  
UTMRC: 9  
UTMRC Desc: unknown UTM  
Location Method: na

Annular Space/Abandonment

Sealing Record

Plug ID: 933170507  
Layer: 2  
Plug From: 1  
Plug To: 9  
Plug Depth UOM: ft

Annular Space/Abandonment

Sealing Record

Plug ID: 933170508  
Layer: 3  
Plug From: 9  
Plug To: 10  
Plug Depth UOM: ft

Annular Space/Abandonment

Sealing Record

Plug ID: 933170506  
Layer: 1  
Plug From: 0  
Plug To: 1

**Plug Depth UOM:** ft

**Method of Construction & Well Use**

**Method Construction ID:** 964907749  
**Method Construction Code:** 0  
**Method Construction:** Not Known  
**Other Method Construction:**

**Pipe Information**

**Pipe ID:** 10870878  
**Casing No:** 1  
**Comment:**  
**Alt Name:**

## Appendix: Database Descriptions

*Environmental Risk Information Services (ERIS) can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to ERIS at the time of update. **Note:** Databases denoted with " \* " indicates that the database will no longer be updated. See the individual database description for more information.*

### Abandoned Aggregate Inventory:

Provincial

AAGR

The MAAP Program maintains a database of abandoned pits and quarries. Please note that the database is only referenced by lot and concession and city/town location. The database provides information regarding the location, type, size, land use, status and general comments.\*

**Government Publication Date: Sept 2002\***

### Aggregate Inventory:

Provincial

AGR

The Ontario Ministry of Natural Resources maintains a database of all active pits and quarries. The database provides information regarding the registered owner/operator, location name, operation type, approval type, and maximum annual tonnage.

**Government Publication Date: Up to Sep 2020**

### Abandoned Mine Information System:

Provincial

AMIS

The Abandoned Mines Information System contains data on known abandoned and inactive mines located on both Crown and privately held lands. The information was provided by the Ministry of Northern Development and Mines (MNDM), with the following disclaimer: "the database provided has been compiled from various sources, and the Ministry of Northern Development and Mines makes no representation and takes no responsibility that such information is accurate, current or complete". Reported information includes official mine name, status, background information, mine start/end date, primary commodity, mine features, hazards and remediation.

**Government Publication Date: 1800-Oct 2018**

### Anderson's Waste Disposal Sites:

Private

ANDR

The information provided in this database was collected by examining various historical documents which aimed to characterize the likely position of former waste disposal sites from 1860 to present. The research initiative behind the creation of this database was to identify those sites that are missing from the Ontario MOE Waste Disposal Site Inventory, as well as to provide revisions and corrections to the positions and descriptions of sites currently listed in the MOE inventory. In addition to historic waste disposal facilities, the database also identifies certain auto wreckers and scrap yards that have been extrapolated from documentary sources. Please note that the data is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.

**Government Publication Date: 1860s-Present**

### Aboveground Storage Tanks:

Provincial

AST

Historical listing of aboveground storage tanks made available by the Department of Natural Resources and Forestry. Includes tanks used to hold water or petroleum. This dataset has been retired as of September 25, 2014 and will no longer be updated.

**Government Publication Date: May 31, 2014**

### Automobile Wrecking & Supplies:

Private

AUWR

This database provides an inventory of known locations that are involved in the scrap metal, automobile wrecking/recycling, and automobile parts & supplies industry. Information is provided on the company name, location and business type.

**Government Publication Date: 1999-Dec 31, 2020**

### Borehole:

Provincial

BORE

A borehole is the generalized term for any narrow shaft drilled in the ground, either vertically or horizontally. The information here includes geotechnical investigations or environmental site assessments, mineral exploration, or as a pilot hole for installing piers or underground utilities. Information is from many sources such as the Ministry of Transportation (MTO) boreholes from engineering reports and projects from the 1950 to 1990's in Southern Ontario. Boreholes from the Ontario Geological Survey (OGS) including The Urban Geology Analysis Information System (UGAIS) and the York Peel Durham Toronto (YPDT) database of the Conservation Authority Moraine Coalition. This database will include fields such as location, stratigraphy, depth, elevation, year drilled, etc. For all water well data or oil and gas well data for Ontario please refer to WWIS and OOGW.

**Government Publication Date: 1875-Jul 2018**

**Certificates of Approval:**

Provincial CA

This database contains the following types of approvals: Air & Noise, Industrial Sewage, Municipal & Private Sewage, Waste Management Systems and Renewable Energy Approvals. The MOE in Ontario states that any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste, must have a Certificate of Approval before it can operate lawfully. Fields include approval number, business name, address, approval date, approval type and status. This database will no longer be updated, as CofA's have been replaced by either Environmental Activity and Sector Registry (EASR) or Environmental Compliance Approval (ECA). Please refer to those individual databases for any information after Oct.31, 2011.

Government Publication Date: 1985-Oct 30, 2011\*

**Dry Cleaning Facilities:**

Federal CDRY

List of dry cleaning facilities made available by Environment and Climate Change Canada. Environment and Climate Change Canada's Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements) Regulations (SOR/2003-79) are intended to reduce releases of tetrachloroethylene to the environment from dry cleaning facilities.

Government Publication Date: Jan 2004-Dec 2018

**Commercial Fuel Oil Tanks:**

Provincial CFOT

Locations of commercial underground fuel oil tanks. This is not a comprehensive or complete inventory of commercial fuel tanks in the province; this listing is a copy of records of registered commercial underground fuel oil tanks obtained under Access to Public Information. Note that the following types of tanks do not require registration: waste oil tanks in apartments, office buildings, residences, etc.; aboveground gas or diesel tanks. Records are not verified for accuracy or completeness.

Government Publication Date: Jul 31, 2020

**Chemical Manufacturers and Distributors:**

Private CHEM

This database includes information from both a one time study conducted in 1992 and private source and is a listing of facilities that manufacture or distribute chemicals. The production of these chemical substances may involve one or more chemical reactions and/or chemical separation processes (i.e. fractionation, solvent extraction, crystallization, etc.).

Government Publication Date: 1999-Jan 31, 2020

**Chemical Register:**

Private CHM

This database includes a listing of locations of facilities within the Province or Territory that either manufacture and/or distributes chemicals.

Government Publication Date: 1999-Dec 31, 2020

**Compressed Natural Gas Stations:**

Private CNG

Canada has a network of public access compressed natural gas (CNG) refuelling stations. These stations dispense natural gas in compressed form at 3,000 pounds per square inch (psi), the pressure which is allowed within the current Canadian codes and standards. The majority of natural gas refuelling is located at existing retail gasoline that have a separate refuelling island for natural gas. This list of stations is made available by the Canadian Natural Gas Vehicle Alliance.

Government Publication Date: Dec 2012 -Dec 2020

**Inventory of Coal Gasification Plants and Coal Tar Sites:**

Provincial COAL

This inventory includes both the "Inventory of Coal Gasification Plant Waste Sites in Ontario-April 1987" and the Inventory of Industrial Sites Producing or Using Coal Tar and Related Tars in Ontario-November 1988) collected by the MOE. It identifies industrial sites that produced and continue to produce or use coal tar and other related tars. Detailed information is available and includes: facility type, size, land use, information on adjoining properties, soil condition, site operators/occupants, site description, potential environmental impacts and historic maps available. This was a one-time inventory.\*

Government Publication Date: Apr 1987 and Nov 1988\*

**Compliance and Convictions:**

Provincial CONV

This database summarizes the fines and convictions handed down by the Ontario courts beginning in 1989. Companies and individuals named here have been found guilty of environmental offenses in Ontario courts of law.

Government Publication Date: 1989-Nov 2020

**Certificates of Property Use:**

Provincial CPU

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all CPU's on the registry such as (EPA s. 168.6) - Certificate of Property Use.

Government Publication Date: 1994-Dec 31, 2020

**Drill Hole Database:**

Provincial DRL

The Ontario Drill Hole Database contains information on more than 113,000 percussion, overburden, sonic and diamond drill holes from assessment files on record with the department of Mines and Minerals. Please note that limited data is available for southern Ontario, as it was the last area to be completed. The database was created when surveys submitted to the Ministry were converted in the Assessment File Research Image Database (AFRI) project. However, the degree of accuracy (coordinates) as to the exact location of drill holes is dependent upon the source document submitted to the MNDM. Levels of accuracy used to locate holes are: centering on the mining claim; a sketch of the mining claim; a 1:50,000 map; a detailed company map; or from submitted a "Report of Work".

Government Publication Date: 1886 - Sep 2020

**Delisted Fuel Tanks:**

Provincial DTNK

List of fuel storage tank sites that were once found in - and have since been removed from - the list of fuel storage tanks made available by the regulatory agency under Access to Public Information.

Government Publication Date: Jul 31, 2020

**Environmental Activity and Sector Registry:**

Provincial EASR

On October 31, 2011, a smarter, faster environmental approvals system came into effect in Ontario. The EASR allows businesses to register certain activities with the ministry, rather than apply for an approval. The registry is available for common systems and processes, to which preset rules of operation can be applied. The EASR is currently available for: heating systems, standby power systems and automotive refinishing. Businesses whose activities aren't subject to the EASR may apply for an ECA (Environmental Compliance Approval). Please see our ECA database.

Government Publication Date: Oct 2011-Dec 31, 2020

**Environmental Registry:**

Provincial EBR

The Environmental Registry lists proposals, decisions and exceptions regarding policies, Acts, instruments, or regulations that could significantly affect the environment. Through the Registry, thirteen provincial ministries notify the public of upcoming proposals and invite their comments. For example, if a local business is requesting a permit, license, or certificate of approval to release substances into the air or water; these are notified on the registry. Data includes: Approval for discharge into the natural environment other than water (i.e. Air) - EPA s. 9, Approval for sewage works - OWRA s. 53(1), and EPA s. 27 - Approval for a waste disposal site. For information regarding Permit to Take Water (PTTW), Certificate of Property Use (CPU) and (ORD) Orders please refer to those individual databases.

Government Publication Date: 1994-Dec 31, 2020

**Environmental Compliance Approval:**

Provincial ECA

On October 31, 2011, a smarter, faster environmental approvals system came into effect in Ontario. In the past, a business had to apply for multiple approvals (known as certificates of approval) for individual processes and pieces of equipment. Today, a business either registers itself, or applies for a single approval, depending on the types of activities it conducts. Businesses whose activities aren't subject to the EASR may apply for an ECA. A single ECA addresses all of a business's emissions, discharges and wastes. Separate approvals for air, noise and waste are no longer required. This database will also include Renewable Energy Approvals. For certificates of approval prior to Nov 1st, 2011, please refer to the CA database. For all Waste Disposal Sites please refer to the WDS database.

Government Publication Date: Oct 2011- Dec 31, 2020

**Environmental Effects Monitoring:**

Federal EEM

The Environmental Effects Monitoring program assesses the effects of effluent from industrial or other sources on fish, fish habitat and human usage of fisheries resources. Since 1992, pulp and paper mills have been required to conduct EEM studies under the Pulp and Paper Effluent Regulations. This database provides information on the mill name, geographical location and sub-lethal toxicity data.

Government Publication Date: 1992-2007\*

**ERIS Historical Searches:**

Private EHS

ERIS has compiled a database of all environmental risk reports completed since March 1999. Available fields for this database include: site location, date of report, type of report, and search radius. As per all other databases, the ERIS database can be referenced on both the map and "Statistical Profile" page.

Government Publication Date: 1999-Oct 31, 2020

**Environmental Issues Inventory System:**

Federal EIIS

The Environmental Issues Inventory System was developed through the implementation of the Environmental Issues and Remediation Plan. This plan was established to determine the location and severity of contaminated sites on inhabited First Nation reserves, and where necessary, to remediate those that posed a risk to health and safety; and to prevent future environmental problems. The EIIS provides information on the reserve under investigation, inventory number, name of site, environmental issue, site action (Remediation, Site Assessment), and date investigation completed.

Government Publication Date: 1992-2001\*

**Emergency Management Historical Event:**

Provincial EMHE

List of locations of historical occurrences of emergency events, including those assigned to the Ministry of Natural Resources by Order-In-Council (OIC) under the Emergency Management and Civil Protection Act, as well as events where MNR provided requested emergency response assistance. Many of these events will have involved community evacuations, significant structural loss, and/or involvement of MNR emergency response staff. These events fall into one of ten (10) type categories: Dam Failure; Drought / Low Water; Erosion; Flood; Forest Fire; Soil and Bedrock Instability; Petroleum Resource Center Event, EMO Requested Assistance, Continuity of Operations Event, Other Requested Assistance. EMHE record details are reproduced by ERIS under License with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2017.

**Government Publication Date:** Dec 31, 2016

**Environmental Penalty Annual Report:**

Provincial EPAR

This database contains data from Ontario's annual environmental penalty report published by the Ministry of the Environment and Climate Change. These reports provide information on environmental penalties for land or water violations issued to companies in one of the nine industrial sectors covered by the Municipal Industrial Strategy for Abatement (MISA) regulations.

**Government Publication Date:** Jan 1, 2011 - Dec 31, 2019

**List of Expired Fuels Safety Facilities:**

Provincial EXP

List of facilities and tanks for which there was once a fuel registration. This is not a comprehensive or complete inventory of expired tanks/tank facilities in the province; this listing is a copy of previously registered tanks and facilities obtained under Access to Public Information. Includes private fuel outlets, bulk plants, fuel oil tanks, gasoline stations, marinas, propane filling stations, liquid fuel tanks, piping systems, etc; includes tanks which have been removed from the ground.

Notes: registration was not required for private fuel underground/aboveground storage tanks prior to January 1990, nor for furnace oil tanks prior to May 1, 2002; registration is not required for waste oil tanks in apartments, office buildings, residences, etc., or aboveground gas or diesel tanks. Records are not verified for accuracy or completeness.

**Government Publication Date:** Jul 31, 2020

**Federal Convictions:**

Federal FCON

Environment Canada maintains a database referred to as the "Environmental Registry" that details prosecutions under the Canadian Environmental Protection Act (CEPA) and the Fisheries Act (FA). Information is provided on the company name, location, charge date, offence and penalty.

**Government Publication Date:** 1988-Jun 2007\*

**Contaminated Sites on Federal Land:**

Federal FCS

The Federal Contaminated Sites Inventory includes information on known federal contaminated sites under the custodianship of departments, agencies and consolidated Crown corporations as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment. The inventory also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. It does not include sites where contamination has been caused by, and which are under the control of, enterprise Crown corporations, private individuals, firms or other levels of government. Includes fire training sites and sites at which Per- and Polyfluoroalkyl Substances (PFAS) are a concern.

**Government Publication Date:** Jun 2000-Sep 2020

**Fisheries & Oceans Fuel Tanks:**

Federal FOFT

Fisheries & Oceans Canada maintains an inventory of aboveground & underground fuel storage tanks located on Fisheries & Oceans property or controlled by DFO. Our inventory provides information on the site name, location, tank owner, tank operator, facility type, storage tank location, tank contents & capacity, and date of tank installation.

**Government Publication Date:** 1964-Sep 2019

**Federal Identification Registry for Storage Tank Systems (FIRSTS):**

Federal FRST

A list of federally regulated Storage tanks from the Federal Identification Registry for Storage Tank Systems (FIRSTS). FIRSTS is Environment and Climate Change Canada's database of storage tank systems subject to the Storage Tank for Petroleum Products and Allied Petroleum Products Regulations. The main objective of the Regulations is to prevent soil and groundwater contamination from storage tank systems located on federal and aboriginal lands. Storage tank systems that do not have a valid identification number displayed in a readily visible location on or near the storage tank system may be refused product delivery.

**Government Publication Date:** May 31, 2018

**Fuel Storage Tank:**

Provincial FST

List of registered private and retail fuel storage tanks. This is not a comprehensive or complete inventory of private and retail fuel storage tanks in the province; this listing is a copy of registered private and retail fuel storage tanks, obtained under Access to Public Information.

Notes: registration was not required for private fuel underground/aboveground storage tanks prior to January 1990, nor for furnace oil tanks prior to May 1, 2002; registration is not required for waste oil tanks in apartments, office buildings, residences, etc., or aboveground gas or diesel tanks. Records are not verified for accuracy or completeness.

**Government Publication Date:** Jul 31, 2020

**Fuel Storage Tank - Historic:**

Provincial

FSTH

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks. Public records of private fuel storage tanks are only available since the registration became effective in September 1989. This information is now collected by the Technical Standards and Safety Authority.

**Government Publication Date: Pre-Jan 2010\***

**Ontario Regulation 347 Waste Generators Summary:**

Provincial

GEN

Regulation 347 of the Ontario EPA defines a waste generation site as any site, equipment and/or operation involved in the production, collection, handling and/or storage of regulated wastes. A generator of regulated waste is required to register the waste generation site and each waste produced, collected, handled, or stored at the site. This database contains the registration number, company name and address of registered generators including the types of hazardous wastes generated. It includes data on waste generating facilities such as: drycleaners, waste treatment and disposal facilities, machine shops, electric power distribution etc. This information is a summary of all years from 1986 including the most currently available data. Some records may contain, within the company name, the phrase "See & Use..." followed by a series of letters and numbers. This occurs when one company is amalgamated with or taken over by another registered company. The number listed as "See & Use", refers to the new ownership and the other identification number refers to the original ownership. This phrase serves as a link between the 2 companies until operations have been fully transferred.

**Government Publication Date: 1986-Jul 31, 2020**

**Greenhouse Gas Emissions from Large Facilities:**

Federal

GHG

List of greenhouse gas emissions from large facilities made available by Environment Canada. Greenhouse gas emissions in kilotonnes of carbon dioxide equivalents (kt CO2 eq).

**Government Publication Date: 2013-Dec 2018**

**TSSA Historic Incidents:**

Provincial

HINC

List of historic incidences of spills and leaks of diesel, fuel oil, gasoline, natural gas, propane, and hydrogen recorded by the TSSA in their previous incident tracking system. The TSSA's Fuels Safety Program administers the Technical Standards & Safety Act 2000, providing fuel-related safety services associated with the safe transportation, storage, handling and use of fuels such as gasoline, diesel, propane, natural gas and hydrogen. Under this Act, the TSSA regulates fuel suppliers, storage facilities, transport trucks, pipelines, contractors and equipment or appliances that use fuels. Records are not verified for accuracy or completeness. This is not a comprehensive or complete inventory of historical fuel spills and leaks in the province. This listing is a copy of the data captured at one moment in time and is hence limited by the record date provided here.

**Government Publication Date: 2006-June 2009\***

**Indian & Northern Affairs Fuel Tanks:**

Federal

IAFT

The Department of Indian & Northern Affairs Canada (INAC) maintains an inventory of aboveground & underground fuel storage tanks located on both federal and crown land. Our inventory provides information on the reserve name, location, facility type, site/facility name, tank type, material & ID number, tank contents & capacity, and date of tank installation.

**Government Publication Date: 1950-Aug 2003\***

**Fuel Oil Spills and Leaks:**

Provincial

INC

Listing of spills and leaks of diesel, fuel oil, gasoline, natural gas, propane, and hydrogen reported to the Spills Action Centre (SAC). This is not a comprehensive or complete inventory of fuel-related leaks, spills, and incidents in the province; this listing is a copy of incidents reported to the SAC, obtained under Access to Public Information. Includes incidents from fuel-related hazards such as spills, fires, and explosions. Records are not verified for accuracy or completeness.

**Government Publication Date: Jul 31, 2020**

**Landfill Inventory Management Ontario:**

Provincial

LIMO

The Landfill Inventory Management Ontario (LIMO) database is updated every year, as the Ministry of the Environment, Conservation and Parks compiles new and updated information. Includes small and large landfills currently operating as well as those which are closed and historic. Operators of larger landfills provide landfill information for the previous operating year to the ministry for LIMO including: estimated amount of total waste received, landfill capacity, estimated total remaining landfill capacity, fill rates, engineering designs, reporting and monitoring details, size of location, service area, approved waste types, leachate of site treatment, contaminant attenuation zone and more. The small landfills include information such as site owner, site location and certificate of approval # and status.

**Government Publication Date: Feb 28, 2019**

**Canadian Mine Locations:**

Private

MINE

This information is collected from the Canadian & American Mines Handbook. The Mines database is a national database that provides over 290 listings on mines (listed as public companies) dealing primarily with precious metals and hard rocks. Listed are mines that are currently in operation, closed, suspended, or are still being developed (advanced projects). Their locations are provided as geographic coordinates (x, y and/or longitude, latitude). As of 2002, data pertaining to Canadian smelters and refineries has been appended to this database.

**Government Publication Date: 1998-2009\***

**Mineral Occurrences:**

Provincial MNR

In the early 70's, the Ministry of Northern Development and Mines created an inventory of approximately 19,000 mineral occurrences in Ontario, in regard to metallic and industrial minerals, as well as some information on building stones and aggregate deposits. Please note that the "Horizontal Positional Accuracy" is approximately +/- 200 m. Many reference elements for each record were derived from field sketches using pace or chain/tape measurements against claim posts or topographic features in the area. The primary limiting factor for the level of positional accuracy is the scale of the source material. The testing of horizontal accuracy of the source materials was accomplished by comparing the plan metric (X and Y) coordinates of that point with the coordinates of the same point as defined from a source of higher accuracy.

**Government Publication Date: 1846-Jan 2020**

**National Analysis of Trends in Emergencies System (NATES):**

Federal NATE

In 1974 Environment Canada established the National Analysis of Trends in Emergencies System (NATES) database, for the voluntary reporting of significant spill incidents. The data was to be used to assist in directing the work of the emergencies program. NATES ran from 1974 to 1994. Extensive information is available within this database including company names, place where the spill occurred, date of spill, cause, reason and source of spill, damage incurred, and amount, concentration, and volume of materials released.

**Government Publication Date: 1974-1994\***

**Non-Compliance Reports:**

Provincial NCPL

The Ministry of the Environment provides information about non-compliant discharges of contaminants to air and water that exceed legal allowable limits, from regulated industrial and municipal facilities. A reported non-compliance failure may be in regard to a Control Order, Certificate of Approval, Sectoral Regulation or specific regulation/act.

**Government Publication Date: Dec 31, 2018**

**National Defense & Canadian Forces Fuel Tanks:**

Federal NDFT

The Department of National Defense and the Canadian Forces maintains an inventory of all aboveground & underground fuel storage tanks located on DND lands. Our inventory provides information on the base name, location, tank type & capacity, tank contents, tank class, date of tank installation, date tank last used, and status of tank as of May 2001. This database will no longer be updated due to the new National Security protocols which have prohibited any release of this database.

**Government Publication Date: Up to May 2001\***

**National Defense & Canadian Forces Spills:**

Federal NDSP

The Department of National Defense and the Canadian Forces maintains an inventory of spills to land and water. All spill sites have been classified under the "Transportation of Dangerous Goods Act - 1992". Our inventory provides information on the facility name, location, spill ID #, spill date, type of spill, as well as the quantity of substance spilled & recovered.

**Government Publication Date: Mar 1999-Apr 2018**

**National Defence & Canadian Forces Waste Disposal Sites:**

Federal NDWD

The Department of National Defence and the Canadian Forces maintains an inventory of waste disposal sites located on DND lands. Where available, our inventory provides information on the base name, location, type of waste received, area of site, depth of site, year site opened/closed and status.

**Government Publication Date: 2001-Apr 2007\***

**National Energy Board Pipeline Incidents:**

Federal NEBI

Locations of pipeline incidents from 2008 to present, made available by the Canada Energy Regulator (CER) - previously the National Energy Board (NEB). Includes incidents reported under the Onshore Pipeline Regulations and the Processing Plant Regulations related to pipelines under federal jurisdiction, does not include incident data related to pipelines under provincial or territorial jurisdiction.

**Government Publication Date: 2008-Sep 30, 2020**

**National Energy Board Wells:**

Federal NEBP

The NEBW database contains information on onshore & offshore oil and gas wells that are outside provincial jurisdiction(s) and are thereby regulated by the National Energy Board. Data is provided regarding the operator, well name, well ID No./UWI, status, classification, well depth, spud and release date.

**Government Publication Date: 1920-Feb 2003\***



**National Environmental Emergencies System (NEES):**

Federal

NEES

In 2000, the Emergencies program implemented NEES, a reporting system for spills of hazardous substances. For the most part, this system only captured data from the Atlantic Provinces, some from Quebec and Ontario and a portion from British Columbia. Data for Alberta, Saskatchewan, Manitoba and the Territories was not captured. However, NEES is also a repository for previous Environment Canada spill datasets. NEES is composed of the historic datasets ' or Trends ' which dates from approximately 1974 to present. NEES Trends is a compilation of historic databases, which were merged and includes data from NATES (National Analysis of Trends in Emergencies System), ARTS (Atlantic Regional Trends System), and NEES. In 2001, the Emergencies Program determined that variations in reporting regimes and requirements between federal and provincial agencies made national spill reporting and trend analysis difficult to achieve. As a consequence, the department has focused efforts on capturing data on spills of substances which fall under its legislative authority only (CEPA and FA). As such, the NEES database will be decommissioned in December 2004.

**Government Publication Date: 1974-2003\***

**National PCB Inventory:**

Federal

NPCB

Environment Canada's National PCB inventory includes information on in-use PCB containing equipment in Canada including federal, provincial and private facilities. Federal out-of-service PCB containing equipment and PCB waste owned by the federal government or by federally regulated industries such as airlines, railway companies, broadcasting companies, telephone and telecommunications companies, pipeline companies, etc. are also listed. Although it is not Environment Canada's mandate to collect data on non-federal PCB waste, the National PCB inventory includes some information on provincial and private PCB waste and storage sites. Some addresses provided may be Head Office addresses and are not necessarily the location of where the waste is being used or stored.

**Government Publication Date: 1988-2008\***

**National Pollutant Release Inventory:**

Federal

NPRI

Environment Canada has defined the National Pollutant Release Inventory ("NPRI") as a federal government initiative designed to collect comprehensive national data regarding releases to air, water, or land, and waste transfers for recycling for more than 300 listed substances.

**Government Publication Date: 1993-May 2017**

**Oil and Gas Wells:**

Private

OGWE

The Nickle's Energy Group (publisher of the Daily Oil Bulletin) collects information on drilling activity including operator and well statistics. The well information database includes name, location, class, status and depth. The main Nickle's database is updated on a daily basis, however, this database is updated on a monthly basis. More information is available at [www.nickles.com](http://www.nickles.com).

**Government Publication Date: 1988-Aug 31, 2020**

**Ontario Oil and Gas Wells:**

Provincial

OOGW

In 1998, the MNR handed over to the Ontario Oil, Gas and Salt Resources Corporation, the responsibility of maintaining a database of oil and gas wells drilled in Ontario. The OGSR Library has over 20,000+ wells in their database. Information available for all wells in the ERIS database include well owner/operator, location, permit issue date, and well cap date, license No., status, depth and the primary target (rock unit) of the well being drilled. All geology/stratigraphy table information, plus all water table information is also provide for each well record.

**Government Publication Date: 1800-Jun 2020**

**Inventory of PCB Storage Sites:**

Provincial

OPCB

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of PCB storage sites within the province. Ontario Regulation 11/82 (Waste Management - PCB) and Regulation 347 (Generator Waste Management) under the Ontario EPA requires the registration of inactive PCB storage equipment and/or disposal sites of PCB waste with the Ontario Ministry of Environment. This database contains information on: 1) waste quantities; 2) major and minor sites storing liquid or solid waste; and 3) a waste storage inventory.

**Government Publication Date: 1987-Oct 2004; 2012-Dec 2013**

**Orders:**

Provincial

ORD

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all Orders on the registry such as (EPA s. 17) - Order for remedial work, (EPA s. 18) - Order for preventative measures, (EPA s. 43) - Order for removal of waste and restoration of site, (EPA s. 44) - Order for conformity with Act for waste disposal sites, (EPA s. 136) - Order for performance of environmental measures.

**Government Publication Date: 1994-Dec 31, 2020**

**Canadian Pulp and Paper:**

Private

PAP

This information is part of the Pulp and Paper Canada Directory. The Directory provides a comprehensive listing of the locations of pulp and paper mills and the products that they produce.

**Government Publication Date: 1999, 2002, 2004, 2005, 2009-2014**

**Parks Canada Fuel Storage Tanks:**

Federal

PCFT

Canadian Heritage maintains an inventory of known fuel storage tanks operated by Parks Canada, in both National Parks and at National Historic Sites. The database details information on site name, location, tank install/removal date, capacity, fuel type, facility type, tank design and owner/operator.

**Government Publication Date: 1920-Jan 2005\***

**Pesticide Register:**

Provincial PES

The Ontario Ministry of the Environment and Climate Change maintains a database of licensed operators and vendors of registered pesticides.

**Government Publication Date:** Oct 2011-Dec 31, 2020

**Pipeline Incidents:**

Provincial PINC

List of pipeline incidents (strikes, leaks, spills). This is not a comprehensive or complete inventory of pipeline incidents in the province; this listing is an historical copy of records previously obtained under Access to Public Information. Records are not verified for accuracy or completeness.

**Government Publication Date:** Oct 31, 2020

**Private and Retail Fuel Storage Tanks:**

Provincial PRT

The Fuels Safety Branch of the Ontario Ministry of Consumer and Commercial Relations maintained a database of all registered private fuel storage tanks and licensed retail fuel outlets. This database includes an inventory of locations that have gasoline, oil, waste oil, natural gas and/or propane storage tanks on their property. The MCCR no longer collects this information. This information is now collected by the Technical Standards and Safety Authority (TSSA).

**Government Publication Date:** 1989-1996\*

**Permit to Take Water:**

Provincial PTTW

This is a subset taken from Ontario's Environmental Registry (EBR) database. It will include all PTTW's on the registry such as OWRA s. 34 - Permit to take water.

**Government Publication Date:** 1994-Dec 31, 2020

**Ontario Regulation 347 Waste Receivers Summary:**

Provincial REC

Part V of the Ontario Environmental Protection Act ("EPA") regulates the disposal of regulated waste through an operating waste management system or a waste disposal site operated or used pursuant to the terms and conditions of a Certificate of Approval or a Provisional Certificate of Approval. Regulation 347 of the Ontario EPA defines a waste receiving site as any site or facility to which waste is transferred by a waste carrier. A receiver of regulated waste is required to register the waste receiving facility. This database represents registered receivers of regulated wastes, identified by registration number, company name and address, and includes receivers of waste such as: landfills, incinerators, transfer stations, PCB storage sites, sludge farms and water pollution control plants. This information is a summary of all years from 1986 including the most currently available data.

**Government Publication Date:** 1986-2016

**Record of Site Condition:**

Provincial RSC

The Record of Site Condition (RSC) is part of the Ministry of the Environment's Brownfields Environmental Site Registry. Protection from environmental cleanup orders for property owners is contingent upon documentation known as a record of site condition (RSC) being filed in the Environmental Site Registry. In order to file an RSC, the property must have been properly assessed and shown to meet the soil, sediment and groundwater standards appropriate for the use (such as residential) proposed to take place on the property. The Record of Site Condition Regulation (O. Reg. 153/04) details requirements related to site assessment and clean up.

RSCs filed after July 1, 2011 will also be included as part of the new (O.Reg. 511/09).

**Government Publication Date:** 1997-Sept 2001, Oct 2004-Nov 2020

**Retail Fuel Storage Tanks:**

Private RST

This database includes an inventory of retail fuel outlet locations (including marinas) that have on their property gasoline, oil, waste oil, natural gas and / or propane storage tanks.

**Government Publication Date:** 1999-Dec 31, 2020

**Scott's Manufacturing Directory:**

Private SCT

Scott's Directories is a data bank containing information on over 200,000 manufacturers across Canada. Even though Scott's listings are voluntary, it is the most comprehensive database of Canadian manufacturers available. Information concerning a company's address, plant size, and main products are included in this database.

**Government Publication Date:** 1992-Mar 2011\*

**Ontario Spills:**

Provincial SPL

List of spills and incidents made available the Ministry of the Environment, Conservation and Parks. This database identifies information such as location (approximate), type and quantity of contaminant, date of spill, environmental impact, cause, nature of impact, etc. Information from 1988-2002 was part of the ORIS (Occurrence Reporting Information System). The SAC (Spills Action Centre) handles all spills reported in Ontario. Regulations for spills in Ontario are part of the MOE's Environmental Protection Act, Part X.

**Government Publication Date:** 1988-Mar 2020; Jul 2020 - Aug 2020

**Wastewater Discharger Registration Database:**

Provincial SRDS

Information under this heading is combination of the following 2 programs. The Municipal/Industrial Strategy for Abatement (MISA) division of the Ontario Ministry of Environment maintained a database of all direct dischargers of toxic pollutants within nine sectors including: Electric Power Generation; Mining; Petroleum Refining; Organic Chemicals; Inorganic Chemicals; Pulp & Paper; Metal Casting; Iron & Steel; and Quarries. All sampling information is now collected and stored within the Sample Result Data Store (SRDS).

Government Publication Date: 1990-Dec 31, 2017

**Anderson's Storage Tanks:**

Private TANK

The information provided in this database was collected by examining various historical documents, which identified the location of former storage tanks, containing substances such as fuel, water, gas, oil, and other various types of miscellaneous products. Information is available in regard to business operating at tank site, tank location, permit year, permit & installation type, no. of tanks installed & configuration and tank capacity. Data contained within this database pertains only to the city of Toronto and is not warranted to be complete, exhaustive or authoritative. The information was collected for research purposes only.

Government Publication Date: 1915-1953\*

**Transport Canada Fuel Storage Tanks:**

Federal TCFT

List of fuel storage tanks currently or previously owned or operated by Transport Canada. This inventory also includes tanks on The Pickering Lands, which refers to 7,530 hectares (18,600 acres) of land in Pickering, Markham, and Uxbridge owned by the Government of Canada since 1972; properties on this land has been leased by the government since 1975, and falls under the Site Management Policy of Transport Canada, but is administered by Public Works and Government Services Canada. This inventory provides information on the site name, location, tank age, capacity and fuel type.

Government Publication Date: 1970-Aug 2019

**Variances for Abandonment of Underground Storage Tanks:**

Provincial VAR

Listing of variances granted for storage tank abandonment. This is not a comprehensive or complete inventory of tank abandonment variances in the province; this listing is a copy of tank abandonment variance records previously obtained under Access to Public Information. In Ontario, registered underground storage tanks must be removed within two years of disuse; if removal of a tank is not feasible, an application may be sought for a variance from this code requirement.

Records are not verified for accuracy or completeness.

Government Publication Date: Jul 31, 2020

**Waste Disposal Sites - MOE CA Inventory:**

Provincial WDS

The Ontario Ministry of Environment, Waste Management Branch, maintains an inventory of known open (active or inactive) and closed disposal sites in the Province of Ontario. Active sites maintain a Certificate of Approval, are approved to receive and are receiving waste. Inactive sites maintain Certificate(s) of Approval but are not receiving waste. Closed sites are not receiving waste. The data contained within this database was compiled from the MOE's Certificate of Approval database. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number. All new Environmental Compliance Approvals handed out after Oct 31, 2011 for Waste Disposal Sites will still be found in this database.

Government Publication Date: Oct 2011-Dec 31, 2020

**Waste Disposal Sites - MOE 1991 Historical Approval Inventory:**

Provincial WDSH

In June 1991, the Ontario Ministry of Environment, Waste Management Branch, published the "June 1991 Waste Disposal Site Inventory", of all known active and closed waste disposal sites as of October 30th, 1990. For each "active" site as of October 31st 1990, information is provided on site location, site/CA number, waste type, site status and site classification. For each "closed" site as of October 31st 1990, information is provided on site location, site/CA number, closure date and site classification. Locations of these sites may be cross-referenced to the Anderson database described under ERIS's Private Source Database section, by the CA number.

Government Publication Date: Up to Oct 1990\*

**Water Well Information System:**

Provincial WWIS

This database describes locations and characteristics of water wells found within Ontario in accordance with Regulation 903. It includes such information as coordinates, construction date, well depth, primary and secondary use, pump rate, static water level, well status, etc. Also included are detailed stratigraphy information, approximate depth to bedrock and the approximate depth to the water table.

Government Publication Date: Apr 30, 2020

## Definitions

**Database Descriptions:** This section provides a detailed explanation for each database including: source, information available, time coverage, and acronyms used. They are listed in alphabetic order.

**Detail Report:** This is the section of the report which provides the most detail for each individual record. Records are summarized by location, starting with the project property followed by records in closest proximity.

**Distance:** The distance value is the distance between plotted points, not necessarily the distance between the sites' boundaries. All values are an approximation.

**Direction:** The direction value is the compass direction of the site in respect to the project property and/or center point of the report.

**Elevation:** The elevation value is taken from the location at which the records for the site address have been plotted. All values are an approximation. Source: Google Elevation API.

**Executive Summary:** This portion of the report is divided into 3 sections:

'Report Summary'- Displays a chart indicating how many records fall on the project property and, within the report search radii.

'Site Report Summary'-Project Property'- This section lists all the records which fall on the project property. For more details, see the 'Detail Report' section.

'Site Report Summary-Surrounding Properties'- This section summarizes all records on adjacent properties, listing them in order of proximity from the project property. For more details, see the 'Detail Report' section.

**Map Key:** The map key number is assigned according to closest proximity from the project property. Map Key numbers always start at #1. The project property will always have a map key of '1' if records are available. If there is a number in brackets beside the main number, this will indicate the number of records on that specific property. If there is no number in brackets, there is only one record for that property.

The symbol and colour used indicates 'elevation': the red inverted triangle will dictate 'ERIS Sites with Lower Elevation', the yellow triangle will dictate 'ERIS Sites with Higher Elevation' and the orange square will dictate 'ERIS Sites with Same Elevation.'

**Unplottables:** These are records that could not be mapped due to various reasons, including limited geographic information. These records may or may not be in your study area, and are included as reference.

## **APPENDIX D**

**LAND TITLE SEARCH DOCUMENTS  
THE COLLEGEWAY AND LOYALIST DRIVE  
MISSISSAUGA, ONTARIO**



Ontario ServiceOntario

LAND  
REGISTRY  
OFFICE #43

PARCEL REGISTER (ABBREVIATED) FOR PROPERTY IDENTIFIER

PAGE 1 OF 1

PREPARED FOR milkias

ON 2021/02/05 AT 14:29:31

ONLAND

13416-0444 (LT)

\* CERTIFIED IN ACCORDANCE WITH THE LAND TITLES ACT \* SUBJECT TO RESERVATIONS IN CROWN GRANT \*

PROPERTY DESCRIPTION:

PART OF BLOCK 124, PLAN 43W745, DESIGNATED AS PARTS 1 AND 2 ON REFERENCE PLAN 43R35476; SUBJECT TO AN EASEMENT OVER PT 2, PL 43R35476 IN FAVOUR OF MISSISSAUGA HYDRO-ELECTRIC COMMISSION AS IN LT610132; CITY OF MISSISSAUGA

PROPERTY REMARKS:

ESTATE/QUALIFIER:

FEE SIMPLE

ABSOLUTE

RECENTLY:

DIVISION FROM 13416-0393

PIN CREATION DATE:

2013/12/11

OWNERS' NAMES

THE CORPORATION OF THE CITY OF MISSISSAUGA

CAPACITY SHARE

ROWN

REG. NUM.	DATE	INSTRUMENT TYPE	AMOUNT	PARTIES FROM	PARTIES TO	CERT/ CHKD
** PRINTOUT INCLUDES ALL DOCUMENT TYPES AND DELETED INSTRUMENTS SINCE 2013/12/11 **						
LT804496	1987/10/01	NOTICE			THE CORPORATION OF THE CITY OF MISSISSAUGA THE REGIONAL MUNICIPALITY OF PEEL	C
LT810132	1987/10/20	TRANSFER EASEMENT			MISSISSAUGA HYDRO-ELECTRIC COMMISSION	C
43R35476	2013/09/06	PLAN REFERENCE				C
PR2472923	2013/12/05	TRANS RELIGIOUS ORG	\$1,578,560	THE ERIN MILLS CONGREGATION OF THE UNITED CHURCH OF CANADA	THE CORPORATION OF THE CITY OF MISSISSAUGA	C

NOTE: ADJOINING PROPERTIES SHOULD BE INVESTIGATED TO ASCERTAIN DESCRIPTIVE INCONSISTENCIES, IF ANY, WITH DESCRIPTION REPRESENTED FOR THIS PROPERTY.

NOTE: ENSURE THAT YOUR PRINTOUT STATES THE TOTAL NUMBER OF PAGES AND THAT YOU HAVE PICKED THEM ALL UP.

## **1 GENERAL**

### **1.1. General Instructions**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. Section Includes**

- 1.1. General Instructions
- 1.2. Section Includes
- 1.3. Language of the Contract
- 1.4. The Contract Documents
- 1.5. Laws, Notices, References, Standards and Regulations
- 1.6. Permits, Deposits and Responsibilities
- 1.7. Project Coordination and Responsibility
- 1.8. Examination of the Place of the Work, Documents, Surfaces and Conditions
- 1.9. Quantity of Items
- 1.10. Standards and Codes
- 1.11. Schedule of Values
- 1.12. Discrepancies and Clarifications
- 1.13. Setting out the Work and Field Engineering
- 1.14. Protection and Damages of Property and Work
- 1.15. Fires and Smoking
- 1.16. Documents at the Place of the Work
- 1.17. Concealed Services
- 1.18. Trademark and Labels
- 1.19. Waste Audits/Plans for Waste Reduction
- 1.20. Interferences
- 1.21. Not In Contract Items and Items Supplied by Owner
- 1.22. Seismic Design and Requirements
- 1.23. Electronic Files

### **1.3. Language of the Contract**

- 1.3.1. The use of the words "include" or "including", or variations thereof, within the *Contract Documents* is not limiting.

### **1.4. The Contract Documents**

- 1.4.1. The *Contract Documents* have been arranged into various divisions, sections, drawings, and schedules for the purpose of presenting the *Work* in a logical and organized form and to enable ease of reference and interpretation, and are not intended to be an arrangement of precise and independent *Subcontractors*, or jurisdiction of responsibility for the various parts of the *Work*. The *Contractor* shall be solely responsible for coordinating the execution of the *Work* of this *Contract* in accordance with the requirements of the *Contract Documents*.
- 1.4.2. As a result, the Consultant shall not be required to decide on questions arising with regard to agreements or contracts between the Contractor and Subcontractors or Suppliers, nor to the extent of the parts of the Work assigned thereto.
- 1.4.3. Further, no extra will be allowed as a result of the failure to coordinate and allocate the Work such that the Work is Provided in accordance with the Contract Documents.
- 1.4.4. The Contract Documents may specify, indicate, or schedule requirements that exceed the requirements of the Ontario Building Code, other applicable codes, requirements of Authorities Having Jurisdiction, and standards cited in the Contract Documents. In such cases, the requirements specified, indicated, or scheduled in the Contract Documents shall govern.

- 1.4.5. This section coordinates, relates, and governs the Work of other sections of the specifications.

**1.5. Laws, Notices, References, Standards and Regulations**

- 1.5.1. The Ontario Building Code - Ontario Regulation 332/12, including amendments, shall govern the Work.
- 1.5.2. Comply with codes, by-laws, and regulations of Authorities Having Jurisdiction over the Place of the Work. Codes and regulations form an integral part of the Contract Documents.
- 1.5.3. It shall be the responsibility of the Contractor to give the required notices and comply with the laws, bylaws, ordinances, rules, regulations, codes, and orders of all Authorities Having Jurisdiction, which are or become in force during the performance of the Work, and which relate to:
- 1.5.3.1. The Work.
  - 1.5.3.2. The preservation of the public health;
  - 1.5.3.3. Environmental protection; and/or,
  - 1.5.3.4. Construction safety.
- 1.5.4. Contractor shall arrange for inspection, testing and acceptance of the Work required by the Authorities Having Jurisdiction. Be responsible for necessary preparations, provisions and pay costs.
- 1.5.5. It is the responsibility of the Contractor to schedule notifications and inspections required by Authorities Having Jurisdiction such that notifications can be properly received and that inspections can be properly undertaken without causing a delay in the Work. The Contractor, at no additional cost to the Owner, shall be solely responsible for any delay in the Work caused by failure to properly schedule required notifications and inspections.
- 1.5.6. The Contractor shall Provide to the chief building official or the registered code agency, where a registered code agency is appointed under the Ontario Building Code Act in respect of the construction to which the notice relates, the required notices set out in Division C - Part 1 Sentence 1.3.5.1(2) and Sentence 1.3.5.2 of the Ontario Building Code, O. Reg. 332/12 as amended. The Contractor shall be present at each site inspection by an inspector or registered code agency as applicable under Division C - Part 1 Sentence 1.3.5.2 of the Ontario Building Code.
- 1.5.6.1. It is the responsibility of the Contractor to schedule notifications to the chief building official or the registered code agency such that the inspection pertaining to the notifications can be made within the time frame as required under Division C – Part 1 Sentence 1.3.5.3 of the Ontario Building Code, O. Reg. 332/12 as amended, without causing a delay in the Work. The Contractor, at no additional cost to the Owner, shall be solely responsible for any delay in the Work caused by failure to properly schedule required notifications and inspections.
- 1.5.7. Without limiting the foregoing, wherever bylaws, codes, or standards are quoted in the Contract Documents, they shall be taken to mean the latest edition, including all revisions, amendments, or supplements, at the time of the Contract, unless an earlier edition is specifically quoted. If more than one bylaw, code, or standard is quoted for a given Product, material or method, the latest edition of the most stringent shall govern.
- 1.5.8. Wherever reference is made to “manufacturer’s instructions” or “manufacturer’s recommendations”, it shall mean printed instructions or recommendations, received directly from the referenced manufacturer. It shall also be taken to mean the latest edition of such instructions or recommendations.
- 1.5.9. The Contractor shall be responsible for any delay in the progress of the Work due to a violation of any legislated requirements, and shall take the necessary steps to avoid delay in the final completion of the work, and such steps will not be considered or approved as changes in the Work.



**1.6. Permits, Deposits and Responsibilities**

- 1.6.1. Owner shall apply and pay for the Building Permit only.
- 1.6.2. All permits, licenses, certificates, and the like, other than the Building Permit, where required for the Work, shall be applied for, paid for, and obtained by the Contractor.
- 1.6.3. Contractor shall obtain all permits required to execute Work on municipal rights of way. Obtain damage deposits for sidewalks, roads and services.
- 1.6.4. The Contractor shall pay for any deposit for clean-up of mud-tracking onto roadways, and for the repair of any damage to roadways adjacent to the Place of the Work as may be required by the Authorities Having Jurisdiction.

**1.7. Project Coordination and Responsibility**

- 1.7.1. The Contractor shall coordinate the progress of the Work, mobilization areas of the Place of the Work, progress schedules, submittals, access to and use of the Place of the Work and facilities subject to any restrictions and conditions in accordance with the Contract Documents, reports and records, and any other processes, events, work, approvals, inspections and testing as may be required for the complete, proper and seamless execution of the Work.
- 1.7.2. The Contractor shall be solely responsible for ensuring that the complete Contract Documents are distributed to, or otherwise made available for review by, all Subcontractors and suppliers as required for the complete and proper and informed coordination and execution of the Work. Failure in this regard will be the sole responsibility of the Contractor and will not be accepted as a justification for a change in the Work and no change in the Work will be approved therefore.
- 1.7.3. The Contractor is required to employ a competent supervisor and necessary assistants who shall be in attendance at the Place of the Work at all times throughout the progress of the Work when work is being performed. The Contractor, through the supervisor, shall maintain good order and discipline among the Contractor's employees engaged on the Work, and among any Subcontractors engaged on the Work.
- 1.7.4. The responsibility as to which Subcontractor provides the required materials or articles, and/or builds-in articles, rests solely with the Contractor unless otherwise explicitly stated in the Contract Documents or directed by the Consultant.
- 1.7.5. The Contractor shall ensure that Subcontractors shall give the Contractor, in writing, instructions and information regarding their requirements as related to other parts of the Work.
- 1.7.6. There shall be cooperation at all times between Subcontractors as required for the proper execution of the Work. The Contractor shall ensure that Subcontractors supply others with the necessary accessories for building-in where required.
- 1.7.7. There shall be cooperation at all times with any representatives of any Inspection and Testing Companies (as may be retained by the Owner) during the performance of their duties.
- 1.7.8. The Contractor shall ensure that each Subcontractor shall report to the Consultant and the Contractor, in writing, any defects of surface or work, prepared by other Subcontractors, that adversely affects the work of their trade. Commencement of work shall imply acceptance of the prepared work otherwise.
- 1.7.9. The Contractor shall ensure that each Subcontractor, upon completion of their work, removes any equipment, surplus materials, and debris resulting from their work. Each Subcontractor shall also, and at its own expense, make good any damage to the work of another Subcontractor as a result of its own work. The definition of what constitutes "damage" shall be at the sole discretion of the Consultant.

**1.8. Examination of the Place of the Work, Documents, Surfaces and Conditions**

- 1.8.1. Examine the Place of the Work and investigate matters relating to the nature of the Work, means of access and egress, obstacles, rights and interests of other parties which may be interfered with during the execution of the Work, conditions and limitations including obstructions, existing structures or facilities, local conditions, actual levels, character and

- nature of the Work, documents related to existing building or buildings, as applicable and when available, and other consideration which may affect performance of the Work.
- 1.8.2. Examine the extent of Work to be performed and matters which are referred to in the Contract Documents prior to start of the Work.
  - 1.8.3. Examine Work to which Work is to be applied, anchored or connected, and relevant as-built conditions.
  - 1.8.4. Each Work operation following on a previous Work operation of a differing Subcontractor, as in the case of finishing and surfacing Work, shall include a thorough examination of the condition of the previous Work. Conditions found unacceptable, either for the commencement of the new Work or its satisfactory completion, shall be reported in writing to the Consultant.
  - 1.8.5. Do not commence Work until unsatisfactory conditions are corrected. Commencement of Work implies acceptance of surfaces, tolerances, and conditions and existing conditions will not be accepted as a contributing factor to subsequent failure or acceptability of the Work.

#### **1.9. Quantity of Items**

- 1.9.1. Where a component, device, item or part of materials or equipment is referred to in the singular number, such reference shall require the provision of as many components, devices, items or parts of material or equipment necessary to complete the Work.

#### **1.10. Standards and Codes**

- 1.10.1. Contract forms, codes, specifications, standards, manuals and installation, application and maintenance instructions referred to in these specifications, unless otherwise specified, amended or date suffixed, shall be latest published editions at Contract date.

#### **1.11. Schedule of Values**

- 1.11.1. The schedule of values specified under GC 5.2 shall include line items identifying full costs for the following:
  - 1.11.1.1. Preparation and submission of closeout submittals in accordance with the requirements of Section 01 77 00.

#### **1.12. Discrepancies and Clarifications**

- 1.12.1. Advise Consultant of discrepancies discovered in requirements of the Contract Documents and request clarification in written form.
- 1.12.2. Advise Consultant when clarifications are required pertaining to meaning or intent of requirements of Contract Documents and request clarification from Consultant in written form.
- 1.12.3. Do not proceed with related Work until written clarification is provided by Consultant.
- 1.12.4. Failure to notify Consultant shall result in Contractor incurring responsibility for resulting deficiencies and expense at no additional cost to the Owner.
- 1.12.5. Written instructions issued by Consultant for the purpose of clarification, implicitly supersede applicable and relevant aspects of the Contract Documents irrespective of whether or not these documents are explicitly or specifically cited in clarification requests or clarification instructions.

#### **1.13. Setting out the Work and Field Engineering**

- 1.13.1. The Contractor shall assume full responsibility for and execute complete layout of the Work to required locations, lines and elevations.
- 1.13.2. Verify all grades, lines, levels, and dimensions as indicated or otherwise provided, and report errors or inconsistencies to the Consultant before commencing work, or as soon as discovered.
- 1.13.3. Upon completion of foundation work, Provide an accurate survey showing the location of the foundations on the Site, the foundation wall dimensions, and the gross floor area of the Foundation Plan. The survey shall be prepared by a surveyor who is a Registered

- Ontario Land Surveyor acceptable to the Owner and the Consultant. The cost of the survey shall be part of the Contract Price.
- 1.13.4. Surveys and Survey Requirements:
- 1.13.4.1. Surveyor shall be an Ontario Land Surveyor, acceptable to the Owner and the Consultant.
- 1.13.4.2. Locate, confirm, and protect control points prior to starting Work. Preserve permanent reference points throughout the Work.
- 1.13.4.3. Establish two permanent benchmarks on Site, referenced to established benchmarks by survey control points. Record locations, with horizontal and vertical data in the Project Record Documents described under Section 01 77 00 Project Closeout.
- 1.13.4.4. Establish lines and levels, locate and lay out by instrumentation.
- 1.13.5. The Contractor shall Provide all Subcontractors with, and be responsible for, all levels and dimensions they require. The Contractor to notify all Subcontractors that such levels and dimensions must be obtained from the Contractor only.
- 1.13.6. The Contractor shall maintain a complete and accurate log of control and survey work as it progresses.
- 1.13.7. Upon completion of foundations and major site improvements, have prepared a certified survey showing dimensions, locations, angles, and elevations of the work completed.
- 1.13.8. As the work progresses, the Contractor shall be responsible for laying-out the exact locations of walls as a guide to the Subcontractors.
- 1.13.9. The Contractor to ensure that all pipes, service lines and ducts are concealed. Any exceptions to this should be noted on the drawings. Advise the Consultant in advance of the installation or fabrication of items where conditions are such that the installation or fabrication will be exposed.

#### **1.14. Protection and Damages of Property and Work**

- 1.14.1. The *Contractor* shall ensure provision of adequate protection of materials, property, and work from damage and staining and to ensure protection of adjacent materials and work of Subcontractors to prevent damage. Any party responsible for damage to the work of another, shall make good such damage to the satisfaction of the Consultant at no additional cost to the Owner. The cost for such making good will not be considered or approved as a change in the Work.
- 1.14.2. Maintain access and surrounding areas to the Place of the Work free from soiling and debris resulting from the Work. Make good any soiling and remove any and all debris caused as a result of the Work to the satisfaction of the Owner and the Consultant.
- 1.14.3. All damage to existing sidewalks, fences, structures, curbs, services, roadways, parking and asphalt areas, grounds, sodding, trees, or other items on, or adjacent to, the Place of the Work, including mud tracks, deemed by the Consultant as being damaged due to the performance of the Work, shall be made good by the Contractor to the satisfaction of the Consultant at no additional cost to the Owner. The cost for such making good will not be considered or approved as a change in the Work.
- 1.14.4. Abide by municipal requirements for maintaining sidewalks and roads in proper condition throughout the course of the Work. Provide a flag-person as required for the safe ingress and egress of vehicles to and from the Place of the Work.
- 1.14.5. Floors and roofs shall not be over-loaded by accumulated materials. Place proper supports and braces as required to safely disseminate any temporary loading.

#### **1.15. Fires and Smoking**

- 1.15.1. Fires are not permitted at the Place of the Work.
- 1.15.2. Explosives shall not be used in the execution of the Work and are not permitted at the Place of the Work.
- 1.15.3. Precautions shall be taken to avoid fire by spontaneous combustion. Remove combustible and non-combustible waste at regular intervals and/or when directed by the Consultant or the Owner.

### **1.16. Documents at the Place of the Work**

- 1.16.1. Maintain at the Place of the Work, one copy of each of following:
- 1.16.1.1. Contract Documents including drawings, specifications, addenda, and other modifications to the Contract.
    - (1) The Issued for Tender (IFT) version of the Contract Documents shall be the version retained at the Place of the Work. The IFC version shall be prepared by the Consultant and provided to the Contractor.
    - (2) Drawings & Specifications "Issued for Construction" are complementary to the Contract Documents. To the best of our knowledge they are an accurate representation of documented revisions. In the case of any discrepancy, omission or conflict between the "Issued for Construction" documents and the Contract Documents, the Contractor is to promptly bring it to the attention of the architect."
    - (3) In cases of dispute, the original signed version, of the Contract Documents, including addenda issued, shall govern over the IFC version.
  - 1.16.1.2. 'Reviewed' or 'Reviewed as Modified' shop drawings.
  - 1.16.1.3. Construction and submittal schedules.
  - 1.16.1.4. Supplemental Instructions, Notices of Change, Change Orders, and Change Directives.
  - 1.16.1.5. Inspection and Testing Reports.
  - 1.16.1.6. Consultant's field review reports and deficiency reports.
  - 1.16.1.7. Reports by Authorities Having Jurisdiction.
  - 1.16.1.8. Building and other applicable permits, and related permit documents.
  - 1.16.1.9. Substantial Performance Procedure issued by Consultant to Contractor
  - 1.16.1.10. Daily log including:
    - (1) Number of Workers actively Working at the Place of the Work by each subcontract.
    - (2) Subcontractors Working at the Place of the Work.
    - (3) Parts of the Work being Worked on.
    - (4) Working hours Worked at the Place of the Work.
    - (5) Activities with intermittent progress.
    - (6) Time lost and explanation for such time lost.
    - (7) Difficulties (Work scheduled to start but did not with the reason why, delays, labour inefficiencies, labour shortage).
    - (8) Products and materials delivered.
    - (9) Equipment mobilized and/or demobilized.
    - (10) Demolition conditions.
    - (11) Start and finish date of each part of the Work.
    - (12) Site specific information as required by Owner.
  - 1.16.1.11. As-built drawings recording as-built conditions, instructions, changes for structure, equipment, wiring, plumbing, and the like, as called for in Section 01 77 00 and Divisions 21, 22, and 23 and Divisions 26, 27, and 28, prior to being concealed.
- 1.16.2. Make above material available to *Consultant* upon request.

### **1.17. Concealed Services**

- 1.17.1. Conceal wiring, conduit, pipes and ductwork in finished areas, unless otherwise indicated.

### **1.18. Trademark and Labels**

- 1.18.1. Trademarks and labels, including applied labels, shall not be visible in finished work in finished areas, unless otherwise accepted or indicated by Consultant.

- 1.18.2. The exceptions to this requirement are trademarks and labels which are essential to identify materials, systems, assemblies, and equipment for maintenance and replacement purposes, and for life safety, fire resistance and temperature rise ratings.

**1.19. Waste Audits/Plans for Waste Reduction**

- 1.19.1. Comply with requirements of Authorities Having Jurisdiction.
- 1.19.2. Deliver to nearest appropriate depot materials accepted for recycling by Region or Municipality having jurisdiction over the Place of the Work, including but not limited to cardboard, paper, plastic, aluminum, steel, and glass. Deliver to nearest appropriate depot scrap and excess gypsum wallboard for recycling of this material. Costs for this Work are included in the Contract Price.

**1.20. Interferences**

- 1.20.1. Coordinate placement of equipment to ensure that components will be properly accommodated within spaces provided prior to commencement of the Work.
- 1.20.2. Take complete responsibility for remedial Work that results from failure to coordinate aspects of Work prior to its fabrication/installation.
- 1.20.3. Ensure that accesses and clearance required by Authorities Having Jurisdiction and/or for easy maintenance of equipment are provided in layout of equipment and services; notify Consultant if indicated clearances are in conflict.
- 1.20.4. Prepare coordination and interference drawings in accordance with Section 01 33 00.

**1.21. Not In Contract Items and Items Supplied by Owner**

- 1.21.1. NIC (Not In Contract) shall be used to designate various items of equipment that require coordination for installation although are not Provided as part of the Work.
- 1.21.2. SBO (Supplied by Owner) shall be used to designate various items of equipment that will be supplied by the Owner for installation by the Contractor as part of the Work.
- 1.21.3. Install items indicated as supplied by Owner (SBO) during the Work. Coordinate shipping and delivery with the Owner. Store items supplied by Owner at the Place of the Work and protect from damage. Install completely, and leave in full operating condition, in accordance with manufacturer's directions.

**1.22. Seismic Design and Requirements**

- 1.22.1. Design building components, assemblies and systems of the Work, as applicable, to meet seismic requirements pertinent to the location of the Place of the Work in accordance with the Ontario Building Code and comply with requirements of Authorities Having Jurisdiction.
- 1.22.2. Post-Disaster Building: Conform to Ontario Building Code requirements for building classification,
- 1.22.3. 'Post Disaster Building'. Elements of structures, non-structural components and equipment shall be designed in accordance with Ontario Building Code requirements for seismic design, connections, and seismic restraint for 'Post-Disaster Buildings'.
- 1.22.4. Vibrating equipment shall receive seismically designed vibration isolation. Only non-vibrating equipment are permitted to be secured to the structure. Structural connection shall be by means of direct connection to the structure by bolting, using rigid seismic restraints, or taught cable restraints. Connection to structure shall occur only at locations capable of withstanding the forces applied.
- 1.22.5. The proposed connections and general design of Products, equipment and systems shall be described in shop drawing format with identification and location of forces imposed on the structure. The shop drawings shall be stamped by a Professional Engineer licensed to practice in the Place of the Work and have the appropriate understanding of the issues at hand. The shop drawings shall be submitted for review to the Consultant prior to putting the Work in hand. The Consultant shall review these shop drawings for loads imposed on the structure.

- 1.22.6. Professional Engineer responsible for preparation of seismic engineered submittal shall review the Work and shall submit letters of general conformity for those parts of the Work in accordance with engineered submittal requirements of Section 01 33 00.

**1.23. Electronic Files**

- 1.23.1. Electronic files (CAD) will not be released until Electronic Files Transfer Form, appended to this section, has been completed and returned to the Consultant. Requests for release of electronic files for Structural, Mechanical, Electrical, Civil or Landscape will require to be completed on their release forms upon request.
- 1.23.1.1. Subcontractors and Suppliers requiring AutoCAD files shall make arrangements with the Contractor. The Consultant will not Provide AutoCAD files directly to Subcontractors or Suppliers.
- 1.23.1.2. The Consultant will require a copyright waiver, and/or CAD data disclaimer, and/or BIM data disclaimer to be signed by the Contractor prior to delivery of such AutoCAD files.
- (1) Copies of each of these disclaimers are appended to this section for reference.
- 1.23.2. The Consultant or other Consultants/subconsultants may charge a fee for providing the electronic files as indicated in the CAD data disclaimer or otherwise at the Consultant's or other Consultant's/Subconsultant's discretion.
- 1.23.2.1. Payment, where required, shall be made directly to the other Consultant/Subconsultant, and not through the Prime Consultant.
- 1.23.3. CAD files shall only be released once payment has been made as stipulated on Electronic Files Transfer Form.

**2 PRODUCTS**

Not applicable.

**3 EXECUTION**

Not applicable.

**END OF SECTION**



**PROJECT NAME**  
CoM Fire Station 123

**PROJECT ADDRESS**  
3050 The Collegeway

## DIGITAL DATA DISCLAIMER

1. The release of electronic files by **DPAI Architecture Inc.** does not imply transfer of copyright and ownership. Electronic files shall remain the property of DPAI Architecture Inc., and in no case shall the transfer of these electronic files be considered a sale.
2. The copyright of this CAD data belongs to **DPAI Architecture Inc.** and it may not be altered or modified or copied or transferred to another company or individual, either in part or whole, without express written permission from **DPAI Architecture Inc.** This material is being furnished for reference purposes only and has not been specially prepared for use by the recipient.
3. The information on the electronic files is considered instruments of service of **DPAI Architecture Inc.** and shall not be used for other projects, for additions to this project, or completion of this project by others.
4. This computer aided design (CAD) data is being provided at the request of and for the convenience of the recipient only. It may be incomplete, contain unintentional inaccuracies, or be partially obsolete. **DPAI Architecture Inc.** makes no warranties, either expressed or implied, of its merchantability and fitness for any particular purpose. The user is further warned that, while all digital CAD data appears to be extremely accurate, this apparent accuracy is an artifact of the techniques used to generate it and is in no way intended to imply actual accuracy. The user of this data takes full responsibility for the accuracy and correctness of all measurements, areas, inventories, etc. extracted from this data either manually or with the use of a computer.
5. The user is advised that any translation of CAD data from one computer system or environment to another can and often does result in the loss of important data. This loss can include, but may not be limited to: portions of text and dimensions; the existence, location or scale of symbols or other elements of graphics - the internal structure of data, including layers and data attributes; and the style or weight of lines. **DPAI Architecture Inc.** makes no representations as to the usability of this CAD data on any system.
6. Users of this computer data are advised to review all current versions, as well as subsequent versions, of project documentation for inconsistencies and revisions. It is the responsibility of the user to identify and make all required revisions or corrections to this data. **DPAI Architecture Inc.** will not issue updates to CAD data.
7. **DPAI Architecture Inc.** reserves the right to remove all indications of its ownership and/or involvement from each electronic file.
8. The User agrees not to modify or alter the electronic documents in any way.
9. The User agrees not to use or reuse the electronic documents in any manner except as expressly permitted by this agreement.
10. By acceptance of this electronic media and the files it contains, the user agrees, to the fullest extent of the law, to indemnify and hold **DPAI Architecture Inc.** harmless from any damage, cost or liability, including but not limited to reasonable attorney's fees and cost of defense, arising from any changes made to these files by anyone other than **DPAI Architecture Inc.** or from reuse of files and data without the prior written consent of **DPAI Architecture Inc.**
11. While reasonable care has been used to ensure that the transfer medium and the material are free of computer viruses, **DPAI Architecture Inc.** accepts no responsibility for any loss or damage that might result from the transmission of computer viruses in this process.
12. **DPAI Architecture Inc.** believes that no licensing or copyright fees due to others on account of the release of electronic files, but to the extent that any are, the user of the files will pay the appropriate fees and hold **DPAI Architecture Inc.** harmless for such claims.
13. If shop drawings are issued by the *Contractor* which appears to have made unaltered use of the CAD files issued by **DPAI Architecture Inc.**, they will be returned without review. Under no circumstances can it be assumed that **DPAI Architecture Inc.** working drawings are sufficiently detailed to become documents for final manufacturing - in other words, shop drawings.
14. The terms of this disclaimer are effective immediately upon the User's receipt of digital information.

## 1 GENERAL

### 1.1. General requirements

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### 1.2. Section Includes

- .1 1.1. General requirements
- .1 1.2. Section Includes
- .2 1.3. Cash Allowances

### 1.3. Cash Allowances

- 1.1.2. Administer cash allowances in accordance with the *Contract* GC 4.1(CCDC2). The *Contract Price*, and not the cash allowances, includes the *Contractor's* overhead and profit in connection with such cash allowances. Under no circumstance is the *Contractor* entitled to overhead and profit on any Cash Allowances Authorizations.
- 1.1.3. The *Contract Price* includes the Cash Allowances stated below.
- 1.1.4. Expenditures from Cash Allowance Stipulated Sum shall be directed by *Consultant* in writing through a Cash Allowance Authorization Form.
- 1.1.5. Unexpended amounts of cash allowances shall be deducted from the *Contract Price* at completion of Work.
- 1.1.6. Cash allowances include supply and installation unless otherwise indicated.
- 1.1.7. The *Contractor* is responsible for coordination of parts of the *Work* to be paid for by Cash Allowance with the remainder of the *Work*, including shop drawings and other submittals, in the same manner as with other *Subcontractors*. Cost for such coordination work is not included in the cash allowance. Include such costs elsewhere in the *Contract Price*.
- 1.1.8. Cash allowances cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, unloading, handling, storage, installation, and other authorized expenses incurred in performing the Work stipulated under the cash allowances.
- 1.1.9. Supply only cash allowances include:
  - 1.1.9.1. Net costs of *Products*
  - 1.1.9.2. Delivery to the *Place of Work*
  - 1.1.9.3. Applicable taxes and duties (excluding *Value Added Taxes*)
- 1.1.10. Supply only cash allowances do not include costs for the following (include such costs elsewhere in *Contract Price*):
  - 1.1.10.1. Storage and handling at the *Place of the Work*.
  - 1.1.10.2. Installation costs.
- 1.1.11. Supply and install cash allowances include:
  - 1.1.11.1. Net cost of *Products*.
  - 1.1.11.2. Delivery to the *Place of the Work*.
  - 1.1.11.3. Unloading, storing, handling of *Products* on the *Place of the Work*.
  - 1.1.11.4. Installation, finishing, and commissioning of *Products*.
  - 1.1.11.5. Applicable taxes and duties (excluding *Value Added Taxes*).
  - 1.1.11.6. Preparation and submission of submittals in accordance with Section 01 33 00.
- 1.1.12. Inspection and testing cash allowances include:
  - 1.1.12.1. Net costs of inspection/testing services.
  - 1.1.12.2. Applicable taxes (excluding *Value Added Taxes*).
- 1.1.13. Cash allowances do not include the *Value Added Taxes* payable by the Owner to the Contractor.
- 1.1.14. Storage at the *Place of the Work* and installation shall be in accordance with the manufacturer's instructions.
- 1.1.15. The value of *Work* performed under a Cash Allowance is eligible to be included in progress payments. Copies of invoices pertaining to expenditures against the Cash Allowance shall be appended to applications for progress payments. Without a submitted invoice, the processing of payments will not be included in the progress draw.



- 1.1.16. The *Contractor* shall prepare a schedule for the ordering of items called for under the cash allowances to avoid delaying the progress of the *Work*. Schedule shall be in accordance with Section 01 33 00.
- 1.1.17. The *Contractor* shall notify the *Consultant* in writing at such time as when 75% of the total Cash Allowance stipulated price has been expensed and when each individual item is expensed to 75%. Under no circumstance is the *Contractor* permitted to expense above the authorized cash allowance value issued per item. It is the responsibility of the *Contractor* to notify the *Owner* and *Consultant* when a revised Cash Allowance Authorization form is required to make adjustment to the issued value for that item.
- 1.1.18. Values noted for cash allowance items are estimates only. *Owner* is permitted to reallocate from other cash allowance values as required.
- 1.1.19. Once the total value amount (not per item) of the Cash Allowance is expensed, a change order be permitted, or as stipulated in the *Contract*, for expenses above and beyond the allotted total Cash Allowance value amount.
- 1.1.20. *Consultant* may direct *Contractor* to obtain bids, at no additional cost to the *Owner*, for *Work* for which payment is made from cash allowances.
- 1.1.21. The total amount of the Cash Allowance shall be advised and will cover the following items:
  - 1.1.21.1. Inspection and Testing Services: *Contractor* shall obtain a minimum of 3 quotes and *Provide* to the *Consultant* and the *Owner* for review prior to issuance of Cash Allowance Authorization.
  - 1.1.21.2. SCBA Compressor
  - 1.1.21.3. Supply and Install PCI Vehicle Exhaust System
  - 1.1.21.4. Supply and Install - Motorola - Fire Station Alerting System (FSA)
  - 1.1.21.5. Supply and Install Fire Monitoring System
  - 1.1.21.6. Supply and Install Security System & CCTV
  - 1.1.21.7. Supply and Install I.T Equipment
  - 1.1.21.8. Gas Service Connection: General Contractor shall apply, obtain permit, and complete testing and coordination of installation with AHJ.
  - 1.1.21.9. Water Service Connection: General Contractor shall apply, obtain permit, and complete testing and coordination of installation with AHJ.
  - 1.1.21.10. Hydro Service Connection: For charges from utility as required to provide new primary service connection. Refer to Contract Documents for full scope.
  - 1.1.21.11. Signage – Interior: Supply and installation of new interior building signage including all required room identification, way finding, department identification etc.
  - 1.1.21.12. Signage – Exterior Pylon: Supply and installation of new exterior building signage. All required below grade conduit and system provisions of power are supplied and installed as part of Division 26 and not covered under this cash allowance item.
  - 1.1.21.13. Signage – Building Signage and Crest
  - 1.1.21.14. Keying / Final Cores
  - 1.1.21.15. Traffic Light controller Pre-Emption
  - 1.1.21.16. Supply and Install PA System - Kelcom
  - 1.1.21.17. Kitchen Appliances and Residential Laundry
  - 1.1.21.18. Air Tightness Testing

## 2 PRODUCTS

Not applicable.

## 3 EXECUTION

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. General Instructions**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. Section Includes**

- 1.1. General Instructions
- 1.2. Section Includes
- 1.3. Or equivalent
- 1.4. Product Substitution Procedures

### **1.3. Or equivalent**

- 1.3.1. Acceptable Products, or Products lists which include the phrase "or equivalent", shall be interpreted to mean that a named Product alternate or equal, if selected for use in lieu of indicated or specified Product, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified Product. The Contractor shall be responsible for all costs and modifications associated with the inclusion of named Product alternate or equal at no additional cost to the Owner.
- 1.3.2. The process for proposing and approving alternates or equals shall be the same process as for proposing and approving product substitutions.
- 1.3.3. Confirm delivery of specified items prior to proposing alternates or equals.

### **1.4. Substitutions**

- 1.4.1. Submission of Substitutions:
  - 1.4.1.1. Proposals for substitutions of Products and materials must be submitted in accordance with procedures specified in this Section.
  - 1.4.1.2. Consultant may review submissions, if directed by Owner, with the understanding that the Contract Time will not be altered due to the time required by the Consultant to review the submission and by the Contractor to implement the substitution in the Work.

### **1.5. Product Substitution Procedures**

- 1.5.1. Base the Work of this Contract and the Contract Price upon using the new materials and Products specified.
- 1.5.2. Where materials and Products are specified only by reference to standards, Provide any material or Product that meets the standard.
- 1.5.3. Materials and Products specified by their proprietary names or catalogue number shall form the basis for the Work. No substitutes for these may be used without the Consultant's prior written authorization which may be obtained in accordance with requirements of this Section.
- 1.5.4. Where a material or Product is specified by naming two or more acceptable materials or proprietary Products, Provide any one of the specified materials or Products. If compliance with a referenced standard is also specified, the material or Product selected shall meet the standard.
- 1.5.5. Substitutions will be considered only when submitted in sufficient time to permit proper investigation by the Consultant, and under the conditions specified herein.
- 1.5.6. Requests for substitution may only be considered if submitted within 30 Days after Contract award. Requests for substitutions submitted after 30 Days after the Contract award may not be considered.
- 1.5.7. There is no obligation on the part of the Consultant or the Owner to accept any proposed substitutions that, in the Consultant's or the Owner's opinion, acting reasonably, do not meet the requirements of the Contract Documents, including this Section.
- 1.5.8. Substitutions proposed may be considered only under the following conditions:

- 1.5.8.1. If the proposed substitute materials and Products, having been brought to the attention of, and considered by, the Consultant as equivalent to those specified, will decrease the Contract Price.
- 1.5.8.2. If the proposed substitute materials and Products, having been brought to the attention of, and considered by, the Consultant as equivalent to those specified, will not increase the Contract Price but will decrease the Contract Time.
- 1.5.8.3. If a material or Product is specified together with a requirement for performance and it can be shown by the Contractor that the specified material or Product will not achieve the specified performance.
- 1.5.8.4. When a substitution is otherwise advantageous to the Owner or to the execution of the Work as determined by the Consultant.
- 1.5.9. When proposing substitutions, the Contractor shall submit with each application, the material and Product names and complete specifications substantiating compliance of the proposed substitution with the requirements of the Contract Documents, including:
  - 1.5.9.1. Product Identification.
  - 1.5.9.2. Detailed, item by item comparison between the properties and characteristics of the specified material or Product, and the proposed substitution.
  - 1.5.9.3. Manufacturer's name, address, and telephone number.
  - 1.5.9.4. Manufacturer's material or Product literature.
  - 1.5.9.5. Performance, technical and test data.
  - 1.5.9.6. Reference standards.
  - 1.5.9.7. Product limitations.
  - 1.5.9.8. Samples.
  - 1.5.9.9. List of existing installations.
  - 1.5.9.10. Changes to the Contract Time, if any.
  - 1.5.9.11. Changes to the Contract Price if any.
- 1.5.10. In making a request for substitution, the Contractor represents that:
  - 1.5.10.1. The Contractor has personally investigated the proposed Product or method, and has determined that it is equal or superior in all respects to that specified.
  - 1.5.10.2. The Contractor will Provide the same guarantee for the substituted Product or method as for the Product or method specified or indicated;
  - 1.5.10.3. The Contractor will coordinate the installation of an accepted substitution into the Work, making such changes as may be required for the Work to be complete in all respects;
  - 1.5.10.4. The Contractor waives all claims for additional costs related to the substitution; and,
  - 1.5.10.5. The cost data provided by the Contractor as part of the Contractor's substitution proposal is complete and includes all related costs including, but not limited to;
  - 1.5.10.6. Coordination and supervision;
  - 1.5.10.7. Installation and independent inspection and testing;
  - 1.5.10.8. Any change in the cost of other affected areas; and,
  - 1.5.10.9. Costs for any detailed design or related engineering work.
- 1.5.11. Should the proposed substitution be accepted, either in part or in whole, the Contractor assumes full responsibility when the substitution affects any other part of the Work.
- 1.5.12. The Contractor shall ensure that substitutions are accommodated by space allotted for the specified materials, Products, methods or processes.
- 1.5.13. The cost of changes in the work of all Specification Sections necessitated by the use of proposed substitutions will not be considered or approved as a change in the Work and no increase in the Contract Time will be considered or approved.
- 1.5.14. Substitutions that have not been accepted through the process described in this section and are shown on shop drawings, will be rejected, whether or not the shop drawings have been reviewed.
- 1.5.15. Credits arising from accepted substitutions will be credited to the Contract Price by way of a Change Order in accordance with Section 01 26 00.
- 1.5.16. No substitutions will be permitted without prior written recommendation by the Consultant and prior written approval by the Owner, acting reasonably.

- 1.5.17. Substitutions submitted on shop drawings without following requirements of this Section prior to submission of the affected shop drawings will cause the shop drawings to be rejected.
- 1.5.18. Consultant's decision concerning acceptance or rejection of proposed substitutions is final. Should it appear to the Consultant that the value of services required to evaluate the substitution exceeds the potential reduction, the Consultant will advise the Owner that the substitution will produce a reduction commensurate with or exceeding the value of the Consultant's services to evaluate the substitution, the Consultant will request the Owner's direction to proceed with evaluation.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

**From:** \_\_\_\_\_ **RFS No:** \_\_\_\_\_  
**To:** \_\_\_\_\_ *(RFS No. To be completed by Consultant)*  
**Copies:** \_\_\_\_\_ **Issue Date:** \_\_\_\_\_

**Product, Material or Equipment Required of the Contract Documents:**

Specification Section: \_\_\_\_\_ Drawing No./Detail: \_\_\_\_\_  
Description: \_\_\_\_\_

**Requested Substitute Product, Material or Equipment:**

Description: \_\_\_\_\_

Attachments Included: ☐ Drawings ☐ Product Data ☐ Samples ☐ Test Reports  
☐ Other: \_\_\_\_\_

Reason for Substitution: \_\_\_\_\_

Expected Lifespan: \_\_\_\_\_ Warranty Duration \_\_\_\_\_

Maintenance Regime: \_\_\_\_\_

Has this item been used in a similar application? ☐ Yes ☐ No

Describe Application: \_\_\_\_\_  
\_\_\_\_\_

Describe Results: \_\_\_\_\_  
\_\_\_\_\_

Owner Contact and Location: \_\_\_\_\_  
\_\_\_\_\_

**Comparisons of the Specified Item and the Proposed Substitution:**

Compare significant qualities of size, weight, durability, performance and visual effect:

-  
-

Describe any changes required in other elements of the Work to accommodate the proposed substitution, including work performed by the Owner and separate contractors:

-  
-

What effect will the proposed substitution have on the work schedule in comparison to the work schedule without approval of the proposed substitution?

-  
-

Cost comparison of the proposed substitution to the originally specified item, including correlating modifications required to other work:

-  
-

Net cost to the Owner: \_\_\_\_\_

Changes in contract time: \_\_\_\_\_

**Signatures:**

Permission to make any substitution after award of contract shall be effected by Change Order. It shall not relieve the Contractor, any subcontractor, or manufacturer, fabricator, or supplier from the responsibility for any deficiency that may exist in the substituted product or any departures or deviations from the Contract Documents as modified by such Change Order.

Except as otherwise expressly specified by the Contractor in the Request for Substitution and expressly approved in such Change Order, the Contractor shall be deemed to warrant, by his request, that the proposed substitute will satisfy all standards and requirements satisfied by the original product, material or equipment specified and the Change Order shall not be deemed to modify the Contract Documents with respect thereto.

If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work shall be considered as an essential part of the proposed substitution, to be accomplished by the Contractor without additional time or expense to the Owner if and when accepted.

Contractor's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Consultants' Action:**

Consultant's Name: \_\_\_\_\_

Consultant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

☐ Accepted ☐ Rejected ☐ More information required.

Comments: \_\_\_\_\_

\_\_\_\_\_

Consultant's Name: \_\_\_\_\_

Consultant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

☐ Accepted ☐ Rejected ☐ More information required.

Comments: \_\_\_\_\_

\_\_\_\_\_

Consultant's Name: \_\_\_\_\_

Consultant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

☐ Accepted ☐ Rejected ☐ More information required.

Comments: \_\_\_\_\_

\_\_\_\_\_

Consultant's Name: \_\_\_\_\_

Consultant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

☐ Accepted ☐ Rejected ☐ More information required.

Comments: \_\_\_\_\_

\_\_\_\_\_

Consultant's Name: \_\_\_\_\_

Consultant's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

☐ Accepted ☐ Rejected ☐ More information required.

Comments: \_\_\_\_\_

\_\_\_\_\_

**End of Section**

## **1 GENERAL**

### **1.1. General Instructions**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. Section Includes**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Sections
- .4 1.4. Changes
- .5 1.5. Change Order
- .6 1.6. Valuation of Changes and Contractor's Mark-UP
- .7 1.7. Mark-Up for Changes in the Work
- .8 1.8. Delays

### **1.3. Related Sections**

- 1.3.1. Section 01 21 13 Allowances
- 1.3.2. Section 01 25 13 Product Substitution Procedures

### **1.4. Changes**

- 1.4.1. Refer to GC 6.1 of the General Conditions of the Contract.
- 1.4.2. The Owner, through the Consultant, without invalidating the Contract, may make changes in the Work consisting of additions, deletions, or other revisions to the Work by Change Order or a Change Directive.
- 1.4.3. The Contractor shall not perform a change in the Work without a Change Order or a Change Directive.
- 1.4.4. The Consultant will prepare and issue Proposed Change Order, Change Orders, and Change Directives.
- 1.4.5. Communication and correspondence related to all changes shall, at all times, be through the Consultant.

### **1.5. Change Order**

- 1.5.1. Refer to GC 6.2 of the General Conditions of the Contract.
- 1.5.2. When a change in the Work is proposed by the Owner or the Consultant or required by conditions at the Place of the Work or Authorities Having Jurisdiction, the Consultant shall Provide a notice describing the proposed change in the Work to the Contractor, to be known as a Notice of Change.
- 1.5.3. Changes in the Work proposed by the Contractor shall be in accordance with Section 01 25 00. Proposed changes not in accordance with the requirements of Section 01 25 00 shall not be considered.
- 1.5.4. Upon receipt of a Proposed Change Order from the Consultant, the Contractor shall present, in a form acceptable to the Consultant and within ten (10) Working Days of the date on the Proposed Change Order, a method of adjustment or an amount of adjustment for the Contract Price, if any, and the adjustment in the Contract Time, if any, for the proposed change in the Work.
- 1.5.5. Contractor shall number their pricing quotes in one sequence in order submitted to Consultant.
- 1.5.6. Owner and Consultant shall have fifteen (15) working days in which to review and approve Contractor's quotations for changes to the work.
- 1.5.7. When the Owner and the Contractor agree to the adjustments in the Contract Price and Contract Time, or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a Change Order, signed by the Owner and the Contractor. The value of the Work performed as the result



of a Change Order shall be included in applications for progress payment as expenditures.

**1.6. Valuation of Changes and Contractor's Mark-UP**

- 1.6.1. Valuation and the Contractor's mark-up for overhead and profit for changes in the Work shall be calculated in accordance with the provisions of the General Conditions GC 6.2.

**1.7. Mark-Up for Changes in the Work**

- 1.7.1. The mark-ups permitted to be applied to the Contract Price for changes to the Work shall be in accordance with the Supplementary Conditions GC 6.2 of the Contract (CCDC 2 - 2008) as provided.
- 1.7.2. Mark-ups for Changes in the Work shall apply to all extras to the Contract Price in accordance with the Supplementary Conditions GC 6.2 of the Contract (CCDC 2 - 2008) as provided.
- 1.7.3. Mark-ups for Changes in the Work shall only apply to credits to the Contract Price in accordance with the Supplementary Conditions GC 6.2 of the Contract (CCDC 2 - 2008) as provided

**1.8. Delays**

- 1.8.1. In the circumstances there is a delay in the construction schedule, refer to GC 6.5 of the General Conditions of the Contract for procedures and submission requirements.

**2 PRODUCTS**

Not applicable.

**3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. General Instructions**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. Section Includes**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Related Sections
- .4 1.4 Request for Interpretation – RFI

### **1.3. Related Sections**

- 1.3.1. Section 01 21 00 Allowances
- 1.3.2. Section 01 25 00 Product Substitution Procedures

### **1.4. Request for Interpretation – RFI**

- 1.4.1. A request for interpretation (RFI) is a formal process used during the Work to obtain an interpretation of the Contract Documents pursuant to GC 2.2.7 through to GC 2.2.10.
  - 1.4.1.1. An RFI shall not constitute notice of claim for a delay or extra to the Contract Price.
- 1.4.2. Submittal procedures:
  - 1.4.2.1. RFI form:
  - 1.4.2.2. Submit RFI on “Request for Interpretation” form as approved by the Consultant. The Consultant shall not respond to an RFI except as submitted on this form.
  - 1.4.2.3. Where RFI form does not Provide sufficient space for complete information to be provided thereon, attach additional sheets as required.
  - 1.4.2.4. Submit with RFI form necessary supporting documentation. The Consultant shall not respond to an RFI where necessary information is missing, insufficient, unclear, or ambiguous.
  - 1.4.2.5. Submit RFI form as follows:
    - (1) 1 copy digitally in pdf format to the Consultant
    - (2) Submit RFIs sufficiently in advance of affected parts of the Work so as not to cause delay in the performance of the Work. Costs resulting from failure to do this will not be paid by the Owner.
    - (3) RFIs shall be submitted only to the Consultant and copied to the Owner.
    - (4) RFIs shall be submitted only by Contractor. RFIs submitted by Subcontractors or Suppliers shall not be accepted.
    - (5) Number RFIs consecutively in one sequence in order submitted.
    - (6) Submit one distinct RFI per RFI form.
  - 1.4.2.6. RFI log:
    - (1) Maintain log of RFIs sent to and responses received from the Consultant, complete with corresponding dates.
    - (2) Submit updated log of RFIs with each meeting for coordination.
  - 1.4.2.7. Submit RFIs sufficiently in advance of affected parts of the Work so as not to cause delay in the performance of the Work. Costs resulting from failure to do this will not be paid by the Owner.
  - 1.4.2.8. The Consultant shall review RFIs from the Contractor submitted in accordance with this section, with the following understandings:
    - (1) The Consultant’s response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Price or Contract Time or changes in the Work.

- (2) Only the Consultant shall respond to RFIs. Responses to RFIs received from entities other than the Consultant shall not be considered.
- 1.4.3. Allow 10 Working Days for review of each RFI by the Consultant.
- 1.4.3.1. The Consultant's review of RFI commences on date of receipt by the Consultant of RFI submittal and extends to date RFI returned by the Consultant.
- 1.4.3.2. When the RFI submittal is received by the Consultant before noon, review period commences that Day; when RFI submittal is received by the Consultant after noon, review period begins on the next Working Day.
- 1.4.3.3. If, at any time, the Contractor submits a large enough number of RFIs such that the Consultant cannot process these RFIs within 10 Working Days, the Consultant, will confer with the Contractor within 3 Working Day of receipt of such RFIs, and the Consultant and the Contractor will jointly prepare an estimate of the time necessary for processing same as well as an order of priority between the RFIs submitted. The Contractor shall accommodate such necessary time at no increase in the Contract Time and at no additional cost to the Owner.
- 1.4.3.4. When RFI submittal shall be reviewed by one or more of Consultant's subconsultants, increase the review period by 5 Working Days for each separate subconsultant.
- 1.4.4. Contractor shall satisfy itself that an RFI is warranted by undertaking a thorough review of the Contract Documents to determine that the claim, dispute, or other matters in question relating to the performance of the Work or the interpretation of the Contract Documents cannot be resolved by direct reference to the Contract Documents. Contractor shall describe in detail this review on the RFI form as part of the RFI submission. RFI submittals that lack such detailed review description, or where the detail provided is, in the opinion of the Consultant, insufficient, shall not be reviewed by the Consultant and shall be rejected.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 General**

### **1.1 General Instructions**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2 References**

- 1.2.1. Canadian Construction Documents Committee (CCDC);
- 1.2.2. CCDC 2-2008, Stipulated Price Contract;
- 1.2.3. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.2.4. Construction Act.

### **1.3 Applications for Progress Payment**

- 1.3.1. Refer to CCDC 2 2008.
- 1.3.2. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.3.3. Make applications for payment on account, as per this Section, as Work progresses.
- 1.3.4. Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- 1.3.5. Submit to Consultant, at least fourteen (14) days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

### **1.4 Schedule of Values**

- 1.4.1. Refer to CCDC 2 2008.
- 1.4.2. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.4.3. Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.
- 1.4.4. Include statement based on schedule of values with each application for payment.
- 1.4.5. Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require establishing value and delivery of products.

### **1.5 Preparing Schedule of Unit Price Table Items**

- 1.5.1. Submit separate schedule of unit price items of Work requested in Bid form.
- 1.5.2. Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
  - 1.5.2.1. Cost of material;
  - 1.5.2.2. Delivery and unloading at site;
  - 1.5.2.3. Sales taxes;
  - 1.5.2.4. Installation, overhead and profit;
  - 1.5.2.5. Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

### **1.6 Progress Payment**

- 1.6.1. Refer to CCDC 2 2008.
- 1.6.2. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.6.3. After a Consultant receives a Contractor's proper invoice, the Consultant will issue to Owner an Application for Payment Form no later than 14 days after receipt of the Contractor's proper invoice. The Application for Payment will be in amount applied for by the Contractor or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing reasons for amendment.

### **1.7 Substantial Performance of Work**

- 1.7.1. Refer to CCDC 2 2008.
- 1.7.2. Amendments to CCDC 2 -2008 - Supplemental Conditions

- 1.7.3. Prepare and submit to Consultant comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Owner agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.
- 1.7.4. No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- 1.7.5. Consultant: state date of Substantial Performance of Work or designated portion of Work in certificate.
- 1.7.6. Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work.

**1.8. Payment of Holdback Upon Substantial Performance of Work**

- 1.8.1. Refer to CCDC 2 2008.
- 1.8.2. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.8.3. After issuance of certificate of Substantial Performance of Work:
  - 1.8.3.1. Submit application for payment of holdback amount.
  - 1.8.3.2. Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
- 1.8.4. After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.
- 1.8.5. Where holdback amount has not been placed in a separate holdback account, Owner shall, 10 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.
- 1.8.6. Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third-party monetary claims against Contractor which are enforceable against Owner.

**1.9. Final Payment**

- 1.9.1. Refer to CCDC 2 2008, GC 5.7.
- 1.9.2. Amendments to CCDC 2 -2008 - Supplemental Conditions
- 1.9.3. Submit application for final payment when Work is completed.
- 1.9.4. After a Consultant receives a Contractor's proper invoice, the Consultant will issue to Owner an Application for Payment Form no later than 14 days after receipt of the Contractor's proper invoice. The Application for Payment will be in amount applied for by the Contractor or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing reasons for amendment.
- 1.9.5. Consultant will issue final certificate for payment when application for final payment is found valid.

**2 Products – Not Applicable to this Section**

**3 Execution – Not Applicable to this Section**

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Schedule Of Values
- .4 1.4 Form Of Submittal
- .5 1.5 Cash Flow Schedule
- .6 1.6 Review And Re-Submittal

### **1.3. SCHEDULE OF VALUES**

- 1.3.1. Submit a Schedule of Values to the Consultant at least 14 days prior to submitting first Application for Payment.
  - 1.3.1.1. For item 01 77 00, Project Manuals, Warranties and As Built Drawings, the Contractor is required to carry a value 2% of the Contract Price in accordance with section 01 77 00.
  - 1.3.1.2. Division 1 – General Conditions shall be broken down. Lump Sum Values shall not be accepted and shall not be used for contract modifications or Delays.
  - 1.3.1.3. General Contract shall provide a line item for Fire Stopping Manual as described in 07 84 00 Firestopping and Smoke Seals.
- 1.3.2. Upon request by Consultant, support values given with data that will substantiate their correctness.
- 1.3.3. Submit quantities of designated materials.
- 1.3.4. Refer to the General Conditions of the contract for details of payment procedure.
- 1.3.5. Schedule of Values shall be used only as basis for Contractor's Application for payment.
- 1.3.6. Refer to same schedule of values for sample breakdown requirements. GC is required to provide in detail the separation between Labour and Material costs as illustrated.

### **1.4. FORM OF SUBMITTAL**

- 1.4.1. Submit Schedule of Values in accordance with this section and the General Conditions of the contractor for Proper Invoice submissions at the end of each month.
- 1.4.2. With the submission of the initial Schedule of Values, Contractor shall submit an initial Cash Flow Projection for the project. With each Application for Payment, Contractor shall submit an updated Cash Flow projection.

### **1.5. CASH FLOW SCHEDULE**

- 1.5.1. Prior to commencement of the Work, submit a detailed cash flow projection schedule indicating anticipated billings on a month-by-month basis for duration of the Work, including timing of holdback release.
- 1.5.2. Update cash flow schedule monthly, recording cumulative as well as monthly totals.

### **1.6. REVIEW AND RE-SUBMITTAL**

- 1.6.1. After review by Consultant, revise and resubmit Schedule (and Working Schedule of Material Values), as required.
- 1.6.2. Resubmit revised schedule in same manner.

**END OF SECTION**

## CERTIFICATE REVIEW

GENERAL CONDITIONS		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 1 GENERAL CONDITIONS												
1	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
1.01	Insurance & Bonding	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.02	Mobilization	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.03	General Conditions Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.04	General Conditions Material & Equipments	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.05	Final Cleaning	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.06	Temporary Protection	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.07	Temporary Fencing	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.08	Perimeter Barricades	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.09	Winter Protection Allowance	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.10	Snow Removal	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.11	Site Safety	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.12	Temporary Access	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.13	Cleanup	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.14	Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.15	TBD	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.16	TBD	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.17	Architectural Close Out Documents - Submission 1	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.18	Architectural Close Out Documents - Submission 2	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.19	Architectural As Built Documents - Submission 1	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
1.20	Architectural As Built Documents - Submission 2	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 1 General Conditions subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
SITE IMPROVEMENTS		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 31 EARTHWORK												
2	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
2.01	Site Mobilization	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.02	Clearing and Grubbing	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.03	Site Fencing	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.04	Strip Site of Topsoil and Dispose of Excess	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.05	Site: Excavate, Cut, Fill & Compact to Subgrade & Dispose	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.06	Building: Excavate Footings & Walls, Dispose of Exc. Materials	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.07	Backfill for Footings and Walls with Granular B	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.08	Spread Stone to U/S of SOG	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
2.09	Site Grading	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 31 Earthwork subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 32 EXTERIOR IMPROVEMENTS												
3	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
3.01	Mud Mat	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.02	Erosion Sediment Control	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.03	Asphalt Paving	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.04	Traffic Line Painting	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.05	Concrete Paving	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.06	Landscaping	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.07	Site Furnishings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.08	Retaining Wall	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
3.09	Chainlink and Composite Fences	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 32 Exterior Improvements subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 33 SITE SERVICES												
4	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
4.01	Site Mobilization	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
4.02	Shop Drawings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
4.03	Water Services	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
4.04	Sanitary Services	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
4.05	Storm Services	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 33 Site Services subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
ARCHITECTURAL / STRUCTURAL		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 3 - CONCRETE												
5	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
5.01	Concrete Formwork - Foundation and Footings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
5.02	Concrete Reinforcing Install - Foundation and Footings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
5.03	Concrete Reinforcing Supply - Foundation and Footings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
5.04	Concrete Reinforcing Install - Slab on Grade	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-



DOCUMENT	APPLICATION FOR PAYMENT #	12116	PROJECT	OWNER	ARCHITECT	CONTRACTOR
01 29 73	0	TBD	TBD		DPAI Architecture Inc.	TBD
	FOR PERIOD ENDING	TBD	TBD		25 Main St W Suite 1800	TBD
	FEBRUARY	TBD	TBD		Hamilton, ON L8P 1H1	TBD

## CERTIFICATE REVIEW

5.05	Concrete Reinforcing Supply - Slab on Grade	\$	-	0.0%	\$	-	\$	-	\$	-
5.06	Cast in Place Concrete Supply - Foundation and Footings	\$	-	0.0%	\$	-	\$	-	\$	-
5.07	Cast in Place Concrete Supply - Slab on Grade	\$	-	0.0%	\$	-	\$	-	\$	-
5.08	Precast Concrete Hollow Core Planks	\$	-	0.0%	\$	-	\$	-	\$	-
5.09	Architectural Precast Concrete Cladding	\$	-	0.0%	\$	-	\$	-	\$	-
5.10	Concrete Sealer	\$	-	0.0%	\$	-	\$	-	\$	-
5.11	Concrete Finishing	\$	-	0.0%	\$	-	\$	-	\$	-
Division 3 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
DIVISION 4 - MASONRY										
6	DESCRIPTION	VALUE		% COMPLETED	COMPLETED		PREVIOUS		CURRENT DRAW	BALANCE TO COMPLETE
6.01	Brick Masonry Install	\$	-	0.0%	\$	-	\$	-	\$	-
6.02	AVB & Insulation	\$	-	0.0%	\$	-	\$	-	\$	-
6.03	Concrete Block Masonry Interior	\$	-	0.0%	\$	-	\$	-	\$	-
6.04	Concrete Block Masonry Exterior	\$	-	0.0%	\$	-	\$	-	\$	-
Division 4 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
DIVISION 5 - METALS										
7	DESCRIPTION	VALUE		% COMPLETED	COMPLETED		PREVIOUS		CURRENT DRAW	BALANCE TO COMPLETE
7.01	Structural Steel Supply	\$	-	0.0%	\$	-	\$	-	\$	-
7.02	Structural Steel Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.03	OWSJ Supply	\$	-	0.0%	\$	-	\$	-	\$	-
7.04	OWSJ Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.05	Steel Roof Decking Material	\$	-	0.0%	\$	-	\$	-	\$	-
7.06	Steel Roof Decking Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.07	Steel Floor Decking Material	\$	-	0.0%	\$	-	\$	-	\$	-
7.08	Steel Floor Decking Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.09	Roof Ladder and Guard Rails	\$	-	0.0%	\$	-	\$	-	\$	-
7.10	Cold-Formed Metal Structural Stud - Material	\$	-	0.0%	\$	-	\$	-	\$	-
7.11	Cold-Formed Metal Structural Stud - Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.12	Metal Fabrications / Miscellaneous Material	\$	-	0.0%	\$	-	\$	-	\$	-
7.13	Metal Fabrications / Miscellaneous Labour	\$	-	0.0%	\$	-	\$	-	\$	-
7.14	Bollard Covers	\$	-	0.0%	\$	-	\$	-	\$	-
7.15	Glass Railing Systems - Material	\$	-	0.0%	\$	-	\$	-	\$	-
7.16	Glass Railing Systems - Labour	\$	-	0.0%	\$	-	\$	-	\$	-
Division 5 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
DIVISION 6 - Woods, Plastics										
8	DESCRIPTION	VALUE		% COMPLETED	COMPLETED		PREVIOUS		CURRENT DRAW	BALANCE TO COMPLETE
8.01	Rough Carpentry / Blocking	\$	-	0.0%	\$	-	\$	-	\$	-
8.02	Architectural Wood Work Fabrication & Material	\$	-	0.0%	\$	-	\$	-	\$	-
8.03	Architectural Wood Work Labour	\$	-	0.0%	\$	-	\$	-	\$	-
8.04	Countertop / Solid Surface Sills	\$	-	0.0%	\$	-	\$	-	\$	-
Division 6 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
DIVISION 7 - Thermal & Moisture Protection										
9	DESCRIPTION	VALUE		% COMPLETED	COMPLETED		PREVIOUS		CURRENT DRAW	BALANCE TO COMPLETE
9.01	Sheet Waterproofing	\$	-	0.0%	\$	-	\$	-	\$	-
9.02	Cavity Wall Thermal Insulation	\$	-	0.0%	\$	-	\$	-	\$	-
9.03	Below Grade Thermal Insulation - Slab & Foundation Wall	\$	-	0.0%	\$	-	\$	-	\$	-
9.04	Above Grade Vapour Barrier	\$	-	0.0%	\$	-	\$	-	\$	-
9.05	Below Grade Vapour Barrier	\$	-	0.0%	\$	-	\$	-	\$	-
9.06	Aluminum Panel Cladding - Panel Material	\$	-	0.0%	\$	-	\$	-	\$	-
9.07	Aluminum Panel Cladding - Panel Labour	\$	-	0.0%	\$	-	\$	-	\$	-
9.08	Aluminum Panel Cladding - Insulation Material	\$	-	0.0%	\$	-	\$	-	\$	-
9.09	Aluminum Panel Cladding - Insulation Labour	\$	-	0.0%	\$	-	\$	-	\$	-
9.10	Metal Cladding System - Soffit Material	\$	-	0.0%	\$	-	\$	-	\$	-
9.11	Metal Cladding System - Soffit Labour	\$	-	0.0%	\$	-	\$	-	\$	-
9.12	SBS Modified Bituminous Membrane Roofing	\$	-	0.0%	\$	-	\$	-	\$	-
9.13	SBS Modified Bituminous Membrane Roofing - Insulation	\$	-	0.0%	\$	-	\$	-	\$	-
9.14	Roofing Pavers	\$	-	0.0%	\$	-	\$	-	\$	-
9.15	Metal Flashing	\$	-	0.0%	\$	-	\$	-	\$	-
9.16	Roof Anchor Line	\$	-	0.0%	\$	-	\$	-	\$	-
9.17	Sprayed Fire-Resistive Materials (SFRM)	\$	-	0.0%	\$	-	\$	-	\$	-
9.18	Firestopping and Smoke Seals	\$	-	0.0%	\$	-	\$	-	\$	-
9.19	Joint Sealants	\$	-	0.0%	\$	-	\$	-	\$	-
Division 7 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-
DIVISION 8 - Openings										
10	DESCRIPTION	VALUE		% COMPLETED	COMPLETED		PREVIOUS		CURRENT DRAW	BALANCE TO COMPLETE
10.01	Steel Doors and Frames - Supply	\$	-	0.0%	\$	-	\$	-	\$	-
10.02	Steel Doors and Frames - Install	\$	-	0.0%	\$	-	\$	-	\$	-
10.03	Rolling Grilles	\$	-	0.0%	\$	-	\$	-	\$	-
10.04	Rolling Fire Doors	\$	-	0.0%	\$	-	\$	-	\$	-

DOCUMENT	APPLICATION FOR PAYMENT #	12116	PROJECT	OWNER	ARCHITECT	CONTRACTOR
0129 73	0	TBD	TBD		DPAI Architecture Inc.	TBD
	FOR PERIOD ENDING	TBD	TBD		25 Main St W Suite 1800	TBD
	FEBRUARY	TBD	TBD		Hamilton, ON L8P 1H1	TBD

## CERTIFICATE REVIEW

10.05	Four Fold Metal Doors	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
10.06	Sectional Overhead Metal Doors	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
10.07	Aluminum Framed Glazing Systems c/w Glass	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
10.08	Door Hardware - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
10.09	Door Hardware - Install	\$	-	5.0%	\$	-	\$	-	\$	-	\$	-
10.10	Architectural Louvers	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 8 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 9 - Finishes												
11	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
11.01	Drywall & Framing Ceilings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.02	Drywall & Framing Partitions	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.03	Tiling - Floor	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.04	Tiling - Wall	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.05	Acoustical Tile Ceiling Systems	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.06	Rubber Base	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.07	Rubber Tile Flooring	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.08	Carpet Tile	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
11.09	Painting	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 9 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 10 - Specialties												
12	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
12.01	Visual Display Surfaces	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.02	Interior Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.03	Washroom Partitions	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.04	Corner Guards	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.05	Washroom Accessories & Janitor Accessories	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.06	Turnout Gear Lockers - Wall Mounted	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.07	Prefinished Metal Lockers	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.08	Exterior Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.09	Traffic Signage	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.10	Metal Shelving	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
12.11	Flagpoles	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 10 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 11 - Equipment												
13	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
13.01	Projection Screens	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 11 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 12 - Furnishings												
14	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
14.01	Roller Window Shades	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
14.02	Entrance Floor Grilles Supply	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
14.03	Entrance Floor Grilles Install	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
14.04	Murphy Bed Mattresses	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 12 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 14 - Conveying Equipment												
15	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
15.01	Elevator	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 14 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
MECHANICAL												
		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 21 - Fire Suppression System												
16	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
16.01	Sprinkler System	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
16.02	Fire Extinguishers	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
16.03	Manuals/Documentation/As-builts	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
Division 21 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
DIVISION 22 - PLUMBING												
17	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE					
17.01	Mechanical Shop Drawings	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
17.02	Mobilization	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
17.03	Equipment Rental	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
17.04	Underslab Plumbing Drainage - Material	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-
17.05	Underslab Plumbing Drainage - Labour	\$	-	0.0%	\$	-	\$	-	\$	-	\$	-

DOCUMENT	APPLICATION FOR PAYMENT #	12116	PROJECT	OWNER	ARCHITECT	CONTRACTOR
01 29 73	0	TBD	TBD		DPAI Architecture Inc.	TBD
	FOR PERIOD ENDING	TBD	TBD		25 Main St W Suite 1800	TBD
	FEBRUARY	TBD	TBD		Hamilton, ON L8P 1H1	TBD

## CERTIFICATE REVIEW

17.06	Above Ground Plumbing Drainage - Material	\$	-	0.0%	\$	-	\$	-	\$	-
17.07	Above Ground Plumbing Drainage - Labour	\$	-	0.0%	\$	-	\$	-	\$	-
17.08	Domestic Water Piping - Material	\$	-	0.0%	\$	-	\$	-	\$	-
17.09	Domestic Water Piping - Labour	\$	-	0.0%	\$	-	\$	-	\$	-
17.10	Gas Piping / Gas Connections	\$	-	0.0%	\$	-	\$	-	\$	-
17.11	Plumbing Fixtures / Specialties	\$	-	0.0%	\$	-	\$	-	\$	-
17.12	Plumbing Equipment	\$	-	0.0%	\$	-	\$	-	\$	-
17.13	Refrigeration Piping Labour & Material	\$	-	0.0%	\$	-	\$	-	\$	-
17.14	Vibration Isolation / Seismic	\$	-	0.0%	\$	-	\$	-	\$	-
17.15	Sleeving / Fire Stopping	\$	-	0.0%	\$	-	\$	-	\$	-
17.16	Precast Trench Drains Supply	\$	-	0.0%	\$	-	\$	-	\$	-
17.17	Commissioning & Start-Up	\$	-	0.0%	\$	-	\$	-	\$	-
17.18	Mechanical Close Out Documents - Submission 1	\$	-	0.0%	\$	-	\$	-	\$	-
17.19	Mechanical Close Out Documents - Submission 2	\$	-	0.0%	\$	-	\$	-	\$	-
17.20	Mechanical As Built Documents - Submission 1	\$	-	0.0%	\$	-	\$	-	\$	-
Division 22 subtotal:		\$	-	0.0%	\$	-	\$	-	\$	-

## DIVISION 23 - HVAC

18	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE
18.01	Vehicle Exhaust Extraction Systems	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.02	Mechanical Equipment Supply (FC, RTU, Split S, ERV)	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.03	Mechanical Equipment Install (FC, RTU, Split S, ERV)	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.04	Mechanical Equipment Supply (IRH)	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.05	Mechanical Equipment Install (IRH)	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.06	Gas Piping Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.07	Gas Piping Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.08	Duct Work - Sheet Metal Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.09	Duct Work - Sheet Metal Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.10	Refrigeration Piping	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.11	Insulation Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.12	Insulation Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.13	Packaged Exhaust Fans	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.14	Grilles, Diffusers, and Registers	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
18.15	Seismic Restraints	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
Division 23 subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -

## DIVISION 25 - INTEGRATED AUTOMATION

19	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE
19.01	Building Automation Controls Materials	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
19.02	Building Automation Control Install	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
19.03	Building Automation Training	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
Division 25 subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -

ELECTRICAL	\$	-	0.0%	\$	-	\$	-	\$	-
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## DIVISION 26 - ELECTRICAL

20	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE
20.01	Mobilization and ESA Notifications	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.02	ESA Inspections	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.03	Duct Bank - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.04	Duct Bank - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.05	Metering - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.06	Metering - Install	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.07	Generator - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.08	Generator - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.09	Exterior Light Fixtures - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.10	Exterior Light Fixtures - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.11	Interior Light Fixtures - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.12	Interior Light Fixtures - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.13	Device Rough-in - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.14	Device Rough-in - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.15	Branch Conduit - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.16	Branch Conduit - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.17	Branch Wiring - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.18	Branch Wiring - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.19	Distribution Equipment - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.20	Distribution Equipment - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.21	Fire Alarm - Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.22	Fire Alarm - Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.23	Testing, Adjusting, and Commissioning	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
20.24	Manuals/Documentation/As-builts	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -
Division 26 subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -

## DIVISION 27 - COMMUNICATIONS

21	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE
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DOCUMENT	APPLICATION FOR PAYMENT #	12116	PROJECT	OWNER	ARCHITECT	CONTRACTOR
01 29 73	0	TBD	TBD	DPAI Architecture Inc.	TBD	
	FOR PERIOD ENDING	TBD	TBD	25 Main St W Suite 1800	TBD	
	FEBRUARY	TBD	TBD	Hamilton, ON L8P 1H1	TBD	

## CERTIFICATE REVIEW

21.01	None	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	\$ -
Division 27 subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	\$ -
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY								
22	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE	
22.01	Security Material	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
22.02	Security Labour	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
Division 28 subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CASH ALLOWANCE								
CASH ALLOWANCE		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CA	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE	
1	TBD	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
2	TBD	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
3	TBD	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
4	TBD	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CASH ALLOWANCE subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CHANGE ORDERS								
CHANGE ORDERS		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CO	DESCRIPTION	VALUE	% COMPLETED	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE	
CO 1	TBD	\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-
CHANGE ORDER subtotal:		\$ -	0.0%	\$ -	\$ -	\$ -	\$ -	-

	CONTRACT AMOUNT	% TO DATE	COMPLETED	PREVIOUS	CURRENT DRAW	BALANCE TO COMPLETE
Sub Total	-	0%	-	-	-	-
HST at 13%	-					
Total Contract	-					
Deficiency retainage			\$0.00			
Basic holdback of		10%	\$0.00			
Finishing holdback of		10%				
Current work less holdbacks			\$0.00			
Holdback previously released			\$0.00			
Holdback released this issue			\$0.00			
Total holdback released			\$0.00			
Payable to date			\$0.00			
Previously payable			\$0.00			
Payable this issue						
HST payable		13%				

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- 1.1 General Instructions
- 1.2 Section Includes
- 1.3 Interference Drawings
- 1.4 Cooperation and Coordination

### **1.3. INTERFERENCE DRAWINGS**

- 1.3.1. Before commencing any work, the General Contractor, along with their trade contractors, shall prepare working/interference drawings, to ensure that all components are to be properly accommodated within the spaces provided, ensuring all clearances required by jurisdictional authorities and for proper maintenance are indicated and maintained.
- 1.3.2. Schedule meetings on site with all associated trades to review all interference areas until all issues have been coordinated and required interference drawings issued.
- 1.3.3. Prepare drawings to indicate coordination and method of installation of a mechanical system with sprinkler, electrical, structural and other systems where their relationship is critical. Ensure all details of equipment, apparatus and connections are coordinated.
- 1.3.4. The General Contractor shall provide interference drawings prepared by their Mechanical, Sprinkler and Electrical subtrades. Drawings are to be red-line markups scanned to PDF Format and shall indicate any perceived interference between mechanical, sprinkler, structural, and electrical work and the work of all other Divisions along with proposed solution to such interference.
- 1.3.5. Failure to coordinate with all other trades could result in reworking of installed equipment, piping or ducting at the discretion of the Consultant. Any reworking to accommodate the installation of other trades is to be performed at no extra cost to the Owner.
- 1.3.6. All interference drawings shall be submitted and approved prior to the second Certificate of Payment being released.

### **1.4. COOPERATION AND COORDINATION**

- 1.4.1. Cooperate and coordinate with other trades as required, for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to, or inserted in work, and set in place or instruct related trades as to their location. Pay cost of extra work caused by and make up time lost, as a result of failure to provide inadequate time, the necessary cooperative information of items to be fixed to, or built in.
- 1.4.2. Provide the Work in accordance with the Contract Documents and be responsible for delays or costs resulting from failure to properly inspect or coordinate the Work, and for replacement or corrective work required.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Language Of The Contract
- .4 1.4. General
- .5 1.5. Identification Of Systems
- .6 1.6. Related Mechanical And Electrical Work
- .7 1.7. Quality Assurance
- .8 1.8. Commissioning And Systems Demonstrations
- .9 1.9. Superintendence
- .10 1.10. Dimensions
- .11 1.11. Submittals
- .12 1.12. Product Delivery, Storage And Handling
- .13 1.13. Job Conditions
- .14 1.14. Warranties
- .15 1.15. Coordination
- .16 1.16. Building Dimension, Templates, Built-Ins, And Coordination
- .17 1.17. Project Record Drawings
- .18 1.18. Detail Finish Drawings
- .19 1.19. Cutting And Patching

### **1.3. LANGUAGE OF THE CONTRACT**

- 1.3.1. The use of the words "include" or "including", or variations thereof, within the *Contract Documents* is not limiting.

### **1.4. GENERAL**

- 1.4.1. Provide the Work in accordance with the Contract Documents and be responsible for delays or costs resulting from failure to properly inspect or coordinate the Work, and for replacement or corrective work required.
- 1.4.2. Coordination of the work of all Sections of the Specification is the responsibility of the Contractor.
- 1.4.3. The Contractor will be deemed to possess the necessary technical skills to carefully evaluate all requirements of the Contract, and to have included in the price all costs for the proper implementation of these requirements.
- 1.4.4. The Contractor's responsibility includes, but is not restricted to, coordination specified in this Section, except where otherwise specified.

### **1.5. IDENTIFICATION OF SYSTEMS**

- 1.5.1. Provide identification of electrical and mechanical system installations and other automated systems or equipment in compliance with Contract Documents.

### **1.6. RELATED MECHANICAL AND ELECTRICAL WORK**

- 1.6.1. Coordination of the installation of systems specified in Divisions 20 & 26, including the interrelating operation and functioning between components of a system and between systems, is the responsibility of those performing the work of Divisions 20 & 26, with final coordination the responsibility of the Contractor.
- 1.6.2. Provide interference drawings as herein specified to ensure proper co-ordination of subtrade work. No extras will be considered for work not properly coordinated prior to installation.

- 1.6.3. Ensure that service poles, pipes, conduit, wires, fill-pipes, vents, regulators, meters and similar Project service work is located in inconspicuous locations. If not indicated on drawings, verify location of service work with Consultant before commencing installation.

#### **1.7. QUALITY ASSURANCE**

- 1.7.1. Requirements of Regulatory Agencies
  - 1.7.1.1. Coordinate requirements of authorities having jurisdiction
- 1.7.2. Quality Control
  - 1.1.1.1. Ensure that work meets specified requirements.
  - 1.7.2.1. Schedule, supervise and coordinate inspection and testing as specified in Section 01 45 00.
- 1.7.3. Job Records
  - 1.1.1.2. Maintain job records and ensure that such records are maintained by Sub-Contractors.

#### **1.8. COMMISSIONING AND SYSTEMS DEMONSTRATIONS**

- 1.8.1. Provide testing, adjusting, balancing and certification and commissioning of mechanical and electrical installations and other automated systems or equipment in accordance with Section 01 77 00.
- 1.8.2. Instruct Owner's designated representatives in operation and maintenance of mechanical and electrical installations and other automated systems or equipment, in accordance with Section 01 77 00.

#### **1.9. SUPERINTENDENCE**

- 1.9.1. The Contractor shall Provide superintendent and necessary supporting staff personnel who shall be in attendance at the Place of the Work while Work is being performed, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
  - 1.9.1.1. The Contractor shall Provide a qualified superintendent to supervise the Work at all times.
- 1.9.2. The Contractor shall appoint a superintendent at the Place of the Work who shall have overall authority at the Place of the Work and shall speak for the Contractor and represent the Contractor's interest and responsibilities at meetings at the Place of the Work and in dealings with the Consultant and the Owner.
- 1.9.3. Supervise, direct, manage and control the work of all the forces carrying out the work, including Sub-Contractors and Suppliers. Carry out daily inspections to ensure compliance with the Contract Documents and the maintenance of quality standards. Ensure that the supervisory staff includes personnel competent in supervising all Sections of Work required.
- 1.9.4. Arrange for sufficient number of qualified assistants to the supervisor as required for the proper and efficient execution of the Work.

#### **1.10. DIMENSIONS**

- 1.10.1. Verify dimensions at the Place of the Work before commencing shop drawings. Before fabrication commences report discrepancies to Consultant in writing. Incorporate accepted variances on shop drawings and as-built records.

#### **1.11. SUBMITTALS**

- 1.11.1. Provide a complete set of all required Contract Documents, together with instructions for changes to the work which are issued, to each firm preparing shop drawings.
- 1.11.2. Schedule and expedite submission of specified submittals.
- 1.11.3. Review submittals and make comments as specified in Section 01 33 00.
- 1.11.4. Ensure that each original submission, and their subsequent revisions and resubmissions are made on schedule.

#### **1.12. PRODUCT DELIVERY, STORAGE AND HANDLING**

- 1.12.1. It is the responsibility of the Contractor to ensure that the supplier or distributor of materials specified or accepted alternatives, which have been bid, has materials on the site when required. The Contractor shall obtain confirmed delivery dates from the supplier and ensure no delay in the progress of the work.
- 1.12.2. Provide equipment delivery schedule, coordinated with construction and submittals schedule, showing delivery dates for major and/or critical equipment. Provide delivery access and unloading areas.
- 1.12.3. Make available areas for storage of products and construction equipment to meet specified requirements, and to ensure a minimum of interference with progress of the work and relocation.
- 1.12.4. Make access available for transference of stored products and equipment to work areas.
- 1.12.5. The Contractor shall contact the Consultant immediately upon receipt of information indicating that any material or item, will not be available on time, in accordance with the original schedule, and similarly it shall be the responsibility of all Sub-Contractors and Suppliers to so inform the Contractor.
- 1.12.6. The Consultant reserves the right to receive from the Contractor at any time, upon request, copies of actual purchase or work orders of any material or products to be supplied for the work.
- 1.12.7. If materials and products have not been placed on order, the Consultant may instruct such items to be placed on order, if direct communication in writing from the manufacturer or prime suppliers is not available indicating that delivery of said material will be made in sufficient time for the orderly completion of the Work.
- 1.12.8. The Consultant's review of purchase orders or other related documentation shall in no way release the Contractor, or his Sub-Contractors and Suppliers from their responsibility for ensuring the timely ordering of all materials and items required, including the necessary expediting, to complete the work as scheduled in accordance with the Contract Documents.

#### **1.13. JOB CONDITIONS**

- 1.13.1. Ensure that conditions within the building are maintained and that work proceeds under conditions meeting specified environmental requirements.
- 1.13.2. Ensure that protection of adjacent property and the work is adequately provided and maintained to meet specified requirements.

#### **1.14. WARRANTIES**

- 1.14.1. Ensure that warranties are provided, as indicated in Section 01 78 36 Warranties.
- 1.14.2. Coordinate warranty conditions of interconnected work to ensure that full coverage is obtained.

#### **1.15. COORDINATION**

- 1.15.1. Coordinate and ensure workers, Subcontractors, and Suppliers cooperate to ensure that the Work will be carried out expeditiously and in proper sequence.
- 1.15.2. Make adjustments to allow adjustable work fit to fixed work.
- 1.15.3. Review Contract Documents and advise the Consultant of possible conflicts between parts of the work before preparation of shop drawings, ordering of products or commencement of affected work.
- 1.15.4. Coordinate and be responsible for layout of all work in each area and work on which subsequent work depends to facilitate mutual progress, and to prevent conflict between parts of the work.
- 1.15.5. No addition to the Total Price will be allowed because of interference between the parts of the work of a trade or between the work of different trades unless such interference was brought to the attention of the Consultant in writing prior to the start of Construction.
- 1.15.6. Ensure that each Section makes known, for the information of the Contractor and other Sections, the environmental and surface conditions required for the execution of its work;



- and that each Section makes known the sequences of others' work required for installation of its work.
- 1.15.7. Ensure that each Section, before commencing work, knows that requirements for subsequent work and that each Section is assisted in the execution of its preparatory work by Sections whose work depends upon it.
  - 1.15.8. Ensure that work to be enclosed within ceiling and/or wall spaces can be so accommodated without interference and with other parts of the work.
  - 1.15.9. Ensure that setting drawings, templates, and all other information necessary for the location and installation of materials, holes, sleeves, inserts, anchors, accessories, fastenings, connections, and access panels are provided by each Section whose work requires co-operative location and installation by other Sections, and that such information is communicated to the applicable installer.
  - 1.15.10. Deliver materials supplied by one Section to be installed by another well before the installation begins, as per Construction Progress Schedule.
  - 1.15.11. Sections giving installation information in error, or too late to incorporate in the work, shall be responsible for having additional work done which is thereby made necessary.
  - 1.15.12. Remove and replace work installed in error which is unsatisfactory for subsequent work.
  - 1.15.13. Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.
  - 1.15.14. Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.
  - 1.15.15. Ensure that clearance required by authorities having jurisdiction and for proper maintenance are indicated on Drawings.
  - 1.15.16. Distribute coordination drawings well in advance of fabrication and installation of work affected. Place no order for affected equipment without submission of coordination drawings to the supplier.

**1.16. BUILDING DIMENSION, TEMPLATES, BUILT-INS, AND COORDINATION**

- 1.16.1. Take necessary dimensions for the proper execution of the Work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for coordination.
- 1.16.2. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the Work and set in place or instruct separate Subcontractors as to their location.
- 1.16.3. Supply items to be built in, as and when required together with templates, measurements, shop drawings and other related information and assistance.
- 1.16.4. Pay the cost of extra work and make up time lost as a result of failure to Provide necessary information and items to be built in.
- 1.16.5. Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the Contract Documents, and ensure that work installed in error is rectified before construction resumes.
- 1.16.6. Check and verify dimensions referring to interfacing of services. Verify such dimensions with interconnected portions of the Work.
- 1.16.7. Do not scale directly from drawings. Obtain clarification from Consultant if there is ambiguity or lack of information.
- 1.16.8. Details and measurements of any work which is to fit or to conform with work installed shall be taken at the Place of the Work.
- 1.16.9. Advise Consultant of discrepancies and omissions in the Contract Documents, that affect aesthetics, or that interfere with services, equipment or surfaces. Do not proceed with work affected by such items without clarification from Consultant.
- 1.16.10. Prepare and submit setting drawings, templates and other information necessary for the location and installation of material, holes, sleeves, inserts, anchors, accessories, fastenings, connections and access panels, in accordance with Section 01 33 00.

- 1.16.11. Subcontractors shall direct related Subcontractors on site of specific locations required for sleeves and openings. The Contractor shall be responsible for coordinating such activity to ensure no interruption in the progress of the Work.
- 1.16.12. Prepare interference drawings to properly coordinate the Work, where necessitated, in accordance with Section 01 33 00.

#### **1.17. PROJECT RECORD DRAWINGS**

- 1.17.1. Record, as the work progresses, work constructed differently than shown on Contract Documents. Record all changes in the work caused by site conditions; by Owner, Consultant, Sub-Consultants, Contractor, and Sub-Contractor originated changes; and by site instructions, supplementary instructions, field orders, change orders, addendums, correspondence, and directions of authorities having jurisdiction. Accurately record location of concealed structure, and mechanical and electrical services, piping, valves, conduits, pull boxes, junction boxes and similar work not clearly in view, the position of which is required for maintenance, alteration work, and future additions. Do not conceal critical work until its location has been recorded.
- 1.17.2. Dimension location of concealed work in reference to building walls, and elevation in reference to floor elevation. Indicate at which point dimension is taken to concealed work. Dimension all terminations and offset of runs of concealed work.
- 1.17.3. Make records in a neat and legibly printed manner with a non-smudging medium.
- 1.17.4. Identify each record drawing as "Project Record Copy". Maintain drawings in good condition and do not use them for construction purposes.
- 1.17.5. After completion of the work, purchase a complete set of white prints from the Consultant and transfer the information recorded on the white prints accurately, neatly in red ink with dimensions, as applicable. Return these marked-up as-built white prints plus two additional sets of white prints to the Consultant for his review. Any subsequent changes found by the Consultant shall remain the responsibility of the Contractor and new white prints will be issued for these changes and resubmitted back to the Consultant at no charge to the Owner.
- 1.17.6. Maintain Project Record Drawings in a state current to Project. Such state will be considered a condition precedent for validation of applications for payment. The Consultant's visual inspection will constitute proof that the record drawings are current.
- 1.17.7. Provide Consultant with accurate red-marked record drawings for their transfer to latest version of drafting software with application for Certificate of Substantial Performance. Final acceptance of the Work will be predicated on receipt and approval of record drawings.

#### **1.18. DETAIL FINISH DRAWINGS**

- 1.18.1. During the course of the work, the Owner will provide the Contractor with detail drawings showing the interior finishes and furnishings of the building. The Contractor shall read these drawings in conjunction with the Contract Documents. The Contractor shall check the detail drawings against the Contract Documents and shall report any discrepancies to the Consultant.

#### **1.19. CUTTING AND PATCHING**

- 1.19.1. Before cutting, drilling, or sleeving structural load-bearing elements, obtain approval of location and methods from the Structural Engineer and the General Contractor.
- 1.19.2. Do not endanger work or property by cutting, digging, or similar activities. No Section shall cut or alter the work of another Section unless such cutting or alteration is approved by the latter Section and the General Contractor.
- 1.19.3. Cut and drill with true smooth edges and to minimum suitable tolerances.
- 1.19.4. Fit construction tightly to ducts, pipes and conduits to stop air movement completely. The Section performing work that penetrates a fire, air, vapour, moisture, thermal or acoustic separation of the building shall pack voids tightly with rock wool, fiberglass or fire stop material as may be required; seal air, vapour and moisture barriers; and caulk joints as may be required to ensure that no air movement through the penetration is possible.

- 1.19.5. Cutting, drilling and sleeving of work shall be done only by the Section who has installed it. The Section requiring drilling and sleeving shall inform the Section performing the work of the location and other requirements for drilling and sleeving.
- 1.19.6. Replace, and otherwise make good, all damaged work, as identified by the Consultant or Contractor.
- 1.19.7. Cutting and Pathing for Holes Required by Mechanical and Electrical work:
  - 1.19.7.1. Including under work of Divisions 20 and 26 cutting or provision of holes up to and including 50 square inches and related patching, except as otherwise indicated.
  - 1.19.7.2. Include under work of this Division holes and other openings larger than 50 square inches, and chases, bulkheads, furring and required patching. This Section shall be responsible for determination of work required for holes in excess of 50 square inches.
- 1.19.8. This Section shall be responsible for all cutting and patching in addition to that specified for mechanical and electrical work and shall directly supervise performance of cutting and patching by other Sections.
- 1.19.9. Patching or replacement of damaged work shall be done by the Sub-Contractor under whose work it was originally executed, and at the expense of the Sub-Contractor who caused the damage.
- 1.19.10. Make patches as invisible as possible in final assembly to the approval of the Consultant/Owner. Unacceptable work will be replaced at no charge to the Owner.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Administrative
- .4 1.4 Contract Start-Up Meeting
- .5 1.5 Pre-Installation Meetings
- .6 1.6 Progress Meetings
- .7 1.7 Pre-Takeover Meeting
- .8 1.8 Post-Construction Meeting
- .9 1.9 Special Meetings

### **1.3. ADMINISTRATIVE**

- 1.3.1. The Contractor shall schedule meetings as specified herein.
  - 1.3.1.1. Such scheduling shall be in consultation both with the Owner and with the Consultant.
  - 1.3.1.2. Written notice of each Site meeting shall, in general, appear at the conclusion of the minutes of the preceding meeting or, else, shall be issued by the Consultant, via memorandum, no less than 24 hours prior to said meeting.
- 1.3.2. The Contractor shall Provide the physical space for the meetings at the Place of the Work, generally to be the Site office (refer to Section 01 50 00 Temporary Work for the complete requirements of the Site office).
- 1.3.3. The Consultant will prepare agendas for meetings specified herein.
  - 1.3.3.1. Agendas shall include, as a minimum, the agenda items specified in the *Contract Documents*.
- 1.3.4. The Consultant will distribute written notice of each meeting specified herein, complete with meeting agenda, 4 Working Days in advance of meeting date to the following, each of who shall be responsible for distributing such notices to other affected parties associated with them (such as, for example, Subcontractors in the case of the Contractor):
  - 1.3.4.1. The Contractor.
  - 1.3.4.2. The Owner.
- 1.3.5. The Consultant will chair and record the minutes of meetings specified herein.
  - 1.3.5.1. The Consultant will distribute copies of minutes to the Owner, the Contractor, and all others in attendance within 3 Working Days after date of meeting.
  - 1.3.5.2. Any exceptions taken to, or clarification/correction required of, the various items recorded in the minutes, shall be furnished in writing and copied to all parties listed on the distribution list of the captioned minutes.
- 1.3.6. Representatives of parties attending meetings shall be authorized to act on behalf of the parties they represent.
- 1.3.7. Subcontractors and suppliers shall not attend meetings unless authorized by the Consultant and/or the Owner.
- 1.3.8. The Contractor shall prepare, and distribute to the Consultant and the Owner at each progress meeting date, the following:
  - 1.3.8.1. Monthly progress reports containing updated schedules, shop drawing logs, requests for interpretation logs, submittals and budget.

- 1.3.8.2. 2 Week Lookahead schedules shall be submitted 24hrs before scheduled meeting.

#### **1.4. CONTRACT START-UP MEETING**

- 1.4.1. Within 10 Days after award of the Contract, request a meeting of parties in the Contract to discuss and resolve administrative procedures and responsibilities prior to the commencement of the Work.
- 1.4.1.1. The Consultant shall chair and minute the Contract start-up meeting, and distribute minutes as described above in Section 01 31 19.
- 1.4.2. Attendees at Contract start-up meeting shall include the following:
- 1.4.2.1. Contractor.
- 1.4.2.2. Contractor's site superintendent(s).
- 1.4.2.3. Consultant.
- 1.4.2.4. Owner.
- 1.4.3. Agenda to include the following:
- 1.4.3.1. General:
- (1) Welcome and Introduction.
- (2) Owner's guidelines and policies.
- 1.4.3.2. Communications:
- (1) Appointment of official representatives of the participants on the Project.
- (2) Project contact list.
- (3) Emergency contact list.
- (4) Correspondence protocols (email, telephone).
- 1.4.3.3. Schedule of progress meetings.
- 1.4.3.4. Status of permits, fees and requirements of the authorities having jurisdiction.
- 1.4.3.5. Status of Contract execution.
- 1.4.3.6. Insurance, transcripts of policies.
- 1.4.3.7. Workplace Safety and Insurance Board Certificate.
- 1.4.3.8. Documents at the Place of the Work (Permit Set, Issued Incorporating Addenda Set / Issued for Construction).
- 1.4.4. Contract Modifications and Instructions:
- 1.4.4.1. Requirements for *Contract* Modification and interpretation procedures:
- (1) Requests for Interpretation.
- (2) Supplemental Instruction.
- (3) Notices of Change.
- (4) Change Directives.
- (5) Change Orders.
- 1.4.4.2. Procedures for distribution, approvals, requests for time extension.
- 1.4.5. Submittals:
- 1.4.5.1. Construction schedule.
- 1.4.5.2. Submittal procedures and schedule of submittals.
- 1.4.5.3. Requests for Substitutions / Alternates.
- 1.4.5.4. Delivery of specified equipment and "long-lead" items.
- 1.4.5.5. Owner supplied products (SBO items).
- 1.4.6. Schedule of Values, progress claims, administrative procedures and holdbacks.
- 1.4.7. Sustainability Requirements: LEED, One Planet Living, other (project specific).
- 1.4.8. Site Policies and Logistics.
- 1.4.8.1. Contractor's safety procedures.
- 1.4.8.2. Site issues and limitations:
- (1) Parking.
- (2) Site access, loading and storage.
- (3) Garbage and construction waste handling.
- (4) Hazardous substances.
- 1.4.8.3. Site security.
- 1.4.8.4. Temporary Facilities – signs, offices, storage sheds and utilities.
- 1.4.8.5. Quality control.

- 1.4.8.6. Infection prevention and control requirements (healthcare projects only).
- 1.4.8.7. Insect control.
- 1.4.9. Project Close Out:
  - 1.4.9.1. Take-over procedures, acceptance and warranties.
  - 1.4.9.2. As-built drawings.
  - 1.4.9.3. Operation and Maintenance manuals.
  - 1.4.9.4. Owner Training.
  - 1.4.9.5. Substantial Performance of the Work.
  - 1.4.9.6. Total Performance of the Work

## **1.5. PRE-INSTALLATION MEETINGS**

- 1.5.1. During the course of the Work prior to Substantial Performance of the Work, schedule pre-installation meetings as required by the Contract Documents or as directed by the Consultant.
- 1.5.2. As far as possible, pre-installation meetings shall be scheduled to take place on the same Day as regularly scheduled progress meetings.
- 1.5.3. Agenda to include the following:
  - 1.5.3.1. Appointment of official representatives of participants in the project.
  - 1.5.3.2. Review of existing conditions and affected work and testing thereof as required.
  - 1.5.3.3. Review of installation procedures and requirements.
  - 1.5.3.4. Review of environmental and Site condition requirements.
  - 1.5.3.5. Schedule of the applicable portions of the Work.
  - 1.5.3.6. Schedule of submission of samples, colour chips, and items for the Consultant's consideration.
  - 1.5.3.7. Requirements for temporary facilities, Site sign, offices, storage sheds, utilities, fences.
  - 1.5.3.8. Requirements for notification for reviews. Allow a minimum of 48 hours' notice to the Consultant for review of the Work.
  - 1.5.3.9. Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests.
  - 1.5.3.10. Delivery schedule of specified equipment.
  - 1.5.3.11. Special safety requirements and procedures.
- 1.5.4. The following shall be in attendance:
  - 1.5.4.1. The Contractor.
  - 1.5.4.2. The Subcontractors affected by the work for which the pre-installation meeting is being conducted.
  - 1.5.4.3. The Consultant.
  - 1.5.4.4. Manufacturer's representatives, as applicable.
  - 1.5.4.5. Inspection and testing company, as applicable.

## **1.6. PROGRESS MEETINGS**

- 1.6.1. During the course of the Work prior to Substantial Performance of the Work, schedule progress meetings as directed by the Consultant.
- 1.6.2. Attendees at progress meetings shall include the following:
  - 1.6.2.1. The Contractor.
  - 1.6.2.2. The Contractor's Site superintendent(s).
  - 1.6.2.3. The Consultant.
  - 1.6.2.4. The Owner.
- 1.6.3. Agenda to include the following:
  - 1.6.3.1. Review, approval of proceedings of previous meeting.
  - 1.6.3.2. Review of items arising from proceedings.
  - 1.6.3.3. Review of progress of the Work since previous meeting and the Contractor's monthly progress report.
  - 1.6.3.4. Field observations, problems, conflicts.
  - 1.6.3.5. Update construction schedule.
  - 1.6.3.6. Problems that impede compliance with construction schedule.

- 1.6.3.7. Review of off-Site fabrication delivery schedules.
- 1.6.3.8. Review material delivery dates/schedule.
- 1.6.3.9. Corrective measures and procedures to regain construction schedule.
- 1.6.3.10. Revisions to construction schedule.
- 1.6.3.11. Progress, schedule, during subsequent period of the Work.
- 1.6.3.12. Review submittal schedules.
- 1.6.3.13. Review status of submittals.
- 1.6.3.14. Maintenance of quality standards.
- 1.6.3.15. Pending changes and substitutions.
- 1.6.3.16. Review of the Contract modifications and interpretations, including, but not limited to: requests for interpretation and log, Notices of Change, Change Orders, Supplemental Instructions, for effect on construction schedule and on the Contract Time.
- 1.6.3.17. Review of status of as-built documents.
- 1.6.3.18. Other business.

### **1.7. PRE-TAKEOVER MEETING**

- 1.7.1. 60 Working Days prior to application for Substantial Performance of the Work, schedule a pre-takeover meeting.
- 1.7.2. Agenda to include the following:
  - 1.7.2.1. Review, approval of proceedings of previous meeting.
  - 1.7.2.2. Review of items arising from proceedings.
  - 1.7.2.3. Review of procedures for Substantial Performance of the Work, completion of the Contract, and handover of the Work.
  - 1.7.2.4. Field observations, problems, conflicts.
  - 1.7.2.5. Review of outstanding Contract modifications and interpretations, including, but not limited to: requests for interpretation and log, Notices of Change, Change Orders, Supplemental Instructions, for effect on construction schedule and on the Contract Time.
  - 1.7.2.6. Problems which impede Substantial Performance of the Work.
  - 1.7.2.7. Review of procedures for deficiency review. Corrective measures required.
  - 1.7.2.8. Review of arrangements for hydro, heating, and other services.
  - 1.7.2.9. Progress, schedule, during succeeding period of the Work.
  - 1.7.2.10. Review submittal requirements for warranties, manuals, and all demonstrations and documentation required for Substantial Performance of the Work.
  - 1.7.2.11. Review of keying and hardware requirements.
  - 1.7.2.12. Review of status of as-built documents and record drawings.
  - 1.7.2.13. Status of commissioning and training.
  - 1.7.2.14. Review the Contractor's deficiency list and status.
  - 1.7.2.15. Cleaning for occupancy.
  - 1.7.2.16. Other business.

### **1.8. POST-CONSTRUCTION MEETING**

- 1.8.1. Prior to application for completion of the Contract, schedule a post-construction meeting. Four Days prior to date for meeting, the Consultant will confirm a date for meeting based on evaluation of completion requirements.
- 1.8.2. Agenda to include the following:
  - 1.8.2.1. Review, approval of proceedings of previous meeting.
  - 1.8.2.2. Confirmation that no business is arising from proceedings.
  - 1.8.2.3. Confirmation of completion of the Contract, and handover of reviewed documentation from the Consultant to the Owner.
  - 1.8.2.4. Confirmation of completion of Notices of Change, Change Orders, and Supplemental Instructions.
  - 1.8.2.5. Problems that impede the Contract completion.
  - 1.8.2.6. Identify unresolved issues or potential warranty problems.
  - 1.8.2.7. Confirmation of completion of deficiencies.

- 1.8.2.8. Corrective measures required.
- 1.8.2.9. Confirmation of arrangements for hydro, heating and other services.
- 1.8.2.10. Confirm submittal requirements for warranties, manuals, and demonstrations and documentation for Contract completion are in order.
- 1.8.2.11. Review of procedures for communication during post-construction period.
- 1.8.2.12. Handover of reviewed record documents by the Consultant to the Owner.
- 1.8.2.13. Handover of the Contract completion insurance policy transcripts by the Contractor.
- 1.8.2.14. Submission of final application for payment.
- 1.8.2.15. Review and finalize outstanding claims, pricing, and allowance amounts.
- 1.8.2.16. Status of commissioning and training.
- 1.8.2.17. Demobilization and the Place of the Work restoration.
- 1.8.2.18. Review of requests for interpretation log.
- 1.8.2.19. Other business.

### **1.9. SPECIAL MEETINGS**

- 1.9.1. The Owner and/or the Consultant reserve the right to require special meetings which may be held on short notice and at which attendance by the Contractor and representatives of affected Subcontractors and suppliers is mandatory. The Consultant will keep detailed and accurate meeting notes and distribute copies promptly to all in attendance and those affected by agreements made at such meetings.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 General
- .4 1.4 Layout And Survey
- .5 1.5 Submittals
- .6 1.6 Drainage
- .7 1.7 Record Drawings
- .8 1.8 Survey Reference Points And Legal Survey Markers
- .9 1.9 Survey Layout
- .10 1.10 Construction Layout
- .11 1.11 Field Engineering

### **1.3. GENERAL**

- 1.3.1. Provide the *Work* in accordance with the *Contract Documents* and be responsible for delays or costs resulting from failure to thoroughly inspect or coordinate the *Work*, and for replacement or corrective work required.

### **1.4. LAYOUT AND SURVEY**

- 1.4.1. Lines, Levels and Locations for Building:
  - 1.4.1.1. Existing grades, lines and site conditions shown on drawings were taken from survey information established by persons engaged directly by Owner. The accuracy of survey information is not the Consultant's responsibility.
  - 1.4.1.2. The Contractor will establish location of property lines. The Contractor shall establish necessary lines, levels and provide batter boards and other means to control the accurate positioning of all building elements.
- 1.4.2. Work Adjacent to Public Property:
  - 1.4.2.1. Verify before commencing Work at adjacent public property, that no plans for altering clearances, set-backs, easements, grades, or otherwise have been made by local Authorities Having Jurisdiction, subsequent to their approval of Contract Documents, and which would affect the original intent.

### **1.5. SUBMITTALS**

- 1.5.1. Submit qualification data for land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- 1.5.2. Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- 1.5.3. Submit two (2) copies of certified survey signed by registered land surveyor.
- 1.5.4. Submit two (2) copies of final property survey showing the Work performed and record survey data.
- 1.5.5. Submit a Certificate of Compliance at completion of site grading stating the "As Constructed" grading elevations, and whether or not they differ from design grades.

## **1.6. DRAINAGE**

- 1.6.1. Ensure that positive drainage is provided to roof, floor and site drains and catch basins, as set in their final positions. Provide constant slopes for drained surfaces to drains and drainage courses.
- 1.6.2. Ensure that allowable construction tolerances and structural tolerances do not permit ponding of water.
- 1.6.3. Verify the extent of each area served by a drain, or drainage course, to eliminate possible undrained surfaces. Coordinate the Work of involved Sections before each proceeds.

## **1.7. RECORD DRAWINGS**

- 1.7.1. Prepare interference and equipment placing drawings to scale to ensure that all components will be properly accommodated within the spaces provided.
- 1.7.2. Ensure that clearances required by Authorities Having Jurisdiction and/or for easy maintenance of equipment will be shown on the above drawings.
- 1.7.3. Interference drawings shall be prepared before any orders for equipment and/or materials are released to suppliers.

## **1.8. SURVEY REFERENCE POINTS AND LEGAL SURVEY MARKERS**

- 1.8.1. Verify existing base horizontal and vertical control points designated on drawings.
- 1.8.2. Locate, confirm, and protect control points and legal survey markers prior to starting site work; preserve permanent reference points during construction.
- 1.8.3. Make no changes or relocations without prior written notice to Consultant.
- 1.8.4. Report to Consultant when a reference point or legal survey marker is lost or destroyed or requires relocation because of necessary changes in grades or locations.
- 1.8.5. Replace control points in accordance with original survey control.
- 1.8.6. Replace legal survey markers lost or destroyed as a result of construction activities.

## **1.9. SURVEY LAYOUT**

- 1.9.1. Coordinate with Contractor for layout and protection of grade controls.
- 1.9.2. Establish permanent benchmark(s) as required, referred to established benchmarks by survey control points, record locations, with horizontal and vertical data.
- 1.9.3. Establish lines and levels, locate and layout, by instrumentation.
- 1.9.4. Stake for grading, cuts, fills, and slopes.
- 1.9.5. Replace grade controls lost or destroyed as a result of construction activities.

## **1.10. CONSTRUCTION LAYOUT**

- 1.10.1. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Consultant promptly if discrepancies are discovered.
- 1.10.2. Engage a land surveyor to lay out the Work using accepted surveying practices:
  - 1.10.2.1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 1.10.2.2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 1.10.2.3. Inform installers of lines and levels to which they must comply.
  - 1.10.2.4. Check the location, level and plumb, of every major element as the Work progresses.
  - 1.10.2.5. Notify Consultant when deviations from required lines and levels exceed allowable tolerances.
  - 1.10.2.6. Verify accuracy of site dimensions shown on drawings.
  - 1.10.2.7. Verify that present, or known future restrictions, are not violated by construction on the site or lines of traverse to all public utilities.
  - 1.10.2.8. Verify accurately the final underground location on site of all buried storm, sanitary, water and electrical duct banks, when applicable.
  - 1.10.2.9. Close site surveys with an error of closure equal to or less than the standard established by Authorities Having Jurisdiction.

- 1.10.3. Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- 1.10.4. Maintain a log of layout control Work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant when requested.

#### **1.11. FIELD ENGINEERING**

- 1.11.1. Locate existing permanent benchmarks, control points and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations:
  - 1.11.1.1. Do not change or relocate existing benchmarks or control points without prior written approval of Consultant.
  - 1.11.1.2. Report lost or destroyed permanent benchmarks or control points promptly.
  - 1.11.1.3. Report the need to relocate permanent benchmarks or control points to Consultant before proceeding.
  - 1.11.1.4. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
  - 1.11.1.5. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 1.11.1.6. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 1.11.1.7. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- 1.11.2. Provide as-built site survey information after completion of demolition and excavation operations ready for construction
  - 1.11.2.1. Survey grade elevations shall be on a 9 m grid or as required to locate property lines and new building structural grid lines.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 PART 1 – GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Construction Progress Reporting
- .4 1.4 Scheduling Roles
- .5 1.5 Scheduling software
- .6 1.6 Schedules
- .7 1.7 Construction Schedule Information
- .8 1.8 Format
- .9 1.9 Submission process
- .10 1.10 Baseline Construction Schedule
- .11 1.11 Progress Schedule
- .12 1.12 Baseline Schedule Revisions

### **1.3. CONSTRUCTION PROGRESS REPORTING**

- 1.3.1. Maintain at the Place of the Work a permanent written record of progress of Work. Make the record available to Consultant and Provide copy if requested. Include in record each day:
  - 1.3.1.1. Commencement and completion dates of the work of each trade in each area of Project.
  - 1.3.1.2. Attendance of Contractor's and Subcontractors work forces at Project and a record of the work they perform.
  - 1.3.1.3. Visits to Place of the Work by Owner, Consultant authorities having jurisdiction, inspection and testing companies, Contractor, Subcontractors, and Suppliers.

### **1.4. SCHEDULING ROLES**

- 1.4.1. Contractor
  - 1.4.1.1. The Contractor is responsible for the preparation and maintenance of Construction Schedule information including the Construction Schedule and other schedules as defined herein. The Contractor is responsible for obtaining planning and scheduling information from its management staff, site supervisory staff, Subcontractors and suppliers in a timely manner as an essential part of the preparation and maintenance of the Construction Schedule and other schedules as defined herein.
  - 1.4.1.2. The Contractor maintains full responsibility for the implementation and management of the construction activities contained in their schedules.
  - 1.4.1.3. The Contractor is to identify to the Owner and Consultant the Contractor's designated individual responsible for utilizing the specified scheduling software to prepare and maintain the Construction Schedule and other schedules, herein defined as the Contractor's Scheduler. The Contractor's Scheduler is required to have a minimum of 5 years of experience utilizing the specified scheduling software for planning and scheduling of construction project.

## **1.5. SCHEDULING SOFTWARE**

- 1.5.1. The Construction Schedule is to be developed utilizing Microsoft Project (2003 or later version). Other third-party scheduling software's are not acceptable.

## **1.6. SCHEDULES**

- 1.6.1. Construction Schedule: Submit a detailed critical path bar chart Construction Schedule with activities itemized to show the orderly planning, organization and execution of the Work, which will enable the Contractor, Consultant and Owner to monitor the progress of the Work and forecast remaining Work. Include in the schedule, the milestone dates for completion of each phase and other milestones specific herein.
- 1.6.2. The Construction Schedule is to be in the form of a series of activities and milestones that are logically linked utilizing the critical path methodology.
- 1.6.3. The Construction Schedule must clearly represent the applicable sequence of work as outlined in the Contract Documents. The Construction Schedule must identify early dates and late dates as well as the Project critical path of activities and completion milestones through each phase of the Project.
- 1.6.4. Organize the Construction Schedule into the Project's phases as outlined in the Contract Documents. The Construction Schedule shall clearly identify the inter-relationships and logic dependencies between the work of different phases.
- 1.6.5. At any given point in time, the Construction Schedule must be fully detailed with activities and milestones for at least the next twelve (12) calendar months or for the entire project duration for projects under 12 months construction time. The level of schedule activity detail beyond the next twelve calendar months can be at a summary level that identifies major groups of activities and milestones for each phase.
- 1.6.6. The Contractor shall Provide further refined and expanded schedule information, as the Work progresses and in sufficient advance of the upcoming work. Dates for the development of this information shall be agreed with the Owner, Consultant.
- 1.6.7. In addition to the Construction Schedule, prepare and submit the following schedules, as specified in Section 01 33 00.
  - 1.6.7.1. Submittal Schedule for Shop Drawings, Product Data and Samples
  - 1.6.7.2. Submittal Schedule for Mock-ups
  - 1.6.7.3. Submittal Schedule of Owner supplied/Contractor installed equipment
  - 1.6.7.4. Equipment Delivery Schedule
  - 1.6.7.5. Building Commissioning and Turnover schedule, to be prepared together with Owner.

## **1.7. CONSTRUCTION SCHEDULE INFORMATION**

- 1.7.1. Submission of the Construction Schedule shall constitute the representation by the Contractor that:
  - 1.7.1.1. The Contractor has distributed the proposed Construction Schedule to the Subcontractors for their review and comment.
  - 1.7.1.2. Seasonal weather conditions have been considered and included in the planning and scheduling of the Work influenced by high and low ambient temperatures and/or precipitation to ensure completion of the Work in accordance with the Contract Documents.
  - 1.7.1.3. The Contractor has incorporated any other special conditions in planning the Work such as specified non-work periods, etc.
  - 1.7.1.4. The Work has been co-ordinated and scheduled to permit time for work associated with the allowances (cash allowances) included as part of this Contract.
  - 1.7.1.5. The Work has been co-ordinated and scheduled to permit time for work associated with the alternatives included as part of this Contract.
- 1.7.2. Include the dates for the commencement and completion of each major task for each distinct part of the Project construction. Activities shall be itemized to show the orderly planning, organization and execution of the Work, which will enable the Contractor and the Owner to monitor the progress of the Work and forecast remaining Work.

- 1.7.3. Include activities in the Construction Schedule for the commencement and completion of each major element of all Contractor and Subcontractor work.
- 1.7.4. Include specific activities and milestones in the Construction Schedule for work under the responsibility of the Owner that must coordinate with the Contractor's work including but not limited to Owner supplied equipment, vacancy and move-in periods. Such activities will be identified by the Contractor and Owner.
- 1.7.5. Include specific activities and milestones in the Construction Schedule for work under the responsibility of the Consultant that must coordinate with the Contractor's work including but not limited to inspections and approvals. Such activities will be identified by the Contractor and Consultant.

## **1.8. FORMAT**

- 1.8.1. Prepare the Construction Schedule in the form of a time-scaled, horizontal bar chart that clearly identifies the Project critical path of activities and completion milestones for the distinct phases and sub- phases of the Project. Provide a separate bar identifying the start and finish of each significant element of construction as required to define a clear progression of activities through the distinct phases/sub- phases of the Project as specified in the Contract Documents.
- 1.8.2. Show sufficient detail to identify the major activities and milestones dates for overall planning and coordination purposes. Activities (with the exception of the contingency for unforeseen delays and delays resulting from changes to the Contract) shall have a maximum duration of 4 weeks. Show milestones for the start and completion of each major work area, building system and phase or sub- phase of the Work.
- 1.8.3. Ensure that work of all disciplines (i.e. mechanical, electrical and all other trades) is included and logically linked within the Construction Schedule. Show manufacturing time and delivery dates (milestones) for major equipment and materials. Show deliveries of Owner supplied equipment required to meet the Construction Schedule.
- 1.8.4. Activities must be in sufficient detail to include for decisions / approvals required by the Owner and/or Consultant for shop drawings, mock ups, sample submissions, deliveries, cash allowance requirement schedule, off site fabrication, erection, on site installation and any other events or sub activities which may pertain to the activities of the Construction Schedule.
- 1.8.5. Construction Schedule information should be in sufficient detail to allow for accurate assessment of percentage completion and coordination with other tasks within the Project Master Schedule.
- 1.8.6. Provide a horizontal time scale identifying the first day of each week as Monday. Show in the Construction Schedule the intended working days and holidays used as the basis for the Construction Schedule information and critical path calculations.
- 1.8.7. Activity descriptions should be as a consistent and clear as possible in terminology. Start activity descriptions with verbs.
- 1.8.8. Include as part of the Construction Schedule information, "dependency logic" information indicating the major predecessor and successor links between schedule activities. When requested, identify the crewing assumptions for the Construction Schedule activities and dependency logic that is governed by or representing crewing availability.

## **1.9. SUBMISSION PROCESS**

- 1.9.1. Submit the Construction Schedule information, to Owner within ten (10) working days from date of award of Contract. Construction Schedule information should be consistent with the milestones.
- 1.9.2. The Owner and Consultant shall have ten (10) Working Days from initial submission, to review and adjust the Construction Schedule, in consultation with the Contractor. The Contractor shall revise and resubmit the Construction Schedule for further review and comment. Upon final review, that Construction Schedule will be defined as the "Baseline" version of the Construction Schedule.

#### **1.10. BASELINE CONSTRUCTION SCHEDULE**

- 1.10.1. The Baseline Construction Schedule will form the basis for Contractor and Owner planning and progress tracking.
- 1.10.2. No changes to the Baseline Construction Schedule reflecting later completion dates of activities or target milestones will be accepted as a revision to the Construction Schedule, unless accepted by Owner in writing.
- 1.10.3. Neither the review of the Baseline Schedule or other date submitted by the Contractor pursuant to this Section, nor any other action on the part of the Consultant under this section shall in any way be deemed as representation by Owner that the Contractor, by following a particular schedule or sequence of operation, can or will complete the Work by the time(s) required by the Contract or by any other time(s). The review of any Baseline Schedule or other date does not relieve the Contractor of his obligation to complete the Work by the time(s) required in the Contract.
- 1.10.4. Submit two paper copies on 11 x 17 inch (Ledger), plus electronic copy in native format from the agreed upon scheduling software. Owner will review schedule and return review copy.

#### **1.11. PROGRESS SCHEDULE**

- 1.11.1. On a monthly basis, update the Construction Schedule showing projected percentage of completion of each item as of the first day of the month. Indicate progress of each activity to date and projected start and finish dates for each activity. Upon submission this will be deemed the Progress Schedule.
- 1.11.2. Include the complete sequence of construction activities.
- 1.11.3. Show approved changes occurring since the previous submission of the Progress Schedule:
  - 1.11.3.1. Changes in scope/time
  - 1.11.3.2. Activities modified since previous submission
  - 1.11.3.3. Revised projections of progress and completion
  - 1.11.3.4. Other identifiable changes
  - 1.11.3.5. Submit the Progress Schedule with each application for payment, clearly indicating progress of Work to date for which money is being claimed.
  - 1.11.3.6. Submit a separate narrative report to define:
    - (1) Problem areas, anticipated delays, and the impact on the schedule
    - (2) Corrective action recommended and its effect
    - (3) Indicate slippage from the schedule, its impact on completion of the phase and the total Project, and possible corrective actions. Appropriate corrective action may include, but not be limited to, assignment of additional labour, trade Subcontractors or equipment, shift or overtime work at no additional cost to the Owner.
    - (4) Submit a separate six week "look-ahead" narrative report indicating major activities to be undertaken or constructed, areas of work, and any impacts upon the Owner over the next month.

#### **1.12. BASELINE SCHEDULE REVISIONS**

- 1.12.1. Updating the Construction Schedule, as required, to reflect actual progress up to the monthly cut-off date shall not be considered a revision to the Baseline Schedule. All other changes, including, but not limited to, the following shall be considered Baseline Schedule revisions:
  - 1.12.1.1. Adding and/or deleting activity relationships
  - 1.12.1.2. Adding and/or deleting activities
  - 1.12.1.3. Changes to original durations
  - 1.12.1.4. Changes to Contract Milestone dates or Constraint dates
  - 1.12.1.5. Performance of work out of sequence
  - 1.12.1.6. Scope Changes through Change Orders

- 1.12.2. If, as a result of the monthly Progress Schedule submission, it appears the Progress Schedule no longer represents the actual progress of the Work, the Contractor shall request, a revision to the Baseline Schedule in accordance with General Condition 11.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .1 1.2. Section Includes
- .2 1.3. Administrative
- .3 1.4. Bonds, Certificates And Schedules
- .4 1.5. Schedule Of Submittals
- .5 1.6. Submission Procedures
- .6 1.7. Product Data Sheets
- .7 1.8. Shop Drawings
- .8 1.9. Samples
- .9 1.10. Certificates And Certification Submittals
- .10 1.11. Coordination And Interference Drawings

### **1.3. ADMINISTRATIVE**

- 1.3.1. Submit to the Consultant all submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as not to cause any delay in the Work. Failure to submit in ample time will not be considered sufficient reason for an extension of the Contract Time, and no claim for extension by reason of such default will be allowed.
- 1.3.2. Submit only those submittals specifically required by the Contract Documents, or those specifically requested by the Consultant. Any submittals submitted that are not specifically required by the Contract Documents, or requested by the Consultant, will be returned to the Contractor at the Contractor's expense without being reviewed.
- 1.3.3. Work affected by a submittal shall not proceed until the review of that submittal is complete.
- 1.3.4. Submittals that contain substitutions will be rejected. Substitutions are permitted only when approved in accordance with Section 01 25 00.
- 1.3.5. The Contractor's review of submittals:
  - 1.3.5.1. The Contractor is to review submittals prior to submission to the Consultant. This review represents that the necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and all of the Contract Documents.
  - 1.3.5.2. Submittals shall bear stamp of the Contractor and signature of a responsible official in the Contractor's organization indicating in writing that such submittals have been checked and coordinated by the Contractor. The Contractor's review shall be performed by qualified personnel who have detailed understanding of those elements being reviewed and of the conditions at the Place of the Work proposed for installation.
  - 1.3.5.3. Check and sign each submittal and make notations considered necessary before submitting to the Consultant for review. Where submittal is substantially and obviously in conflict with requirements of the Contract Documents, reject submittal without submitting to the Consultant and request resubmission.
  - 1.3.5.4. The Contractor shall assume sole responsibility for any conflicts occurring in the Work that result from lack of comparison and coordination of submittals required for the Work.
  - 1.3.5.5. Notify the Consultant in writing of changes made on submittals from the Contract Documents. The Consultant's review of submittals shall not relieve the

- Contractor of responsibility for changes made from the Contract Documents not covered by written notification to the Consultant.
- 1.3.5.6. Submittals that clearly have not been reviewed by the Contractor, or are not stamped, signed, dated, and identified as to the specific project, will be returned without being reviewed.
  - 1.3.5.7. No changes to the Work or the Contract Documents shall be made by way of submittals.
  - 1.3.5.8. .1 Changes to the Work shall only be made following procedures specified for changes in the Work.
  - 1.3.5.9. .2 Submittals that include changes to the Work or the Contract Documents shall be stamped "REVISE AND RESUBMIT" and returned.
  - 1.3.6. The Consultant's review of submittals:
    - 1.3.6.1. Review of submittals by the Consultant is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the Contract Documents. This review shall not mean that the Consultant approves the detail design inherent in the submittals, responsibility for which shall remain with the Contractor. Such review shall not relieve the Contractor of responsibility for errors or omissions in the submittals, or responsibility for meeting requirements of the Contract Documents.
    - 1.3.6.2. As part of their scope of work, Consultant shall review shop drawings no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, then Contractor shall reimburse the Consultant for time expended in these extra reviews. Time shall be invoiced to the Owner (to be deducted from monies due to the Contractor and paid to Consultant by Owner) at rates recommended by Consultant's professional association and disbursements shall be invoiced at Consultant's cost. The Contractor shall cover directly costs and administration associated with courier services and the like for these extra shop drawing reviews.
    - 1.3.6.3. The Contractor shall be responsible for dimensions to be confirmed and correlated at the Place of the Work for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the Work.
    - 1.3.6.4. The Consultant's review and markings on submittals do not authorize changes in the Work or the Contract Time, and will be accommodated at no additional cost to the Owner. If, in the opinion of the Contractor, the Consultant's markings on submittals constitute a change in the Work or will effect a change in the Contract Time, then the Contractor shall so notify the Consultant in writing and request an interpretation following the procedures for requests for interpretation in accordance with Section 01 26 00. If the Consultant finds that the Consultant's markings on submittals do constitute a change in the Work or will effect a change in the Contract Time, then a Change Order will be prepared therefore. The time taken to process such a request for interpretation shall not, in and of itself, constitute a change in the Work nor increase the Contract Time.
    - 1.3.6.5. Submittals received but not required by the Contract Documents or requested by the Consultant will not be reviewed by the Consultant and will be marked 'NOT REVIEWED' by the Consultant and returned to the Contractor.
  - 1.3.7. Prepare submittals using SI (metric) units.
  - 1.3.8. Verify that field measurements and affected adjacent work are coordinated.
  - 1.3.9. The Contractor's responsibility for errors and omissions in the submissions is not relieved by the Consultant's review of submittals.
  - 1.3.10. The Contractor's responsibility for deviations in the submission from the requirements of the Contract Documents is not relieved by the Consultant's review of submittals.
  - 1.3.11. Make submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the Work. Be responsible for delays, make up time lost and pay added costs, at no additional cost to the Owner, incurred because of not making submittals in due time to permit proper review by Consultant.

- 1.3.11.1. Once submitted, a submittal shall not be re-submitted until original submission has been reviewed by Consultant and returned to Contractor.
- 1.3.12. Submittals that contain substitutions will be rejected. Substitutions are permitted only on substitution submittals as specified in Section 01 25 00.
- 1.3.13. Do not proceed with work affected by a submittal, including ordering of Products, until relevant submittal has been reviewed by Consultant.
- 1.3.14. Keep copies of reviewed submittals at the Place of the Work in an organized condition. Only submittals that have been reviewed by the Consultant and include the Consultant's Submittal Review Form, as applicable, are permitted at the Place of the Work.
- 1.3.15. The Work shall conform to reviewed submittals subject to the requirements of this section. Remove and replace materials or assemblies not matching reviewed submittals at no increase in the Contract Time and at no additional cost to the Owner.
- 1.3.16. Engineered submittals:
  - 1.3.16.1. Submittals for items required to be engineered shall be prepared under the direct control and supervision of a Professional Engineer, registered in the Place of the Work and having the minimum professional liability insurance and requirements as required by the Professional Engineers of Ontario, who shall also apply his/her professional seal and signature to submittals prepared under their direct control and supervision.
  - 1.3.16.2. Include with engineered submittal, Professional Engineer's certificate of insurance.
  - 1.3.16.3. Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, and Authorities Having Jurisdiction.
  - 1.3.16.4. Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal. Prepare calculations in a clear and comprehensive manner so that they can be easily reviewed. Incomplete or haphazard calculations will be rejected.
  - 1.3.16.5. The Professional Engineer responsible for the preparation of engineered submittals shall undertake periodic field review, including review of associated mock-ups, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and shall submit a field review report after each visit. Field review reports shall be submitted to the Consultant, to Authorities Having Jurisdiction as required, and in accordance with the Ontario Building Code.
  - 1.3.16.6. Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the Professional Engineer to be familiar with the progress and quality of such work and to determine if the work is proceeding in general conformity with the Contract Documents, including reviewed shop drawings and design calculations.
  - 1.3.16.7. Upon completion of the parts of the Work covered by the engineered submittal, the Professional Engineer responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, shall prepare and submit to the Consultant and Authorities Having Jurisdiction, as required, a letter of general conformity for those parts of the Work, certifying that they have been provided in accordance with the requirements both of the Contract Documents and of the Authorities Having Jurisdiction over the Place of the Work.
  - 1.3.16.8. Costs for such field reviews and field review reports and letters of general conformity are included in the Contract Price.

#### **1.4. BONDS, CERTIFICATES AND SCHEDULES**

- 1.4.1. Prior to commencement of the Work, the Contractor is required to Provide to the Owner a copy of the Contractor's current Certificate of Clearance from the Workplace Safety and Insurance Board.

- 1.4.2. No later than 10 Working Days prior to, and as a condition of, the first application for progress payment, the Contractor is required to submit the following to the Consultant:
  - 1.4.2.1. A copy of the Contractor's Certificate of Clearance from the Workplace Safety and Insurance Board provided to the Owner in accordance with paragraph 1.4.1 (above).
  - 1.4.2.2. A schedule of values for the parts of the Work showing values for each part of the Work distributed over each section of the Technical Specifications to the satisfaction of the Consultant. Make revisions to the schedule as required until acceptance by the Consultant is achieved.
  - 1.4.2.3. A construction progress schedule in accordance with paragraph 1.8 of this Section (below).
  - 1.4.2.4. Bonding information shall be submitted to the Region in accordance with the requirements of the Contract Documents.

## **1.5. SCHEDULE OF SUBMITTALS**

- 1.5.1. Before commencement of the Work, submit to the Consultant a detailed schedule of submittals required by the Contract Documents correlated to the construction progress schedule specified under paragraph 1.8 of this section (below).
  - 1.5.1.1. Schedule shall be accompanied by a checklist, correlated to both the schedule of submittals and the schedule of inspections and tests (specified under Section 01 45 00), listing the following:
    - (1) Shop drawings.
    - (2) Samples.
    - (3) Mock-ups.
    - (4) Reviews, tests and inspections by:
      - (A) Manufacturers.
      - (B) Authorities Having Jurisdiction.
      - (C) Inspection and testing companies.
    - (5) Demonstration and training.
- 1.5.2. Indicate dates for submitting, review time, resubmission time, float time, and last date for meeting construction schedule.
- 1.5.3. Consultant will review submittal schedule and advise the Contractor if volume and timing of submittals will permit timely review and response. The Consultant may require modifications to submittals schedule in order to allow adequate time for review of submittals. Adjust submittals schedule and construction schedule as required to comply with Consultant's needs.
- 1.5.4. Make provisions in schedule for at least 10 Working Days for the Consultant's review of submittals. When submittals have to be reviewed by one or more of the Consultant's subconsultants, add 5 more Working Days for a total of 15 Working Day review period.
- 1.5.5. If the Consultant requires resubmission of submittals, allow for an additional 10 Working Days review for each resubmission.
- 1.5.6. If, at any time, the Contractor submits a large enough number of submittals such that the Consultant cannot process these submittals within 10 Working Days, the Consultant, in consultation with the Contractor within 3 Working Days of receipt of such submittal, will Provide the Contractor with an estimate of the time necessary for processing same. The Contractor shall accommodate such necessary time at no increase in the Contract Time and at no additional cost to the Owner.
- 1.5.7. The Contractor shall periodically resubmit the submittal schedule to correspond to changes in the construction schedule. Such resubmissions shall maintain the minimum 10 Working Day period for the Consultant's review.
- 1.5.8. Schedule submissions of submittals well in advance of scheduled dates for installation, to Provide lead time for reviews and possible resubmissions and for placing orders and securing delivery so as to avoid delays in the Work.

## **1.6. SUBMISSION PROCEDURES**

- 1.6.1. Coordinate each submittal with requirements of the Work and Contract Documents. Individual submittals shall include related information.
- 1.6.2. Distribute copies of submittals to parties whose work is affected by submittals except Consultant and Owner before final submission for review by Consultant.
- 1.6.3. Accompany submittals with transmittal letter, containing:
  - 1.6.3.1. Date.
  - 1.6.3.2. Project title and number.
  - 1.6.3.3. Contractor's name and address.
  - 1.6.3.4. Contractor's review stamp.
  - 1.6.3.5. Identification and quantity of each submittal.
  - 1.6.3.6. Other pertinent data.
- 1.6.4. Each submittal shall be identified numerically by relevant specification section number with a numeric indicator for multiple submittals by that section followed by revisions number, for example 04 05 19-01-R0.
- 1.6.5. Submit original PDF documents only: scanned documents shall not be accepted.
- 1.6.6. Make any changes in submittal that Consultant may require, consistent with Contract Documents, and resubmit as directed by Consultant.
- 1.6.7. Notify Consultant, in writing when resubmitting, of any revisions other than those requested by Consultant.
- 1.6.8. After Consultant's review, distribute copies to affected parties.

## **1.7. PRODUCT DATA SHEETS**

- 1.7.1. Submit Product data sheets as follows:
  - 1.7.1.1. 1 copy digitally in pdf format to Consultant
- 1.7.2. Submit Product data sheets as called-for by the Contract Documents or as the Consultant may reasonably request where shop drawings will not be prepared due to a standardized manufacture of a Product. Manufacturers' catalogue cuts will be acceptable in such cases, providing that they are 213 mm x 275 mm (8-1/2" x 11") originals, and that they indicate choices including sizes, colours, model numbers, options and other pertinent data, including installation instructions. Submissions showing only general information are not acceptable.
- 1.7.3. Where requirements of Contract Documents are more stringent than design proposed on Product data sheets, the requirements of the Contract Documents take priority.
- 1.7.4. Upon completion of review by Consultant, 1 marked set of Product data sheets will be returned to Contractor in digital format for reproduction and distribution.
- 1.7.5. Retain 1 complete set of prints of reviewed Product data sheets for issuance to Owner immediately prior to Substantial Performance of the Work, in an acceptable, bound manner and in accordance with Section 01 77 00.

## **1.8. SHOP DRAWINGS**

- 1.8.1. The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.
- 1.8.2. The Contractor shall submit shop drawings digitally in PDF format to the Consultant.
- 1.8.3. The Contractor shall Provide all shop drawings called for in the Contract Documents or as the Consultant may reasonably request.
- 1.8.4. The Contractor shall submit copies of reviewed shop drawings to Authorities Having Jurisdiction as required.
- 1.8.5. Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and all other information necessary for completion of the work.
- 1.8.6. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that such items have been coordinated, regardless of where in the Contract Documents the adjacent items are specified or indicated. Indicate cross references to the Contract Documents.

- 1.8.7. Shop drawings shall clearly define the division of responsibility. No Products, items or equipment, or description of work, shall be indicated to be supplied, or work to be done, "By Others" or "By Purchaser." It shall also be understood that any items, equipment, or description of the work shown on the shop drawings shall form a part of the Contract Documents unless specifically noted to the contrary. Shop drawings that do not clearly define the division of responsibility will be returned to the Contractor for same before being accepted for review by the Consultant.
- 1.8.8. Shop drawings shall include:
  - 1.8.8.1. Fabrication and erection dimensions.
  - 1.8.8.2. Plans, sections, elevations, arrangements and sufficient full size details which indicate complete construction, components, methods of assembly as well as interconnections with other parts of the Work.
  - 1.8.8.3. Design calculations prepared by professional engineer, as required, substantiating sizes for members and connections based on design loads.
  - 1.8.8.4. Clear definition of the division of responsibility for the work described thereon. No Products, items or equipment, or description of work, shall be indicated to be supplied, or work to be done, "By Others" or "By Purchaser". Shop drawings marked with either of these phrases will be rejected without having been reviewed by the Consultant.
  - 1.8.8.5. Location and type of exposed anchors, attachments and locations and types of fasteners, including concealed reinforcements to accept mounted fasteners.
  - 1.8.8.6. Adhesives, joinery methods and bonding agents.
  - 1.8.8.7. Kinds and grades of materials, their characteristics relative to their purpose, detailed description of finishes and other fabrication information.
  - 1.8.8.8. Configurations, types and sizes required; identify each unit type on drawing and on Product.
  - 1.8.8.9. Descriptive names of equipment and mechanical and electrical characteristics when applicable.
  - 1.8.8.10. Data verifying that superimposed loads will not affect function, appearance and safety or work shown on shop drawings, as well as other interconnected work.
  - 1.8.8.11. Assumed design loadings, dimensions of elements and material specifications for load-bearing members.
  - 1.8.8.12. Proposed chases, sleeves, cuts and holes in structural members.
  - 1.8.8.13. Wall thicknesses of metals.
  - 1.8.8.14. Location and types of welds. For structural welds use AWS symbols and clearly show net weld lengths and sizes.
  - 1.8.8.15. Materials, gauges, and sizes being supplied including connections, attachments, reinforcement, anchorage and locations of exposed fastenings.
  - 1.8.8.16. Installation instructions and details for products to be installed by separate Subcontractors, including function of each part.
  - 1.8.8.17. A list of Products covered by, or included on, the shop drawing. List of Products shall be complete and show manufacturer's name, Product name, generic description, standard certification where specified, manufacturer's complete installation data and precautions against wrong installation, operation and maintenance.
  - 1.8.8.18. Refer to individual sections of the specifications for more particular requirements for shop drawings.
- 1.8.9. Compatibility statement: Include with each shop drawing a statement that each Product and material indicated on the shop drawing is compatible with each other Product and material with which it comes into contact.
- 1.8.10. Consultant markings and resulting action required:
  - 1.8.10.1. Shop drawings requiring no changes will be marked 'REVIEWED', and shall be submitted for as-built drawings purposes.
  - 1.8.10.2. Shop drawings requiring several changes will be marked 'REVIEWED as NOTED' and shall be revised and submitted for as-built drawings purposes.

- 1.8.10.3. Shop drawings requiring substantial changes will be marked 'REVISE AND RESUBMIT' and Shall be revised and resubmitted until Consultant stamps drawings with 'REVIEWED' or 'REVIEWED as NOTED'.
- 1.8.11. The Consultant will require a maximum of 10 Working Days from receipt of shop drawings for processing of same. The Contractor shall make allowances in the scheduling of the Work for this period of time for each submission and shall, also, make allowances in the schedule for the following potentialities:
- 1.8.11.1. If, upon review, adjustments are made on the shop drawings by the Consultant and they are returned to the Contractor marked "Revise and Resubmit," the shop drawing shall be revised as required and clean copies resubmitted to the Consultant for an additional review. The Consultant will, for each resubmission, require a maximum of 10 Working Days from receipt for processing of shop drawings.
- 1.8.11.2. No claim for an increase in the Contract Time or claim for a change in the Work shall be considered or approved as a result of any of the following:
- (1) The time taken for processing of shop drawings by the Consultant unless longer than 10 Working Days after receipt of same.
  - (2) The time taken by the Contractor for revision and resubmission of shop drawings.
  - (3) Any adjustments made on the shop drawings by the Consultant that are consistent with the intent of the Contract Documents.
- 1.8.12. Make the changes in the shop drawings as the Consultant may require, consistent with the Contract Documents. When resubmitting, notify the Consultant in writing of any revisions made other than those requested.
- 1.8.13. If, upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, all submitted copies of the shop drawing (except the two retained by the Consultant) will be returned to the Contractor marked as "Reviewed" or "Reviewed as Noted", and fabrication or installation of the work may proceed.
- 1.8.14. Upon completion of review by Consultant, 1 marked set of shop drawings will be returned to Contractor in digital format for reproduction and distribution.
- 1.8.15. Retain 1 complete set of prints of reviewed shop drawings for issuance to Owner immediately prior to Substantial Performance of the Work, in an acceptable, bound manner and in accordance with Section 01 77 00.
- 1.8.16. Submit copies of reviewed shop drawings to authorities having jurisdiction as required.

## **1.9. SAMPLES**

- 1.9.1. Submit for review samples as requested in the Contract Documents. Label samples as to origin and intended use in the Work.
- 1.9.2. Unless otherwise directed by the Consultant, deliver samples prepaid to the Site office and notify the Consultant in writing of the availability of sample for review.
- 1.9.3. Notify the Consultant in writing at the time of submission of any deviations in the samples from the requirements of the Contract Documents.

## **1.10. CERTIFICATES AND CERTIFICATION SUBMITTALS**

- 1.10.1. Certificates and certifications submittals: Provide a statement that includes signature of entity responsible for preparing certification.

## **1.11. COORDINATION AND INTERFERENCE DRAWINGS**

- 1.11.1. The Contractor shall be responsible for preparing and submitting to the Consultant for review, a consolidated set of installation coordination/interference drawings for the building showing how the building systems (including, but not limited to, domestic heating and cooling piping, air distribution systems, air control boxes, reheat coils, fire protection piping, electrical distribution, fire alarm systems, lighting, communication cabling, security cabling, new and existing structural work and conduit runs) will fit together above ceiling areas and in exposed ceiling, to allow ceiling heights required by the Contract Documents and by maintenance and control access.

- 1.11.1.1. Each Subcontractor whose work is affected by the information presented on the coordination and interference drawings shall sign-off on the drawings prior to submission to the Consultant and thereby agrees to coordinate their parts of the Work to preserve the coordination and interference guidelines represented by the coordination and interference drawings.
- 1.11.2. Prepare sleeve drawings for work of Divisions 03 and 05, and Divisions 21, 22, and 23, and Divisions 26, 27, and 28 showing size and location of penetrations through load bearing elements. Submit sleeving drawings in electronic form to Consultant for review not less than 10 Working Days prior to construction of affected work.
- 1.11.3. Prepare embedded conduit drawings, showing size and location of penetrations through load bearing elements. Submit embedded conduit drawings in electronic form to Consultant for review not less than 10 Working Days prior to construction of affected work.
- 1.11.4. Prepare insert setting drawings for work to be cast into concrete and/or mortared into masonry elements. Submit insert setting drawings in electronic form to Consultant for review not less than 10 Working Days prior to construction of affected work.
- 1.11.5. Coordinate placement of equipment to ensure that components will be properly accommodated within spaces. Provide prior to commencement of Work. In areas where equipment and services are exposed, care shall be taken to organize and layout services in an organized and orderly manner. Where possible services are to run parallel or at right angles to one another as required. Consultant may request that service layout be reconfigured to suit sightline concerns during the coordination drawings review phase. These drawing changes are to be executed at no additional cost to the Owner.
- 1.11.6. Take complete responsibility for remedial work that results from failure to coordinate the Work prior to fabrication and installation.
- 1.11.7. Ensure that accesses and clearance required by jurisdictional authorities and/or for easy maintenance of equipment are Provided in layout of equipment and services.
  - 1.11.7.1. Indicate required access points, clearances, and sizes for equipment and pieces of equipment required in the Work. Note areas where access is compromised by interferences with other services for review by the Consultant. Do not proceed with installation of equipment in such compromised areas until a proposed means of providing access has been accepted by the Consultant.
- 1.11.8. Prepare and circulate coordination, interference and sleeving drawings prior to placing orders for equipment and materials.
- 1.11.9. Coordination and interference drawings shall be circulated for mark-ups by Subcontractors responsible for work of Divisions 3, 5, 9, 11, 14, Divisions 21, 22, and 23, and Divisions 26, 27, and 28.
- 1.11.10. Coordinate preparation and submission of coordination and interference drawings with shop drawings.
- 1.11.11. Show cross sections in key areas, as required, and as defined by Consultant. Show rebar, structural elements, piping, air handling and heating systems distribution, sprinkler system distribution, lighting, gypsum board wall and ceiling assemblies, acoustical isolation, Products and systems involving life safety, conveying systems, electrical distribution.
- 1.11.12. Show ductwork as 2 lines. Show cross sections in key areas, as required, and as directed by Consultant. Show re-bar, structural elements, air handling and heating systems distribution, gypsum board wall and ceiling assemblies, acoustical isolation, Products and systems involving life safety, conveying systems, and electrical distribution.
- 1.11.13. Coordination and interference drawings shall be produced in uniform scale on media that will allow overlays to be assembled. Upon incorporation of details, drawings shall be submitted to Consultant for review. Areas of conflict or interference shall be resolved in a mutually agreed manner between Subcontractors and resubmitted on coordination and interference drawings until accepted by Consultant.

## **PART 2 - PRODUCTS**

Not applicable.



**PART 3 - EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including Sections of Division 1.
- 1.1.2. This section describes requirements applicable to all Division Sections.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Reference Standards
- .4 1.4 Responsibility
- .5 1.5 Safety Activities
- .6 1.6 Posting Of Documents
- .7 1.7 Correction Of Non-Compliance
- .8 1.8 Hazardous Work
- .9 1.9 Work Stoppage
- .10 1.10 Fire Protection

### **1.3. REFERENCE STANDARDS**

- 1.3.1. Safety Province of Ontario: Occupational Health and Safety Act, Regulation and Code R.S.O -Amended 2022, including requirements for a "Constructor" as defined by the Act.

### **1.4. RESPONSIBILITY**

- 1.4.1. The " Constructor " according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- 1.4.2. Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site specific Health and Safety Plan.
- 1.4.3. Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Consultant verbally and in writing.

### **1.5. SAFETY ACTIVITIES**

- 1.5.1. Perform site specific safety hazard assessment related to project.
- 1.5.2. Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work.
- 1.5.3. Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

### **1.6. POSTING OF DOCUMENTS**

- 1.6.1. Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

### **1.7. CORRECTION OF NON-COMPLIANCE**

- 1.7.1. Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.
- 1.7.2. Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- 1.7.3. Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

**1.8. HAZARDOUS WORK**

- 1.8.1. Blasting or other use of explosives is not permitted without prior receipt of written instruction by Consultant.
- 1.8.2. Use powder actuated devices only after receipt of written permission from Owner.

**1.9. WORK STOPPAGE**

- 1.9.1. Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

**1.10. FIRE PROTECTION**

- 1.10.1. Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction governing codes, regulations and bylaws.
- 1.10.2. Burning rubbish and construction waste materials is not permitted on site.
- 1.10.3. Maintain placed or installed fire resistive construction to protect the portions of the Work during construction.

**2 PRODUCTS**

Not applicable.

**3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- .1 Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Requirements
- .4 1.4 References to Regulatory Requirements
- .5 1.5 Precedence
- .6 1.6 Codes
- .7 1.7 Industry Standards
- .8 3.1 Applicable Laws, Ordinances and Regulations

### **1.3. REQUIREMENTS**

- 1.3.1. This Section includes regulatory requirements applicable to the Contract Documents and the Project and Work. This Section shall cover the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.
- 1.3.2. The applicable edition of all codes shall be that currently adopted at the time of issuance of permits by the Authority Having Jurisdiction and shall include all modifications and additions adopted by that authority.
- 1.3.3. The applicable date of laws and ordinances shall be that of the date of performance of the Work affected by such laws and ordinances.
- 1.3.4. Specific reference in the Specifications to codes and regulations or to requirements of regulatory agencies shall mean the latest edition of each adopted by the regulatory agency in effect at the time of issuance of permits.
- 1.3.5. All materials, installation, and construction shall comply with the applicable provisions of current laws, codes, safety rules, and regulations of local, federal and any other applicable authorities ("Codes").
- 1.3.6. Codes referenced in the Contract Documents shall have full force and effect as though set out in full in these Specifications. Nothing in the Contract shall be construed to permit Work not conforming to applicable Code requirements.
- 1.3.7. The Codes and other authorities referenced in the Contract Documents are not a comprehensive list of all Codes applicable to the Work; the Codes listed in the Contract Documents are referenced for the information and convenience of the Contractor only. The Consultant does not represent that all Codes applicable to the Work have been cited or adequately described in the Contract Documents. Contractor is solely responsible for compliance with all Codes applicable to the Work and relevant to the Contractor's means and methods of performing said Work.

### **1.4. REFERENCES TO REGULATORY REQUIREMENTS**

- 1.4.1. General:
  - 1.4.1.1. References to codes, standards or regulatory requirements made on Drawings or in Specifications are considered an integral part of Contract Documents as minimum requirements.
- 1.4.2. All statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of all public Authorities Have Jurisdiction of the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references below.
- 1.4.3. Referenced Codes, laws, ordinances, rules and regulations shall have full force and effect as though printed in full in these Specifications. Contractor is assumed to be and

shall be familiar with these requirements, including having readily available access to these requirements.

- 1.4.4. References on the Drawings or in the Specifications to "code", "Code" or "building code" similar terms, not otherwise identified, shall mean the codes specified above, together with all additions, amendments, changes, and interpretations adopted by code Authorities of the Jurisdiction having authority over the Project.
- 1.4.5. Contractor shall conform to all applicable federal, provincial, and local codes, laws, ordinances, rules and regulations, whether or not referenced in the Contract Documents. Compliance with applicable regulatory requirements is the responsibility of the Contractor.

## **1.5. PRECEDENCE**

- 1.5.1. Where specified requirements differ from the requirements of applicable codes, ordinances and standards, the more stringent requirements shall take precedence with no change in Contract Price or Contract Time.
- 1.5.2. Where Contract Documents require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Contract Documents shall take precedence.
- 1.5.3. Where no requirements are identified on Contract Documents, comply with all requirements of applicable codes, ordinances and standards of governing Authorities Have Jurisdiction.

## **1.6. CODES**

- 1.6.1. Applicable Codes:
  - 1.6.1.1. The codes that apply to this Project include, but are not limited to, the currently adopted editions. Comply with Codes in effect at the time of issuance of permits.
- 1.6.2. Application of the Codes:
  - 1.6.2.1. Whenever there is a conflict between general and specific requirements in the code, the specific requirements shall be followed.
  - 1.6.2.2. Where differences exist between codes affecting this Work, the code affording the greatest protection shall govern.
  - 1.6.2.3. Where codes other than those listed in this Section are referred to in the different sections of the Specifications, it is understood that they apply fully as if cited herein.
  - 1.6.2.4. All Work performed shall be in accordance with applicable codes; a copy of each shall be kept at the Place of Work.
  - 1.6.2.5. If Contractor observes that the drawings and Specifications are at variance with the codes, he or she shall notify the consultant, in writing, at once.

## **1.7. INDUSTRY STANDARDS**

- 1.7.1. Application:
  - 1.7.1.1. The industry standards applicable to the Work are indicated in appropriate individual sections of these Specifications, either by their names and the names of the trade associations, government agencies or other producers of standards, or by well recognized abbreviations thereof:
    - (1) Refer questions on the meaning of abbreviated designations to the Consultant for clarification before proceeding with Work affected thereby.
    - (2) Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
- 1.7.2. Any material specified by reference to the number, symbol, or title of a specific standard, such as Commercial Standard, Federal Specifications, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendments or supplements thereto in effect on the date of Contract Documents.

- 1.7.3. The standard referred to, except as modified in the Contract Documents, shall have full force and effect as though printed in these Specifications.
- 1.7.4. These standards are not furnished to Contractor since manufacturers and trades involved are assumed to be familiar with their requirements. Where copies of standards are needed for proper performance of the Work, the Contractor shall obtain such copies which shall be maintained at the Place of Work by the Contractor and made available for review on request by the Consultant
- 1.7.5. Where referenced Standard specifications require weather protection, it shall be provided by the Contractor at no additional cost to the Owner and shall be deemed necessary in order to construct the Project within the specified time period.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

### **3.1 APPLICABLE LAWS, ORDINANCES AND REGULATIONS**

- 3.1.1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, provincial, and local governmental agencies and jurisdictions having authority over the Project.
- 3.1.2. Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
- 3.1.3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Price, except where changes in laws, ordinances, rules and regulations occur subsequent to time of issuance of permits.
- 3.1.4. No Change Order shall be considered for any change in any applicable federal, provincial, or local code or regulation if similar language existed in an alternate applicable regulation in force at the time of issuance of permits.
- 3.1.5. Contractor shall not allow design or construction of any conditions wherein the finished Work will not comply with current applicable codes. No Change Order shall be considered for the Work correction of any Work not complying with code.

**END OF SECTION**

## 1 GENERAL

### 1.1. GENERAL INSTRUCTIONS

- .1 Read and be governed by conditions of the *Contract Documents*, including sections of Division 01.

### 1.2. SECTION INCLUDES

- .1 1.1 General Instructions  
.2 1.2 Section Includes  
.3 1.3 Abbreviations

### 1.3. ABBREVIATIONS

- 1.1.1. When the following abbreviations are used in the Contract Documents, they have the meaning listed:

A	
&	And
@	At
A	Ampere
AA	Aluminum Association
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturer's Association
AASHO	American Association of State Highway Officials
ABS	Acrylonitrile Butadiene Styrene
AC	Alternating Current
ACG	AABC Commissioning Group
ACI	American Concrete Institute
ACME	Association of Consulting Management Engineers
ACT	Acoustic Ceiling Tile
ACR	Air Conditioning and Refrigeration Field Services
ADA	Americans with Disabilities Act
ADC	Air Distribution and Control
AFF	Above Finish Floor
AFUE	Annual Fuel Utilization Efficiency
AG	Above Grade
AGA	American Gas Association
AHC	Architectural Hardware Consultant
AHJ	Authorities Having Jurisdiction
AHRI	Air Conditioning, Heating & Refrigeration Institute
AHU	Air Handling Unit
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical & Insulating Material Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AJT	UL Class J Time Delay Fuse

AL	Aluminum
ALUM	Aluminum
AMACF	Advanced Main Air Circulating Fan
AMCA	Air Moving and Conditioning Association Inc.
ANSI	American National Standards Institute
AODA	Accessibility for Ontarians with Disabilities Act
AP	Aluminum Panel
API	Atmospheric Pressure Ionization
ARCH	Architectural
ARI	Air-Conditioning, Heating, and Refrigeration Institute
ASC	Application Specific Controllers
ASHRAE	American Society of Heating Refrigerating and Conditioning Engineers
ASL	Above Sea Level
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing and Materials
ATC	Acoustic Tile Ceiling
ATS	Automatic Transfer Switch
AUTO	Automatic
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute (USA)
AWMAC	Architectural Woodwork Manufacturers Association of Canada
AWS	American Welding Society
AWWA	American Water Works Association

## **B**

BO	Bottom Of
B/W	Between
B-AAC	BACnet Advanced Application Controller
BAB	Roof Anchor - Bolt Around Beam
BACnet	Building Automation and Control networks
BAS	Building Automation System
B-ASC	BACnet MS/TP Advanced Application Controller
B-AWS	BACnet Advanced Operator Workstation
BBMD	BACnet/IP Broadcast Management Device
BCup	Copper-Phosphorous Brazing Alloy
BD	Board
BF	Barrier Free
BFPB	Barrier-Free Push Button
BFDO	Barrier-Free Door Operator
BHMA	Builders Hardware Manufacturers Association
BIT	Bituminous
BL or BLK	Block
BLDG	Building



BLKG	Blocking
BMS	Building Management System
BN	Bullnose
B-OD	BACnet Operator Display
B-OWS	BACnet Operator Workstation
BS	Black-Out Window Shade
BTL	BACnet Testing Laboratory
BTU	British thermal unit
BX	Flexible Metal Conduit cable

## C

C.B.U	Concrete Block Unit
C.L.	Centerline
C.M.U	Concrete Masonry Unit
C.W.	Curtain Wall
C/W	Complete With
CA	Commissioning Agent
CA ITEM	Cash Allowance Item
CAB	Cabinet
CaGBC	Canada Green Building Council
CATV	Cable Television
CBD	Cement Board
CCA	Canadian Construction Association
CCMC	Canadian Construction Materials Centre
CCRC	Canadian Code for Residential Construction
CCT	Correlated Color Temperature
CCTV	Closed Circuit Television
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CFC	Chlorofluorocarbon
CFM	Cubic feet per minute
CFMA	Construction Financial Management Association
CFUA	Canadian Fire Underwriters Association
CG	Corner Guard
CGA	Canadian Gas Association
CGL	Commercial General Liability
CGSB	Canadian General Standards
CH	Coat Hook
CHAN	Channel
CIQS	Canadian Institute of Quantity
CISC	Canadian Institute of Steel Construction
CISPI	Cast Iron Soil Pipe Institute
CITC	Canadian Institute of Timber Construction
CK	Caulk
CL	Closet

CLA	Canadian Lumbermen's Association
CLG	Ceiling
cm	Centimeter
CMHC	Canada Mortgage and Housing Corporation
CNTR	Counter
CO	Carbon Monoxide
COFI	Council of Forest Industries of British Columbia
COL	Column
CONC	Concrete
CONST	Construction
CONT	Continuous
CONTR	Contractor
CORR	Corridor
COV	Change of Value
CP	Cap Screw
CPCI	Canadian Pre-stressed Concrete Institute
CPMA	Canadian Paint Manufacturers Association
CPT	Carpet
CPTB	Carpet Base
CPVC	Chlorinated polyvinyl chloride
CR	Card Reader
CRCA	Canadian Roofing Contractors Association
CRN	Canadian Registration Number
CRS	Course
CSA	Canadian Standards Association
CSC	Construction Specifications of Canada
CSI	Construction Specifications Institute (USA)
CSPI	Corrugated Steel Pipe Institute
CSR	Vibro-Acoustics Restrained Spring
CSSBI	Canadian Sheet Steel Building Institute
CT	Ceramic Floor Tile
CTB	Ceramic Tile Base
CUA	Canadian Underwriter's Association
cUL	Canadian Underwriters Laboratories
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CWP	Cold Working Pressure
CWS	Canada-Wide Standard
CWT	Ceramic Wall Tile
Cx	Commissioning
CYL	Cylinder Lock
<b>D</b>	
D.F	Drinking Fountain
D.O	Door Operator

DB	Dry-bulb temperature
dB	Decibel
dBA	Decibel A-weighting
DC	Door Contact
DDC	Direct Digital Control
DET	Detail
DFO	Department of Fisheries and Oceans
DFT	Dry Film Thickness
DHI	Door Hardware Institute
DIA	Diameter
DIM	Dimension
DIN	Deutsches Institut fur Normung
DIVS.	Divisions
DN	Down
DND	Department of National Defense, Canada
DR	Door
DS	Downspout
DWG	Drawing
DWGS	Drawings
DWR	Drawer
DWV	Drain, Waste and Vent
DX	Direct Expansion

## E

E	East
E.W	Each Way
ECM	Electronic Control Module
ED	Exit Device
EDC	Electronic Door Contact
EDO	Electronic Door Operator
EDS	Electronic Door Strike
EEMAC	Electrical Equipment Manufacturers Association of Canada
EFT	Electrical Fast Transient
EGSA	Electrical Generating Systems Association
EHO	Electronic Hold Open
EIA	Electronic Industries Alliance
EJ	Expansion Joint
EL	Elevation
ELECT	Electrical
ELEV	Elevator
EMC	Electromagnetic compatibility
EMER	Emergency
EMI	Electromagnetic interference
EMS	Electric Motor Starter

EMT	Electrical Metallic Tubing (Conduit)
ENCL	Enclosure
ENTR	Entrance, Entry
EP	Epoxy Paint
EPA	Environmental Protection Agency
EPDM	Ethylene Propylene Diene Monomer rubber
EPX	Epoxy Flooring
EQ	Equal
EQUIP	Equipment
ERV	Energy Recovery Ventilator
ES	Electric Strike
ESA	Electrical Safety Authority
ESD	Electro Static Discharge
EW	Eye Wash
EX or EXIST	Existing
EXP	Exposed
EXT	Exterior

## F

F.A	Fire Alarm
FACP	Fire Alarm Control Panel
FAPS	Fire Alarm Pull Station
FCC	Federal Communications Commission
FCU	Fan Coil Unit
FD	Floor Drain
FDC	Fire Department Connection
FDN	Foundation
FE	Fire Extinguisher
FEC	Fire Extinguisher Cabinet
FF	Factory Finished
FH	Rating Fire & Hose
FHC	Fire Hose Cabinet
FIN	Finish
FLR	Floor
FM	Factory Mutual
FPM	Feet per minute
FR	Fire Retardant
FRR	Fire Resistance Rating
FRS	Fire Route Sign
FS	Folding Seat
FT	Feet, Foot
FT	Foot
FTG	Footing

## G

g/L	Grams Per Liter
GA	Gauge
GALV	Galvanized
GANA	Glass Association of North America
GB	Grab Bar
GFI	Ground Fault Interrupter
GFCI	Ground Fault Circuit Interrupter
GL	Glazing
GND	Ground
GPM	Gallons Per Minute
GR	Grade
GWB	Gypsum Wall Board
GWB-AR	Gypsum Wall Board-Abuse Resistant (Inherently MR As Well)
GWB-MR	Gypsum Wall Board-Moisture Resistant
GWMP	Ground Water Management Plan
GYP	Gypsum Board

## H

HB	Hose Bib
HCFC	Hydrochlorofluorocarbons
HD	Hand Dryer
HDA	Heavy Duty Asphalt
HDF	High Density Fiberboard
HDPE	High Density Polyethylene
HDW	Hardware
HDWD	Hardwood
HLR	Horizontal Lifeline Fall Protection System - Roof Mounted
HLW	Horizontal Lifeline Fall Protection System - Wall Mounted
HM	Hollow Metal
HMP	Hollow Metal Panel
HOA	Hand-Off-Automatic
HOC	Hold Open Close
HOD	Hold Open Device
HORIZ	Horizontal
HP	Horse Power
HR	Hour
HRC	High Rupturing Capacity
HRD	Hair Dryer
HS	Hardware Schedule
HSN	Hub and Spigot No-hub (see ASTM C564)
HSP	Hose Standpipe
HSS	Hollow Steel Selection
HT	Height
HV	High Voltage
HVAC	Heating, Ventilation, and Air Conditioning

HW	Hot Water
Hz	Hertz
<b>I</b>	
IAP	Insulated Aluminum Panel
IAPMO	International Association of Plumbing and Mechanical Officials
IAQ	Indoor Air Quality
IC	Intumescent Coatings
ICD	Implantable Cardioverter-defibrillator
ID	Identification
IDIA	Inside Diameter
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
IFB	Impregnated Fibre Board
IG	Insulating Glass
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Association
IGMAC	Insulated Glass Manufacturers Association of Canada
IN	Inch, Inches
INFO	Information
INSUL	Insulated
INSUL	Insulation
INT	Interior
I/O	Input/Output
IP	Internet Protocol
ISO	International Organization for Standardization
IT	Infrastructure Technology
<b>J</b>	
JC	Janitor Closet
JT	Joint
<b>K</b>	
kA	kiloampere
KHz	kilohertz
KP	Kick Plate
kPa	kilopascal
KPD	Key Pad
Kph	kilometers per hour
KVA	kilovolt amps
KVAR	kilovolt-amperes reactive
kW	kilowatt
kwh	kilowatt-hour
KWS	kilowatt-second

<b>L</b>	
L.F	Linear Foot
L.H	Left Hand
l/s	Liters Per Second
LAM	Laminate
LAN	Local Area Network
LAV	Lavatory
LCD	Liquid Crystal Display
LDA	Light Duty Asphalt
LED	Light-Emitting Diode
LINO	Linoleum
LKR	Locker
LNT	Lintel
LP	Low Point
LPM	Liters Per Minute
LRG	Large
LSRCA	Lake Simcoe And Region Conservation Authority
LTIC	Laminated Timber Institute of Canada
LV	Low Voltage
LVL	Level
LVR	Louver
LVR.O	Louver Opening
LVT	Low Voltage thermostat

<b>M</b>	
M	Meter
M.O	Masonry Opening
m/s	Meter Per Second
mA	Milli-Ampere
MAINT	Maintenance
MAS	Masonry
MAT	Mineral Acoustic Tile
MAT'L	Material
MAX	Maximum
MCC	Motor Control Center
MCM	Thousand Circular Mils
MECH	Mechanical
MED	Medium
MERV	Minimum Efficiency Reporting Value
MFG	Manufacturing
MFR	Manufacturer
MI	Mirror
MIA	Marble Institute of America
MIN	Minimum

MIN	Minute
MISC	Miscellaneous
MM	Millimeter
MM	Millimeters
MNR	Ministry of Natural Resources
MOE	Ministry of The Environment
MP	Metal Plate
MPA	Megapascal
MPH	Miles Per Hour
MPMDD	Modified Proctor Maximum Dry Density
MS	Metal Stud
MSS	Manufacturers Standardization Society
MS/TP	Master Slave Token Passing
MSTP	Multiple Spanning Tree Protocol
MTC	Ministry of Transportation and Communications
MTC COORD	Multiple Trade Coordination Required
MTD	Mounted
MTL	Metal
mV	Millivolt
MWLLBD(L)	Murphy Wall Bed - Lateral
MWLLBD(V)	Murphy Wall Bed - Vertical

## N

N	North
NAAMM	National Association of Architectural Metal Manufacturers (USA)
NACE	National Association of Corrosion Engineers
NAIMA	North American Insulation Manufacturers Association
NBC	National Building Code of Canada
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards (USDC)
NC	Noise Criterion
NCM	No Centre Mullion
ND	Napkin Dispenser
NDT	Non-Destructive Testing
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFWH	Non-Freeze Wall Hydrant
NG	Natural Gas
NHLA	National Hardwood Lumber Association (USA)
NIC	Not in Contract
NLGA	National Lumber Grades Authority
NO	Number
NO/NC	Normally Open/Normally Closed



NOX	Nitrous Oxide
NPSH	Net Positive Suction Head
NPT	National Pipe Thread
NPD	Kinetics Noise Control
NRC	National Research Council
NS	Non-Slip
NTS	Not to Scale
NWWDA	National Wood Window and Door Association

## O

OAT PG	Outdoor Air Temperature Program
O&M	Operations & Maintenance
OBC	Ontario Building Code
OC	On Centre
OCIP	Owner Controlled Insurance Program
OD	Outside Diameter
ODBC	Oracle Database Connectivity
ODP	Qzone Depletion Prevention
ODS	Overhead Door Stop
OEM	Original Equipment Manufacturing
OESC	Ontario Electrical Safety Code
OFC	Ontario Fire Code
OH	Overhead
OHC	Overhead Closer
OHSA	Occupational Health and Safety Act
OPG	Opening
OPP	Opposite
OPSS	Ontario Provincial Standard Specifications
ORN	Ornamental
OSA	Outside Air
OS&Y	Outside Screw and Yoke
OWSJ	Open Web Steel Joist
OZ.	Ounce

## P

PA	Paging System
Pa	Pascal
PANIC	Rated Panic Device
PAR	Parallel
PART	Partition
PB	Push Button
PC	Precast
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDF	Portable Document Format

PDI	Plumbing and Drainage Institute
PE	Pressure Electric (Switch)
PER	Perimeter
PERP	Perpendicular
PF	Picofarad
PH	Potential Hydrogen (Ph Unit of Measure)
PIB	Polyisobutylene
PID	Proportional Integrative Derivative
PL or PLL	Plastic Laminate
PL	Plate
PLAM	Plastic Laminate
PLF	Platform
PNL	Panel
PNT	Paint
POL	Polished
PP	Push Plate
PR	Pair
PREFAB	Prefabricated
PREFIN	Prefinished
PREMANUF	Pre-Manufactured
PRFN	Pre-Finished
PRL	Private Lock
PROF	Profile
PRV	Pressure Reducing Valve
PSI	Pounds Per Square Inch
PSID	Pounds Per Square Inch Differential
PSIG	Pounds Per Square Inch Gauge
P/T	Pressure and Temperature
PT	Porcelain Tile
PTD	Paper Towel Dispenser
PTD/WR	Paper Towel Dispenser & Waste Receptacle
PTFE	Polytetrafluoroethylene
PTL	Push to Lock
PTTW	Permit to Take Water
PVC	Polyvinyl Chloride
PWD	Plywood

## Q

QTR.	Quarter
QTY	Quantity

## R

R	Radius
R/A	Return Air
RA	Roof Anchor

RAT'G	Rating
RB	Resilient Base
RCA	Reinforced Concrete Apron
RCM	Removable Centre Mullion
RD	Roof Drain
REF	Reference
REQ'D	Required
RES	Residential
REX	Request to Exit
RFCI	RF-Conducted Immunity
RFI	Radio Frequency Interference
RM	Room
RMCAO	Ready mix Concrete Association of Ontario
RMS	Root Mean Square
RO	Rough Opening
RPM	Revolutions per minute
RPU	Remote page unit
RSH	Recessed Soap Holder
RSI	R-Value (SI units)
RSL	Resilient
RWL	Rainwater Leader

## S

S	South
SA	Supply Air
SAE	Society of Automotive Engineers
SAT	Supply Air Temperature
SBS	Styrene Butadiene Styrene
SC(OT)	Scupper - Overflow Type
SCADA	Supervisory Control and Data Acquisition
SCHED	Schedule
SCR	Shower Curtain and Rod
SCS	Solid Core Steel
SCW	Solid Core Wood
SD	Soap Dish
SDI	Steel Deck Institute
SEAL	Sealer
SECT	Section
SEI CMM	American Software Engineering Institute Capability Maturity Model
SER	Service
SH	Shower Head
SH/C	Shower Head & Control
SHLV	Shelving
SHR	Vibro-Acoustics Spring Hangers
SIM	Similar

SM	Sheet Metal
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SND	Sanitary Napkin Dispenser
SP	Steel Plate
SPDT	Single Pole Double Throw
SPEC	Specification
SPEC'D	Specified
SPMDD	Standard Proctor Maximum Dry Density
SPS	Solid Polymer Surfacing
SPST	Single Pole Single Throw
SQ	Square
SQFT	Square Feet, Square Foot
SR/C	Shower Rod and Curtain
SS	Stainless Steel
SSK	Service Sink
SSPC	Steel Structure Painting Council
SSUR	Solid Surfacing (Material)
SSUR(IS)	Solid Surface (Material) For Island Countertops
SSUR(WS)	Solid Surface (Material) For Window Sills
ST	Stain
STA	Standard
STC	Sound Transmission Class
STD.	Station
STL	Steel
STN	Stone
STOR	Storage
STRUCT	Structural
SUSP	Suspended
SYS	System
<b>T</b>	
T&G	Tongue and Groove
T/O	Top Of
TAB	Testing, Adjusting, and Balancing
TB	Thermally Broken
TBB	Tile Backer Board
TBT	Thermally Broken Threshold
TCP	Transmission Control Protocol
TEC	Thermoelectric coolers
TEL	Telephone
TEMP	Temperature
TG	Tempered Glass
TH	Threshold
THD	Total Harmonic Distortion
THRU	Through

TIA	Telecommunications Industry Association
TIAC	Thermal Insulation Association of Canada
TOD	Time of Day
TOFM	Toilet - Floor Mounted
TOS	Top of Structure
TOWM	Toilet - Wall Mounted
TPD	Toilet Paper Dispenser
TRANSP	Transparent
TRCA	Toronto and Region Conservation Authority
TS	Transition Strip
TSSA	Technical Standards & Safety Authority
TTD	Toilet Tissue Dispenser
TTH	Toilet Tissue Holder
TTMAC	Terrazzo, Tile and Marble Association of Canada
TV	Television
TVSS	Transient Voltage Surge Suppressor
TWB	Towel Bar
TWF	Through Wall Flashing
TYP	Typical

## U

UL	Underwriters Laboratories (USA)
ULC	Underwriters Laboratories Canada
UNFIN	Unfinished
UNO	Unless Noted Otherwise
UOD	Underside of Deck
UOS	Unless Otherwise Specified
UPS	Uninterruptible Power Supply
UR	Urinal
UOS	Underside of Steel
USAS	United States of America Standards Institute
USB	Universal Serial Bus
USGPM	Us Gallons Per Minute
USS	Underside of Structure
UTC	Coordinated Universal Time
UV	Ultraviolet

## V

V	Volts
VAC	Voltage Alternating Current
VAV	Variable Air Volume
VB	Vapour Barrier
VCT	Vinyl Composite Tile
VDC	Voltage Direct Current
VERT	Vertical

VEST	Vestibule
VFD	Variable Frequency Drive
VIF	Verify
VLAN	Virtual Local Area Network
VOC	Volatile Organic Compound
VP	Vent Pipe
<b>W</b>	
W	West
W/	With
W/O	Without
WAN	Wide Area Network
WC	Water Column
WD	Wood
WG	Wired Glass
WHI	Warnoch Hersey
WM	Wire Mesh
WO	Window Opening
WOG	Water Oil Gas
WR	Washroom
WRGBB	Water Resistant Gypsum Backing Board
WS	Wall Stop
WS	Window Shade
WSBO	Window Shade & Blackout Blind
WSIB	Workplace Safety and Insurance Board
WT	Wall Tile
WTS	Weatherstripping
WWF	Welded Wire Fabric
<b>X</b>	
XLPE	Cross-linked Polyethylene
<b>Y</b>	
YR	York Region

## 2 PRODUCTS

Not Included

## 3 EXECUTION

Not Included

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Requirements
- .4 1.4. Tolerances For Installation Of Work
- .5 1.5. Construction Review
- .6 1.6. Quality Control
- .7 1.7. Inspection And Testing
- .8 1.8. Inspection And Testing Services And Reference Standards
- .9 1.9. Submittals
- .10 1.10. Responsibilities Of The Consultant
- .11 1.11. Responsibilities Of The Contractor
- .12 1.12. Responsibilities Of Inspection And Testing Companies
- .13 1.13. Contractor's Field Quality Control
- .14 1.14. Independent Inspection And Testing
- .15 1.15. Access To The Work And Cooperation
- .16 1.16. General Procedures
- .17 1.17. Inspection And Testing Procedures
- .18 1.18. Defective Work
- .19 1.19. Scheduling And Reports
- .20 1.20. Test And Mix Designs
- .21 1.21. Mill Tests
- .22 1.22. Mockups
- .23 1.23. Equipment And Systems
- .24 1.24. Manufacturer's Field Review

### **1.3. RELATED REQUIREMENTS**

- 1.3.1. Pre-installation meetings: in accordance with Section 01 31 19.
- 1.3.2. Materials and workmanship quality assurance and reference standards: in accordance with Section 01 60 00.
- 1.3.3. Balancing and testing of systems - under Divisions 21, 22, and 23, and Divisions 26, 27, and 28.

### **1.4. TOLERANCES FOR INSTALLATION OF WORK**

- 1.4.1. Unless acceptable tolerances are otherwise specified in a Section or a reference standard or are otherwise required for proper functioning of equipment, site services, and mechanical and electrical systems:
- 1.4.1.1. "plumb and level" shall mean plumb or level within 3mm in 3048mm
  - 1.4.1.2. "square" shall mean not in excess of 10 seconds lesser or greater than 90°.
  - 1.4.1.3. "straight" shall mean within 3mm under a 3048mm long straight edge.

### **1.5. CONSTRUCTION REVIEW**

- 1.5.1. The Consultant and his Sub-Consultants may carry out construction review during the progress of the work. The Consultant's general review during construction, and inspection and testing by independent inspection and testing companies reporting to the Consultant, are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve him of contractual responsibility.

## **1.6. QUALITY CONTROL**

- 1.6.1. Bring to the attention of the Consultant any defect in the work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and state his recommendations in writing.
- 1.6.2. The Consultant may appoint and direct inspection and testing companies to review completed work in addition to inspection and testing specified for inclusion in the work under Source and Field Quality Control in other Sections.

## **1.7. INSPECTION AND TESTING**

- 1.7.1. Source and Field Quality Control Specified in Other Sections:
  - 1.7.1.1. This Section includes requirements for performance of inspection and testing specified under Source Quality Control and Field Quality Control in other Sections of the Specification.
  - 1.7.1.2. Do not include in work of this Section responsibilities and procedures that relate solely to an inspection and testing company's function under the direction of the Owner and that are specified in another Section which is paid for directly by the Owner. Such information is included in this Section for only the Contractor's information.
- 1.7.2. Do not limit responsibility for ensuring that products and execution of the work meet Contract requirements and inspection and testing required to this end, to specified inspection and testing.
- 1.7.3. Payment for Inspection and Testing Services:
  - 1.7.3.1. Payment for specified inspection and testing will be made by the Contractor, as required by each applicable Section.
  - 1.7.3.2. Payment for re-inspection and retesting of defective and rejected work shall be made by the Owner and back-charged to the Contractor.
  - 1.7.3.3. Contractor to engage approved company(s) for inspections and tests for additional inspections and tests as may be performed for the Contractor's own purposes and convenience. Include cost of this inspection and testing in the Stipulated Price Contract.

## **1.8. INSPECTION AND TESTING SERVICES AND REFERENCE STANDARDS**

- 1.8.1. Qualifications of Inspection and Testing Companies:
  - 1.8.1.1. Companies engaged for inspection and testing shall provide equipment, methods of recording and evaluation, and knowledgeable personnel to conduct tests precisely as specified in reference standards.
  - 1.8.1.2. If requested, submit affidavits and copies of certificates of calibration made by an accredited calibrator to verify that testing equipment was calibrated and its accuracy ensured within the previous twelve months.
  - 1.8.1.3. Inspection and testing of concrete and concrete materials will be carried out by a CSA Certified testing laboratory to CSA A283, for review in accordance with CSA A23.1/A23.2.
- 1.8.2. Reference Standards:
  - 1.8.2.1. Perform inspection and testing in accordance with standards quoted and as required by procedures described in specified reference standards that are applicable to the work being inspected and tested.

## **1.9. SUBMITTALS**

- 1.9.1. Submit inspection and testing reports in accordance with Section 01 33 00.

## **1.10. RESPONSIBILITIES OF THE CONSULTANT**

- 1.10.1. The Contractor will submit a list of Inspection and Testing companies to the Consultant for their review.
- 1.10.2. The Contractor will obtain a minimum of 3 quotes from inspection and testing companies in the type and extent of inspection and testing to be undertaken, be presented to the



Consultant and Client for review. Selected Inspection and Testing company will be executed under the Cash Allowance.

- 1.10.3. The Consultant will receive submitted reports of inspections and tests for evaluation and will decide upon any actions that may be required.
- 1.10.4. The Consultant will provide Drawings and Specifications required by inspection and testing companies.

#### **1.11. RESPONSIBILITIES OF THE CONTRACTOR**

- 1.11.1. Inspection and testing performed by firms engaged for Source and Field Quality Control specified in other Sections shall not relieve the Contractor from responsibility of performing his work in accordance with the Contract Documents.
- 1.11.2. Provide access for inspection and testing personnel to work in progress and to fabricator's operations.
- 1.11.3. Provide samples of materials to be tested in required quantities at locations testing is performed.
- 1.11.4. Submit copies of mill test reports in accordance with Section 01 33 00.
- 1.11.5. Provide labour and facilities:
  - 1.11.5.1. To facilitate inspections and tests.
  - 1.11.5.2. For storing of specimens at require temperature and free from vibration, in conformance with reference standard and inspection and testing company instructions.
  - 1.11.5.3. For obtaining, handling and transporting of samples at site and plant.
- 1.11.6. Notify Consultant, and inspection and testing company at least 48 hours before work to be inspected and tested commences.
- 1.11.7. When it is discovered on inspection that work is proceeding with incorrect materials or methods, ensure that corrections are immediately made and that improperly completed work is replaced.
- 1.11.8. Inspect all work done by subtrades prior to application of final cover materials i.e. pressure plates, drywall ceilings, concrete slab pours and the like.

#### **1.12. RESPONSIBILITIES OF INSPECTION AND TESTING COMPANIES**

- 1.12.1. Determine from the Specifications and Drawings the extent of inspection and testing required for work of Contract as directed by Consultant. Notify Consultant of any omissions or discrepancies in the work inspected and/or tested.
- 1.12.2. Perform applicable inspection and testing described in the Specification and as may be additionally directed.
- 1.12.3. Provide competent inspection and testing personnel when notified by the Contractor that applicable work is proceeding. Inspection personnel shall co-operate with the Consultant and Contractor to expedite the work.
- 1.12.4. Inform the Consultant of intended scheduling of inspections and of each visit of inspection personnel to the work site and fabricator's operations.
- 1.12.5. Notify the Consultant and Contractor of deficiencies and irregularities in work immediately they are observed in course of inspections and tests.
- 1.12.6. Inspection and testing companies shall not perform or supervise any of the Contractor's work, and shall not authorize:
  - 1.12.6.1. Performance of work that is not in strict accordance with the Contract Documents.
  - 1.12.6.2. Approval or acceptance of any part of the work.

#### **1.13. CONTRACTOR'S FIELD QUALITY CONTROL**

- 1.13.1. The Contractor is responsible for field quality control of the Work including quality control of Subcontractors and material Suppliers.
- 1.13.2. Ensure that the only specified or approved Products and materials are used.
- 1.13.3. Provide and maintain an effective quality control program, in accordance with the Quality Assurance Program, and perform sufficient inspections and tests of all items of work, including those of Subcontractors, to ensure compliance with Contract Documents.

- 1.13.4. Furnish appropriate facilities, instruments, and testing devices required for performance of the quality control function.
- 1.13.5. Required certificates of inspection testing or approval shall be secured by the Contractor and delivered to the Owner in such time as not to delay progress of the Work.
- 1.13.6. The Contractor shall develop a field quality control manual covering both factory and field installation. The form of the manual shall be reviewed and accepted by the Consultant. This manual will document quality control practices of the Contractor, Subcontractors, and major Suppliers. The manual shall include, but not be limited to, specific criteria related to:
  - 1.13.6.1. Concrete slab moisture and pH testing and surface preparation, including flatness and levelness.
  - 1.13.6.2. Surface preparation.
  - 1.13.6.3. Fastener and anchor installation.
  - 1.13.6.4. Air barrier continuity: identify continuity of air barrier systems, including joints and overlapping of dissimilar systems.
  - 1.13.6.5. Air barrier, adhesion testing.
  - 1.13.6.6. Sealant mixing, tack time, set time.
  - 1.13.6.7. Sealant staining of porous substrate testing.
  - 1.13.6.8. Sealant adhesion testing, including butterfly tests where applicable.
  - 1.13.6.9. Painting, verification and adhesion testing where required.
  - 1.13.6.10. Material compatibility testing.
  - 1.13.6.11. On line fabrication quality control practices.
  - 1.13.6.12. Shipping.
  - 1.13.6.13. Field installation.
  - 1.13.6.14. Field inspection and testing (by Contractor).
  - 1.13.6.15. Field inspection and testing (independent).
- 1.13.7. Inspection and testing shall be performed by company qualified to perform the inspections or tests specified or required.
- 1.13.8. The Contractor is to maintain a logbook (copies to be provided to the Consultant at completion of fabrication) documenting date, time, results, and significance of in-plant testing carried out, where applicable, linked to daily production. The form of this logbook shall be reviewed and accepted by the Consultant.

#### **1.14. INDEPENDENT INSPECTION AND TESTING**

- 1.14.1. The Owner and the Consultant shall have access to the Work at all times. If part of the Work is in preparation at locations other than the Place of the Work, access shall be given to such work whenever it is in progress.
- 1.14.2. Independent inspection and testing services will be used to verify compliance with requirements of the *Contract Documents*. These services do not relieve the Contractor of responsibility for compliance with the *Contract Documents*.
  - 1.14.2.1. Specified tests, inspections, and related actions do not limit the Contractor's other quality assurance and control procedures that facilitate compliance with the *Contract Documents* requirements.
  - 1.14.2.2. Requirements for the Contractor to provide quality control services required by Consultant, Owner, or authorities having jurisdiction are not limited by provisions of this section.
  - 1.14.2.3. Inspections and tests specified or required that are not specified as independent inspection and testing are the responsibility of the Contractor and are not covered under the Owner's quality assurance requirements.
- 1.14.3. The Consultant will, on behalf of Owner, appoint inspection and testing companies, representing, reporting and responsible to the Owner through the Consultant.
  - 1.14.3.1. Cost of inspection and testing company services will be authorized as a disbursement from Cash Allowance as specified in Section 01 21 00. Inspection and testing company shall submit monthly invoice original to Contractor for review, relating invoices to tests and inspection reports. Provide original receipts for disbursements. Invoices for inspection and testing services shall be

- forwarded by Contractor to Consultant for inclusion in progress payment application.
- 1.14.4. Additional testing services required because of changes in materials, proportions of mixes requested by Contractor or Subcontractors as well as additional testing services for materials occasioned by lack of identification or by failure of such materials being replaced to meet requirements of the Contract Documents or testing of structure or elements including load testing, shall be carried out at no additional cost to the Owner.
  - 1.14.5. Inspection and testing required by codes or ordinances, or by an authority having jurisdiction, and made by a legally constituted authority, shall be the responsibility of the Contractor and shall be paid for by the Contractor and not be paid by Owner, unless otherwise specified in the Contract Documents.
  - 1.14.6. Inspection or testing performed exclusively for Contractor's convenience shall be sole responsibility of Contractor and will not be paid by Owner.
  - 1.14.7. Inspection and testing shall be performed by company qualified to perform the inspections or tests specified or required.
  - 1.14.8. Requirements of regulatory companies:
    - 1.14.8.1. Testing shall be conducted in accordance with requirements of the building code.
    - 1.14.8.2. Obtain certification where required by the building code and standards.
  - 1.14.9. Inspection and tests required by codes or ordinances, or by an Authority Having Jurisdiction, and made by a legally constituted authority, shall be the responsibility of the Contractor and not requested or directed by the Consultant. Required inspection and testing shall be paid for by the Contractor and not be paid by the Owner, unless otherwise specified in the Contract Documents.
  - 1.14.10. Inspection or testing performed exclusively for Contractor's convenience shall be the sole responsibility of the Contractor and will not be paid for by the Owner.
  - 1.14.11. The inspection and testing service does not relieve the Contractor of its responsibility to perform regular shop and Site inspection, and quality control of production.
  - 1.14.12. Inspection and testing services, field and laboratory testing, shall be required for, but not limited to, the following:
    - 1.14.12.1. Excavation, backfill and compaction; inspection and testing.
    - 1.14.12.2. Founding soils; inspection.
    - 1.14.12.3. Paving systems; inspection and testing.
    - 1.14.12.4. Concrete reinforcement.
    - 1.14.12.5. Concrete.
    - 1.14.12.6. Mortar.
    - 1.14.12.7. Structural steel.
    - 1.14.12.8. Steel deck.
    - 1.14.12.9. Roofing

#### **1.15. ACCESS TO THE WORK AND COOPERATION**

- 1.15.1. The Contractor shall allow the Independent Inspection and Testing Agencies access to the Work, wherever the Work is in progress, or wherever Products, materials, or equipment are stored prior to shipping, including to off-Site manufacturing and fabrication plants.
- 1.15.2. Provide access to the Work for representatives of inspection and testing companies.
- 1.15.3. Provide inspection company with materials and installation information as required and/or requested.
- 1.15.4. Cooperate with inspection and testing companies and give adequate notification of any changes in source of supply, additional work shifts and other proposed changes.
- 1.15.5. No Product nor part of the Work shall be installed before it is tested when a test is specified or required, nor shall work be executed where a test or inspection is required and the inspector cannot attend.
- 1.15.6. Supply labour required to assist inspection and testing company in sampling and making tests.
- 1.15.7. Repair work damaged as a result of inspection and testing work.

- 1.15.8. Cost of above labour and material shall be borne by the Contractor.
- 1.15.9. Inspection and testing company services do not relieve the Contractor of responsibility for normal shop and site inspection, and quality control of manufacturing and installation.

#### **1.16. GENERAL PROCEDURES**

- 1.16.1. The Contractor shall notify the appropriate agency and the Consultant sufficiently in advance of the requirement for tests in order that attendance arrangements can be made reasonably.
- 1.16.2. Submit samples and/or materials required for testing, as specifically requested in the Contract Documents. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the progress of the Work.
- 1.16.3. The Contractor shall Provide labour and facilities to obtain and handle samples and materials at the Place of the Work. Provide sufficient space to store and cure test samples.

#### **1.17. INSPECTION AND TESTING PROCEDURES**

- 1.17.1. Perform specified inspection and testing only in accordance with specified reference standards, or as approved.
- 1.17.2. Observe and report on compliance of work to requirements of Contract Documents.
- 1.17.3. Ensure that inspectors are on site or at fabricator's operations for full duration of critical operations, and as otherwise required to determine that work is being performed in accordance with the Contract Documents.
- 1.17.4. Identify samples.
- 1.17.5. Identify sources of materials.
- 1.17.6. Review and report on progress of work. Report on count of units fabricated and inspected at fabricator's operations.
- 1.17.7. Observe and report on conditions of significant work in progress at time of inspection or at fabricator's operations. Include where applicable and if critical to work in progress:
  - 1.17.7.1. Time and date of inspection.
  - 1.17.7.2. Temperature of air, materials, and adjacent surfaces.
  - 1.17.7.3. Humidity of air, and moisture content of materials and adjacent materials.
  - 1.17.7.4. Presence of sunlight, wind, rain, snow, and other weather conditions.
- 1.17.8. Include in reports all information critical to inspection and testing.
- 1.17.9. Ensure that only materials from the work and intended for use therein are tested.
- 1.17.10. Determine locations for work to be tested.

#### **1.18. DEFECTIVE WORK**

- 1.18.1. Where evidence exists that defective workmanship may have occurred, or that the Work may have been carried out incorporating defective materials, or tests demonstrate that installed conditions do not comply with the requirements of the Contract Documents, the Consultant reserves the right to have appropriate inspections, tests, and surveys performed, analytical calculation of structural strength made and the like in order to help determine the extent of defect and whether such work must be replaced. Inspections, tests, and surveys carried out under these circumstances will be made at the Contractor's expense, and will not be paid by Owner, unless the results indicate that the work so tested, inspected or surveyed is not defective or that, in Consultant's opinion, the work so tested, inspected, or surveyed may be accepted, in which case tests, inspections or surveys will be paid by Owner.
- 1.18.2. If the Contractor covers, or permits to be covered, work that has been designated for special tests, inspections or approvals before such tests, inspections or approvals have been made, the Contractor shall, if so directed by the Consultant uncover the work, have the inspections or tests satisfactorily completed, and make good the work. Such uncovering and making good will not be considered or approved as a change in the Work.
- 1.18.3. The Consultant may order any part of the Work to be examined if the Work is suspected not to be in accordance with the Contract Documents. If, upon examination, such work is

- found not to be in accordance with the Contract Documents, the Contractor shall correct such work and pay the cost of the examination and correction neither of which will be considered or approved as a change in the Work. If such work is found to be in accordance with the Contract Documents, the Owner will pay for the cost of examination and replacement as a change in the Work in accordance with Section 01 26 00.
- 1.18.4. Additional testing required because of changes in materials, proportions of mixes requested by the Contractor or Subcontractors as well as any extra testing of materials occasioned by lack of identification or by failure of such materials being replaced to meet requirements of the Contract Documents or testing of structure or elements including load testing, shall be carried out at no additional cost to the Owner.
  - 1.18.5. The Contractor shall make good any Subcontractor's work damaged by such removals or re-executions at the Contractor's expense and promptly.
  - 1.18.6. If, in the opinion of the Consultant, it is not expedient to correct the defective work or the work not performed in accordance with the Contract Documents, the Owner may deduct from the monies otherwise due to the Contractor, the difference in value between the work performed and that required in the Contract Documents, the amount of which shall be determined by the Consultant.

#### **1.19. SCHEDULING AND REPORTS**

- 1.19.1. Contractor shall prepare schedule for inspection and testing company services in accordance with Section 01 33 00 and as follows:
  - 1.19.1.1. Establishing schedule:
    - (1) By advance discussion with the selected inspection or testing company, determine the appropriate time necessary to perform the required services and to issue related reports.
    - (2) Allow for required time within construction schedule.
  - 1.19.1.2. Adherence to schedule:
    - (1) Contractor shall advise inspection and testing companies in advance when inspection and testing of the Work is required.
    - (2) Amount of advance notice shall be as required by the inspection and testing company but shall be no less than 2 Working Days.
    - (3) When inspection and testing company is ready to perform inspection and testing according to predetermined schedule, but is prevented from inspection and testing or taking specimens due to incompleteness of the parts of the Work scheduled for inspection and testing, extra costs for inspection and testing attributable to the delay may be back-charged to Contractor at no additional cost to the Owner.
  - 1.19.1.3. Notify inspection and testing company at least 3 Working Days before work required to be inspected commences, and arrange for a meeting at the Place of the Work, to be held 1 Working Day before the work starts with the following present:
    - (1) The Contractor, and the Subcontractor responsible for the work to be inspected and/or tested, the inspection and testing company representatives, the product manufacturer's representative when required, and the Consultant.
  - 1.19.1.4. Give 2 Working Days' prior notice to inspection and testing company of the commencement of each phase of the Work requiring inspection and provide inspection and testing company with materials and installation information.
- 1.19.2. Reports and documents
  - 1.19.2.1. Inspection and testing company shall submit shop inspection and site inspection reports within 5 Working Days of each inspection.
  - 1.19.2.2. Distribute reports as follows:
    - (1) Owner; 2 copies.
    - (2) Consultant; 1 copy.
    - (3) Contractor; 2 copies.
    - (4) Consulting engineers, as applicable; 1 copy each.

- (5) Provide copies to the Subcontractor whose work is being inspected and/or tested, or to the manufacturer/fabricator of the material being inspected and/or tested.
- 1.19.2.3. Inspection and testing companies shall submit a written report for each inspection or test, including pertinent data such as conditions at the Place of the Work, dates, test references, locations of tested materials, actual Product identification, testing methodology, procedures, and descriptions, site instructions given, recommendations and/or any other information required by standard applicable to reporting of tests and inspections.
  - (1) Report shall clearly indicate failure of Product or procedures to meet applicable standards, give recommendations for retesting or correction. Inspector shall contact Contractor and Consultant immediately when Product or Product assembly fails to meet requirements of the Contract Documents.
- 1.19.2.4. Upon completion of portions of the Work subject to independent inspection and testing, submit to the Consultant duplicate certificates of acceptance of the installation issued by the independent inspection and testing company.
- 1.19.3. Copies of all inspection and test reports shall be submitted as part of the Project Records Documents in accordance with Section 01 77 00.

## **1.20. TEST AND MIX DESIGNS**

- 1.20.1. Furnish test results and mix designs as required by the Contract Documents or as may reasonably be requested by the Consultant.
- 1.20.2. The procedures for submittal of test results and mix designs shall be the same as those required for shop drawings in accordance with Section 01 33 00 Submittals.
- 1.20.3. Test results and mix designs are to be considered as forming part of the Project Record Documents in the same manner as shop drawings in accordance with Section 01 77 00 Project Closeout.
- 1.20.4. The costs of tests and mix designs beyond those called for in the Contract Documents, or beyond those required by the authorities having jurisdiction, shall be appraised by the Consultant and may be authorized as a change in the Work.
- 1.20.5. Specimens and samples for testing, unless otherwise specified in the Contract Documents, will be taken by the inspection and testing company; sampling equipment and personnel will be provided by the inspection and testing company; and deliveries of specimens and samples to the testing company will be performed by the testing company unless otherwise specified.
- 1.20.6. Inspection and testing company shall take samples necessary to verify quality as specified. Taking of samples shall not endanger the structure or life safety and shall be taken so as to best represent the Work as a whole.
- 1.20.7. Samples shall be handled, packaged, stored, and delivered in accordance with specified tests. Sample handling where required shall duplicate conditions at the Place of the Work (such as site-cured concrete cylinders).

## **1.21. MILL TESTS**

- 1.21.1. Submit mill test certificates required by the Contract Documents.
- 1.21.2. The procedures for submittal of mill test certificates shall be the same as those required for shop drawings in accordance with Section 01 33 00 Submittals.
- 1.21.3. Mill test certificates are to be considered as forming part of the Project Record Documents in the same manner as shop drawings in accordance with Section 01 77 00.

## **1.22. MOCKUPS**

- 1.22.1. The Contractor shall ensure that all Subcontractors and suppliers prepare mockups for work specifically requested in the Contract Documents. Any costs associated with the preparation of mockups shall be included in the Contract Price.
- 1.22.2. Provide field or shop erected example of work complete with specified materials and workmanship.

- 1.22.3. Construct in locations acceptable to the Consultant unless otherwise indicated in the Contract Documents.
- 1.22.4. Prepare the mockups for review by the Consultant with reasonable promptness and in an orderly sequence, so as not to delay the progress of the Work.
- 1.22.5. Failure to prepare mockups in ample time will not be considered sufficient reason for an extension of the Contract Time, and no claim for extension by reason of such default will be allowed.
- 1.22.6. Refer to the respective Specification Sections to determine whether the mockup may remain as part of the Work or must be removed.
- 1.22.7. Protect and maintain mock-ups until directed to be removed. Commence work demonstrated in mock-up only after review and acceptance of workmanship. Mock-ups may not become part of finished work, except with explicit, prior, written acceptance of Consultant.
- 1.22.8. Work for which a mockup is required in accordance with the Contract Documents shall not proceed until the required mockup has been reviewed by the Consultant.
- 1.22.9. Resubmit mock-ups until written acceptance is obtained from Consultant.

### **1.23. EQUIPMENT AND SYSTEMS**

- 1.23.1. Submit testing, adjustment and balancing reports for mechanical and electrical systems as required by the Contract Documents, and in accordance with Divisions 21, 22, and 23 and Divisions 26, 27, and 28, as applicable.
- 1.23.2. The procedures for submittal of adjustment and balancing reports for mechanical and electrical systems shall be the same as those required for shop drawings in accordance with Section 01 33 00 Submittals.
- 1.23.3. Adjustment and balancing reports for mechanical and electrical systems are to be considered as forming part of the Project Record Documents in the same manner as shop drawings in accordance with Section 01 77 00 Project Closeout.

### **1.24. MANUFACTURER'S FIELD REVIEW**

- 1.24.1. Where manufacturer's field review is specified, manufacturer's representative shall review the relevant parts of the work at the Place of the Work, or wherever such affected work is in progress, to ensure that work is being executed in accordance with manufacturer's written recommendations.
- 1.24.2. Manufacturer's field review is to ensure that the Products specified are being used in the Work and are being applied on surfaces prepared in accordance with their recommendations and the requirements of the Contract Documents.
- 1.24.3. Unless otherwise indicated in the Contract Documents, manufacturer's representative shall undertake a minimum of 1 field review, with additional reviews as deemed necessary by the manufacturer, to determine that the work of such sections is in accordance with the manufacturer's written recommendations.
- 1.24.4. The Contractor shall ensure that the manufacturer's representative submits a type-written report on manufacturer's letterhead within 2 Working Days after each field review. Report shall document manufacturer's representative's field observations and recommendations.
- 1.24.5. Manufacturer's field review reports shall be prepared and distributed following the procedures specified for preparation and submittal of inspection and testing reports given above.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 PART 1 - GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Installation and Removal
- .4 1.4 Temporary Drainage and Dewatering
- .5 1.5 Sanitary Facilities
- .6 1.6 Water Supply
- .7 1.7 Temporary Heating and Ventilation
- .8 1.8 Temporary Power and Light
- .9 1.9 Temporary Telephone
- .10 1.10 Hoisting
- .11 1.11 Plant, Machinery and Scaffolding
- .12 1.12 Site Storage and Over Loading
- .13 1.13 Site Office
- .14 1.14 Equipment, Tool, and Material Storage
- .15 1.15 Construction Sign
- .16 1.16 Hoarding
- .17 1.17 Weather Enclosures
- .18 1.18 Dust Tight Screens
- .19 1.19 Protection of Building Finishes and Equipment
- .20 1.20 Protection of Concrete Floors to Remain Exposed in Finished Work
- .21 1.21 Waste Management
- .22 1.22 Snow Removal
- .23 1.23 Control of Dust, Debris and Noise
- .24 1.24 Traffic Control and Road Maintenance
- .25 1.25 Security
- .26 1.26 Design and Safety Requirements for Temporary Facilities
- .27 1.27 Moisture Control

### **1.3. INSTALLATION AND REMOVAL**

- 1.3.1. Provide temporary utilities, facilities, and controls in order to execute the Work expeditiously.
- 1.3.2. Arrange, obtain, and pay cost for permits required for temporary facilities and controls.
- 1.3.3. Remove from the Place of the Work all such work after use.

### **1.4. TEMPORARY DRAINAGE AND DEWATERING**

- 1.4.1. The Work includes the removal of collected groundwater and surface water accumulating from precipitation and groundwater infiltration throughout the course of the Work until date of Substantial Performance of the Work.
- 1.4.2. Provide temporary drainage and pumping facilities to keep excavations and the Place of the Work free from standing water.
- 1.4.3. Do not discharge onto adjacent properties. Do not discharge onto adjacent roadways where such discharge may interfere with the safe and normal use thereof or where catch basins do not exist.
- 1.4.4. Keep drainage lines and gutters open. No flow of water shall be directed across or over pavements except through pipes or properly constructed troughs. Keep portions of the Work properly and efficiently drained during construction and until completion. Be



responsible for disturbances, dirt and damage which may be caused by or result from water backing up or flowing over, though, from or along any part of the Work, or due to operations which may cause water to flow elsewhere.

- 1.4.5. Keep trenches and other excavations free of water. Remove water in a manner that will prevent loss of soil and maintain the stability of existing soils.
- 1.4.6. Dispose of such water in a manner that will not be hazardous to public health and safety, private property, or to the Work.
- 1.4.7. Drainage of trenches or other excavation through storm drainage pipe will be allowed only with the express permission of the Authority Having Jurisdiction.
- 1.4.8. When drainage is permitted in writing to be directed to existing catch basins, regularly and at Substantial Performance of the Work inspect such catch basins and remove accumulated debris and sediment.

#### **1.5. SANITARY FACILITIES**

- 1.5.1. Provide sufficient sanitary facilities for workers in accordance with local health authorities.
- 1.5.2. Maintain in clean condition and properly screened from public view.

#### **1.6. WATER SUPPLY**

- 1.6.1. Provide a continuous supply of potable water for use in the Work.
- 1.6.2. Arrange for connection with the appropriate utility company and pay costs for installation, maintenance, and removal.
- 1.6.3. Pay for utility charge at prevailing rates.

#### **1.7. TEMPORARY HEATING AND VENTILATION**

- 1.7.1. Provide and pay for temporary heating, cooling, and ventilating required for the Work during the construction period, including attendance, maintenance and fuel.
- 1.7.2. Provide temporary heat and ventilation as required to:
  - 1.7.2.1. Facilitate continuous uninterrupted progress of the Work.
  - 1.7.2.2. Protect the Work and Products against damage and defacement caused by weather, harmful levels of temperature, humidity, and moisture.
  - 1.7.2.3. Provide ambient temperatures and humidity levels for proper storage, installation and curing of materials, in accordance with specified standards and manufacturer's requirements.
  - 1.7.2.4. Provide adequate ventilation to meet health regulations for safe working environment.
- 1.7.3. Construction heaters used inside buildings must be vented to the outside or be flameless type. Solid fuel salamanders are not permitted.
- 1.7.4. Maintain temperatures of minimum 10°C in areas where the Work is in progress, unless indicated otherwise in the specification sections.
- 1.7.5. Ventilate heated areas and keep building free of exhaust or combustion gases.
- 1.7.6. Heat shall be uniformly distributed to avoid hot or cold areas or excessive drying.
- 1.7.7. Make good any damage caused by inadequate or excessive heat. Such making good will not be considered or approved as a change in the Work.
- 1.7.8. Contractor is responsible to provide temporary heating as required throughout the duration of the project schedule to fully execute the work at not additional cost to the Owner.

#### **1.8. TEMPORARY POWER AND LIGHT**

- 1.8.1. Provide and maintain an adequate temporary electrical service for performance of the Work including, but not limited to, operation of electric pimps, motors, vibrators and other power tools, hoisting and related construction and general illumination during the Work.
- 1.8.2. All costs associated with providing temporary power, inclusive of generators and temporary power by Authorities Having Jurisdiction, to execute the work is at the expense of the contractor. It is the responsibility of the contractor to provide temporary power to

the Place of Work at no additional cost to the Owner. Claims for additional fuel costs for generators will not be accepted.

- 1.8.3. Arrange for temporary power required during construction for the proper execution of the Work and the safe and proper operating of power tools. Temporary power to be in accordance with Divisions 26, 27 and 28.
- 1.8.4. Arrange for connection with the appropriate utility company. Pay costs for any required permits, for installation, maintenance, and removal.
- 1.8.5. Pay for utility charge at prevailing rates.
- 1.8.6. Abide by the rules of the Canadian Electrical Code.
- 1.8.7. Maintain in good working order throughout the course of the Work.

#### **1.9. TEMPORARY TELEPHONE**

- 1.9.1. Provide and pay for a temporary telephone, to be located in the Site office, and available for use by the Owner, Consultant and Subcontractors.
- 1.9.2. The Contractor shall pay all service and local use charges for the telephone, including installation and removal on completion of the Work. Long distance charges shall be paid to the Contractor by the person or company making the call.
- 1.9.3. Superintendent shall be equipped with mobile telephone device.

#### **1.10. HOISTING**

- 1.10.1. Provide, operate, and maintain any hoists/cranes required for moving of workers, materials and equipment.
- 1.10.2. Hoists/cranes are to be operated by a qualified operator only. Proof of operator's qualification shall be provided upon request.

#### **1.11. PLANT, MACHINERY AND SCAFFOLDING**

- 1.11.1. Provide formwork, scaffolding, equipment, tools, machinery including lifts, and incidental appurtenances necessary for the proper execution of the Work.
- 1.11.2. Erect plant, machinery and scaffolding to permit access to building and the Work.
- 1.11.3. Use scaffolds in such manner as to interfere as little as possible with other trades' operations.
- 1.11.4. Support scaffolds from finished surfaces only after taking precautions to prevent damage. No supports, clips, brackets, or similar devices shall be welded, bolted, or otherwise affixed to any finished member or surface without prior permission.

#### **1.12. SITE STORAGE AND OVER LOADING**

- 1.12.1. Confine the Work and the operations of workers to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with Products or construction machinery and equipment.
- 1.12.2. Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.
- 1.12.3. Handle and store materials so as to prevent damage or defacement to the Work and surrounding property.

#### **1.13. SITE OFFICE**

- 1.13.1. Provide a weathertight, lockable office for the use of the Contractor, Subcontractors, the Consultant, engineers, and the Owner when at the Place of the Work, and for the purposes of Site meetings.
- 1.13.2. The Site office shall have heat, light, and ventilation from sources as outlined above.
- 1.13.3. Provide a meeting table, shelving, file cabinets, and the like, suitable for the storage and review of the Contract Documents, shop drawings, Change Orders, Supplemental Instructions, and all other record documents as required by the Contract Documents and by the Authorities Having Jurisdiction.
- 1.13.4. The Site office shall not be used for the storage of Products, or construction machinery or equipment.

**1.14. EQUIPMENT, TOOL, AND MATERIAL STORAGE**

- 1.14.1. Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- 1.14.2. Locate materials not required to be stored in weatherproof sheds at the Place of the Work in a manner to cause the least interference with the Work.
- 1.14.3. Owner is not responsible for securing Products or materials at the Place of the Work.

**1.15. CONSTRUCTION SIGN**

- 1.15.1. Supply and install a sign at the Place of the Work during the course of the Work. Contractor is to supply and install nominal 100 mm x 100 mm wood posts and framing and is to fix the sign to the framing.
- 1.15.2. The maximum size of the sign shall be 1200 mm x 2400 mm.
- 1.15.3. No other signs, other than for safety, caution, or instruction, will be permitted.

**1.16. HOARDING**

- 1.16.1. Provide hoarding and barricades as and where required by Authorities Having Jurisdiction or required to protect the public, workers, and public and private property from injury or damage.
- 1.16.2. Include for the provision of overhead protection and temporary exits and exit signs as may be required during the course of the Work.
- 1.16.3. Include for the provision of temporary gates and/or doors to Provide restricted access to the Place of the Work as required.

**1.17. WEATHER ENCLOSURES**

- 1.17.1. Provide weathertight closures to unfinished door and window openings, tops of shafts, and other openings in floors and roofs.
- 1.17.2. Close-off floor areas where walls are not finished, seal-off other openings, and enclose building interior work area for temporary heat.

**1.18. DUST TIGHT SCREENS**

- 1.18.1. Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work, and the public.
- 1.18.2. Maintain and relocate protection until such work is complete.

**1.19. PROTECTION OF BUILDING FINISHES AND EQUIPMENT**

- 1.19.1. Provide protection for finished and partially finished building finishes and equipment during performance of the Work.
- 1.19.2. Protect the Work from damage, discolouring, and defacement. Maintain protection until the Work is complete.
- 1.19.3. Protect completed work from soiling, abrasion, punctures, damage, and defacement, and maintain protection until the surrounding or overhead work is complete.
- 1.19.4. Keep surfaces free of oils, grease or other materials that may damage or deface them or affect bond of applied Products.
- 1.19.5. Remove and replace materials damaged or defaced as a result of failure to provide adequate protection.
- 1.19.6. Have damaged or defaced work corrected by workers meeting qualification requirements of the Contract Documents.
- 1.19.7. Provide minimum 3 mm thick Masonite board protection, or finish flooring manufacturer approved alternative, to all finished floors.
- 1.19.8. The Contractor shall be held responsible for damage due to lack of, or improper, protection, and will be required to make good any such damage. Such making good will not be considered or approved as a change in the Work.

#### **1.20. PROTECTION OF CONCRETE FLOORS TO REMAIN EXPOSED IN FINISHED WORK**

- 1.20.1. Non-marking protection material shall be placed over concrete floors designated as exposed.
- 1.20.2. Post the following on warning signs at locations leading to areas of where concrete floors are to remain exposed in finished work (see Concrete Floor Contractors Association of Canada):
  - 1.20.2.1. Concrete floors shall be protected from staining, damage and excessive loading at all times:
    - (1) No traffic is permitted on new concrete floors for the first 3 days after placement.
    - (2) Foot traffic is permitted between 3-7 days after placement (curing materials must be replaced where disturbed by traffic).
    - (3) Scissor lifts and light equipment are permitted 7 days after slab placement.
    - (4) Vehicles shall be diapered to prevent oil and other liquid spills (remove leaking equipment from the jobsite immediately).
    - (5) Tires shall be non-marking or taped with non-marking tape to prevent marking of the floors.
    - (6) Trucks, forklifts, and any other heavy loads may only to be placed on the floor if they have been previously approved by the Consultant.
    - (7) Spills shall be cleaned up immediately to avoid permanent staining of the concrete.
    - (8) Concrete shall be protected from scratching and impact damage at all times. No cutting, painting, welding, or other injurious activities shall be performed without protecting the concrete from damage prior to the commencement of work.

#### **1.21. WASTE MANAGEMENT**

- 1.21.1. Do not bury rubbish and waste materials at the Place of the Work.
- 1.21.2. Do not dispose of waste into waterways or storm or sanitary sewers.
- 1.21.3. Do not burn waste materials at the Place of the Work.
- 1.21.4. Comply with waste disposal requirements of authorities having jurisdiction.
- 1.21.5. Remove waste material from the Place of the Work daily. If waste is collected in bins, bins to be removed from site once full.
- 1.21.6. Arrange and pay for removal of debris and waste from the Place of the Work.
- 1.21.7. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. Pay fees.

#### **1.22. SNOW REMOVAL**

- 1.22.1. Allow no accumulation of ice and snow within the Place of the Work. There shall be no use of salt for de-icing in areas of building work.
- 1.22.2. Remove snow from access routes to the Work to maintain uninterrupted progress of the Work.

#### **1.23. CONTROL OF DUST, DEBRIS AND NOISE**

- 1.23.1. Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- 1.23.2. Control dust and dirt produced during the Work to prevent dispersion beyond the immediate work areas.
- 1.23.3. Prevent materials from contaminating air beyond application area, by providing temporary enclosures and ventilation/filtration.
- 1.23.4. Limit noise levels in accordance with requirements of authorities having jurisdiction and the Owner.
- 1.23.5. Prevent abrasive-blasting, pressure-washing spray, and other extraneous materials from contaminating air beyond application area.

#### **1.24. TRAFFIC CONTROL AND ROAD MAINTENANCE**

- 1.24.1. Do not block roads or impede traffic. Keep construction traffic to designated roads only.
- 1.24.2. Provide flag person to direct traffic as required.
- 1.24.3. Provide a hard surface area at the Place of the Work for cleaning down trucks prior to entry onto municipal roads or private roads outside of the Place of the Work.
- 1.24.4. Keep public and private roads free of dust, mud and debris resulting from truck, machinery and vehicular traffic related specifically to this Project, for the duration of Work.
- 1.24.5. Clean roads regularly, public, or private. Wash down and scrape flush roads at least daily when earth moving operations take place. Maintain public property in accordance with requirements of Authorities Having Jurisdiction.

#### **1.25. SECURITY**

- 1.25.1. The Contractor shall be solely responsible for securing the Place of the Work and the Work, and for securing areas used for the storage of Products or construction machinery and equipment. The Owner will have no responsibility in this regard.
- 1.25.2. Provide and maintain security lighting.
- 1.25.3. Provide and maintain temporary locks. Premises to be locked after working hours.

#### **1.26. DESIGN AND SAFETY REQUIREMENTS FOR TEMPORARY FACILITIES**

- 1.26.1. Be responsible for design, erection, operation, maintenance, and removal of temporary structural and other temporary facilities. Engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the Contract Documents; and in cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.
- 1.26.2. Engage and pay for a Professional Engineer to design and supervise construction and maintenance of hoardings, covered ways, protective canopies, and project sign(s). Designs provided by the Consultant or the Owner for such work cover general appearance only.

#### **1.27. MOISTURE CONTROL**

- 1.27.1. Concrete slabs shall be properly cured and dried before installation of finished flooring assemblies.
  - 1.27.1.1. Allow for one of the following methods:
    - (1) Drying time.
    - (2) Drying action by mechanical methods.
    - (3) Moisture mitigation coating as specified below.
    - (4) Drying action by other method and/or materials as approved by affected flooring manufacturer.
- 1.27.2. Before installation of weather barriers, when materials are subject to wetting, protect as follows:
  - 1.27.2.1. Protect porous materials from water damage.
  - 1.27.2.2. Protect stored and installed material from flowing or standing water.
  - 1.27.2.3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 1.27.2.4. Remove standing water from decks.
  - 1.27.2.5. Keep deck openings covered or dammed.
- 1.27.3. After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
  - 1.27.3.1. Do not load or install gypsum board or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 1.27.3.2. Keep interior spaces reasonably clean and protected from water damage.
  - 1.27.3.3. Periodically collect and remove waste containing cellulose or other organic matter.

- 1.27.3.4. Discard or replace water-damaged material.
- 1.27.3.5. Do not install material that is wet.
- 1.27.3.6. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- 1.27.4. After completing and sealing of the building enclosure but prior to the full operation of permanent heating, ventilation, and air conditioning systems, maintain as follows:
  - 1.27.4.1. Control moisture and humidity inside building by maintaining effective drying conditions.
  - 1.27.4.2. Use permanent heating, ventilation, and air conditioning system to control humidity subject to the prior written approval of the Consultant.
  - 1.27.4.3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.1. Section Includes
- .4 1.3. Permits
- .5 1.4. Submittals
- .6 1.5. Hoarding Design
- .7 2.1. Hoarding Materials
- .8 3.1. Hoarding Fabrication
- .9 3.2. Design and Safety Requirements for Temporary Work

### **1.3. PERMITS**

- 1.3.1. Arrange and pay for necessary permits for proper execution and completion of the work of this section.

### **1.4. SUBMITTALS**

- 1.4.1. Shop Drawings:
- 1.4.1.1. Submit shop drawings for temporary barriers and enclosures in accordance with Section 01 33 00.
  - 1.4.1.2. Clearly indicate details of construction, profiles, jointing, fastening and other related details.

### **1.5. HOARDING DESIGN**

- 1.5.1. Design hoarding to meet bylaws and regulations of authorities having jurisdiction and obtain approvals from authorities having jurisdiction.
- 1.5.2. Location and types of hoarding as indicated on Drawings.
- 1.5.3. Design and install hoarding to withstand wind loads at the Place of Work without collapse, permanent deformation, or other failure of the hoarding system.

## **2 PRODUCTS**

### **2.1. HOARDING MATERIALS**

- 2.1.1. Gypsum Hoarding:
- 2.1.1.1. Provide rough hardware required for the work in this Section.
  - 2.1.1.2. Metal framing, as noted on drawings.
  - 2.1.1.3. Re-used material may be used.
  - 2.1.1.4. Dimensions as follows, unless otherwise indicated or required by authorities having jurisdiction:
    - (1) Framing: 92mm metal studs at 400mm o/c, filled with acoustical batt insulation
    - (2) Hoarding: Gypsum Board, 1220mm x 2440mm x 16mm thick  
Re-used material may be used.
    - (3) Hoarding to be painted in accordance with Section 09 90 00,  
Colour: As selected by the Consultant.
- 2.1.2. Temporary Fencing:
- 2.1.2.1. Perimeter project fencing is to be supplied and installed by the project, under the direction of the project manager/engineer, to enclose and secure the project

- site and associated laydown areas, while providing screening from construction activities.
- 2.1.2.2. Height: 2030mm (+/- 6'-8") above grade at project areas or combined project and laydown areas, and 2440mm (8') feet at dedicated construction/laydown areas where materials and large equipment may be stored. All fence panels to align with adjacent panels along top.
  - 2.1.2.3. Materials: Fencing metals to be low sheen black finish, 60mm (2-3/8") galvanized posts with 11-gauge chain link fencing, 41mm (1-5/8") top and bottom rail. All fencing to have screening fabric, attached with galvanized metal heavy gauge wire clips, black color.
  - 2.1.2.4. Fabric: Black, closed mesh woven polyethylene cloth, with reinforced band and grommets along top and sides for secure anchoring to chain link panels.
  - 2.1.2.5. Anchoring: Embed fence posts for 1830mm (6') panels securely into ground whenever possible, as determined at on-site meetings. Fence posts may be installed on concrete blocks if frequent relocation is anticipated, only if approved by Consultant's. Pull fabric tight and smooth, overlap grommets and clip together if fence fabric ends between posts. Metal wire clips to be used in all grommets, crimped tight. No cuts or openings allowed in fence fabric.
- 2.1.3. Signage:
- 2.1.3.1.
  - 2.1.3.2. Provide suitable sized notice signs at entrance to the Place of the Work with contrasting text "RESTRICTED ACCESS – CONSTRUCTION SITE" complete with the name of the Contractor.

### **3 EXECUTION**

#### **3.1. HOARDING FABRICATION**

- 3.1.1. Provide hoarding immediately upon award of Contract.
- 3.1.2. Erect framing members and install hoarding panels at the perimeter of the Place of the Work as indicated or required by authorities having jurisdiction to fully enclose the Place of the Work and as follows, unless otherwise indicated or required by authorities having jurisdiction:
  - 3.1.2.1. Height of hoarding: 2440mm (8') minimum, unless otherwise indicated, above grade at any point.
  - 3.1.2.2. Vertical framing spaced 400mm (16") on centre, maximum.
  - 3.1.2.3. Horizontal rails securely screwed to vertical framing at top and bottom.
  - 3.1.2.4. Erect panels around objects as required.
  - 3.1.2.5. Hoarding shall contain no opening more than 100mm (4") wide or less than 914mm (3') above the bottom of the fence except where required for access from the Place of the Work.
  - 3.1.2.6. Provide no rails, either horizontal or diagonal bracing, attachments, or pattern of openings on the outside that would facilitate climbing.
  - 3.1.2.7. At access openings: Provide gates that provide performance and safety at least equivalent to hoarding and contain wire mesh of sufficient openness to provide visibility for traffic entering or existing the Place of the Work.
- 3.1.3. Provide overhead protection hoarding where public access is required. Provide hoarding, access gates, access doors, in conformance with the Contract Documents and authorities having jurisdiction.
- 3.1.4. Incorporate silt control fabric from 200mm (8") below existing grade and attach to hoarding to provide silt control to requirements of authorities having jurisdiction and Owner.
- 3.1.5. Hoarding hardware: Provide rough and finish hardware as required.

#### **3.2. DESIGN AND SAFETY REQUIREMENTS FOR TEMPORARY WORK**

- 3.2.1. Be responsible for design, erection, operation, maintenance and removal of temporary structural and other temporary facilities, barriers and enclosures.



- 3.2.2. Engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the Contract Documents; and in cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.
- 3.2.3. Engage and pay for professional engineer(s) registered in Place of the Work to design and supervise construction and maintenance of hoardings, covered ways, protective canopies and project sign(s). Designs provided by Consultant or Owner for such work cover general appearance only.

**END OF SECTION**

## **1 PART 1 - GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Summary
- .4 1.4 Availability of Products
- .5 1.5 Delivery, Storage and Handling
- .6 1.6 Concealment
- .7 1.7 Remedial *Work*
- .8 1.8 Location of Fixtures
- .9 1.9 Fastenings
- .10 1.10 Protection of *Work* in Progress
- .11 2.1 Quality
- .12 2.2 Availability
- .13 2.3 Inserts, Anchors, and Fasteners
- .14 3.1 Manufacturer's Instructions
- .15 3.2 Overloading
- .16 3.3 Galvanic/Dissimilar Metal Corrosion
- .17 3.4 Penetrations
- .18 3.5 Product Installation Requirements

### **1.3. SUMMARY**

- 1.3.1. Product quality, availability, and delivery, storage, and handling.
- 1.3.2. Existing facilities.
- 1.3.3. Workmanship, coordination, and fastenings.
- 1.3.4. Manufacturer's instructions.

### **1.4. AVAILABILITY OF PRODUCTS**

- 1.4.1. In the event of delays in supply of Products, and should it subsequently appear that the Work may be delayed for such reason, Consultant reserves the right to substitute more readily available Products of similar character, at no additional cost to the Owner.

### **1.5. DELIVERY, STORAGE AND HANDLING**

- 1.5.1. The Contractor is to be responsible for the costs of transportation of the Products required in the performance of the Work.
- 1.5.2. Transportation costs of Products supplied by the Owner will be paid for by the Owner.
- 1.5.3. The Contractor shall be responsible for unloading, handling, and storing all Products in accordance with the manufacturers' requirements and recommendations, and in a manner to prevent damage, adulteration, deterioration and soiling.
- 1.5.4. Store packaged or bundled Products in original and undamaged condition, with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.
- 1.5.5. Store Products subject to damage from weather in weathertight enclosures.
- 1.5.6. Store any cementitious products clear of earth or concrete floors, and away from walls.
- 1.5.7. Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- 1.5.8. Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- 1.5.9. Removal and replacement of Products damaged due to improper delivery, storage, or handling will not be considered or approved as a change in the Work.

## **1.6. CONCEALMENT**

- 1.6.1. In finished areas, conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise.
- 1.6.2. Before installation, inform the Consultant if there is a contradictory situation where concealment is not possible. Install as required by the Consultant.

## **1.7. REMEDIAL WORK**

- 1.7.1. Perform remedial work required to repair or replace the parts or portions of the Work identified as defective or unacceptable. Coordinate adjacent affected work as required.
- 1.7.2. Perform remedial work using specialists familiar with the materials affected. Perform the work in such a manner as to neither damage nor endanger any other portion of the Work.
- 1.7.3. Any remedial work required will not be considered or approved as a change in the Work.

## **1.8. LOCATION OF FIXTURES**

- 1.8.1. Consider the location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- 1.8.2. Inform the Consultant of a conflicting installation and proceed as directed.

## **1.9. FASTENINGS**

- 1.9.1. Provide metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless specifically indicated otherwise.
- 1.9.2. Prevent electrolytic action between dissimilar metals and materials.
- 1.9.3. Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the Contract Documents.
- 1.9.4. Space anchors within their load limit or shear capacity and ensure that they Provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- 1.9.5. Keep exposed fastenings to a minimum, space evenly and install neatly.
- 1.9.6. Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

## **1.10. PROTECTION OF WORK IN PROGRESS**

- 1.10.1. Adequately protect items of Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant. Such removal and replacement, or repair, will not be considered or approved as a change in the Work.
- 1.10.2. Prevent overloading of any part of the Work. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without the written approval of the Consultant.

# **2 PRODUCTS**

## **2.1. QUALITY**

- 2.1.1. Products, construction materials and equipment, and articles (any of which may be referred to as "Products" throughout the Contract Documents) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with the Contract Documents) for the purpose intended. If requested, the Contractor shall furnish evidence as to the type, source, and quality of the Products provided.
- 2.1.2. Specified options: The Work is based on materials, Products and systems specified by manufacturer's catalogued trade names, references to standards, by prescriptive specifications and by performance specifications.
  - 2.1.2.1. Where only one manufacturer's trade name is specified for a Product, the Product is single sourced and shall be supplied by the specified manufacturer.
  - 2.1.2.2. Where more than one manufacturer's trade name is specified for a Product, supply one Product from list of Products specified.

- 2.1.2.3. When a Product is specified by reference to a standard, select one Product from manufacturer that meets or exceeds the requirements of the standard and manufacturer's written application directions.
- 2.1.2.4. When a Product or system is specified by prescriptive or performance specifications, Provide one Product or system which meets or exceeds the requirements of the prescriptive or performance specifications and manufacturer's written application directions.
- 2.1.2.5. The onus is on the Contractor to prove compliance with governing published standards, prescriptive specifications and with performance specifications.
- 2.1.2.6. Visual selection specification:
  - (1) Where specifications include the phrase "as selected by *Consultant* from manufacturer's full range" or similar phrase, select a product that complies with requirements. *Consultant* will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- 2.1.2.7. Visual matching specification:
  - (2) Where specifications require "match *Consultant's* sample", provide a product that complies with requirements and matches *Consultant's* sample. *Consultant's* decision will be final on whether a proposed product matches.
- 2.1.3. Products, materials, equipment and articles (referred to as Products throughout the Contract Documents) incorporated in the Work shall be new, not damaged or defective, and of the quality standards specified, for the purpose intended. If requested, furnish evidence as to type, source and quality of Products Provided.
- 2.1.4. Basis of design:
  - 2.1.4.1. Where Contract Documents list Basis of Design this indicates the Product or system that was used in the preparation of the design included in the Contract Documents, and which may be deemed as an acceptable Product.
  - 2.1.4.2. The basis of design establishes the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products from other manufacturers.
  - 2.1.4.3. This does not preclude the use of other Products or systems in the Work, provided the proposed Product or system complies with the design and performance requirements contained in the Contract Documents, and Products or systems proposed for use in the work that are not the named basis of design follow procedures for product substitutions specified under Section 01 25 00.
- 2.1.5. Where Contract Documents list acceptable Products or acceptable manufacturers, select as applicable, one Product meeting performance of specifications and manufacturer's written application directions.
- 2.1.6. Where Contract Documents require design of a Product or system, and minimum material requirements are specified, the design of such Product or system shall employ materials specified within applicable section. Where secondary materials or components are not specified, augment with materials meeting applicable code limitations, and incorporating compatibility criteria with adjacent work.
- 2.1.7. Defective Products, whenever identified prior to the completion of the Work, will be rejected, regardless of previous inspections or reviews. Inspection or review of the Work in progress by the Consultant, the Owner, or Independent Inspection and Testing Agencies does not relieve the Contractor of responsibility for the quality of the Products or Work, but, rather, is a precaution against oversight or error. The Contractor shall remove and replace defective Products at the Contractor's own expense and be responsible for any delays and expenses caused by rejection, which delays, and expenses will not be considered or approved as changes in the Work.
- 2.1.8. Should any dispute arise as to the quality or fitness of the Products, the decision rests solely with the Consultant and shall be based upon the requirements and intent of the Contract Documents.

- 2.1.9. Unless otherwise indicated in the Contract Documents, maintain uniformity of manufacture and manufacturer for any particular or similar item or items throughout the Work.
- 2.1.10. Products exposed in the finished work shall be uniform in colour, texture, range, and quality, and be from one production run or batch, unless otherwise indicated.
- 2.1.11. Owner retains right to select from choices available within specified Products for colours, patterns, finishes or other options normally made available. Submit full range of Product options in accordance with 01 33 00 for such selection.
- 2.1.12. Permanent labels, trademarks, and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in the mechanical/electrical room, or as may be provided otherwise in the Contract Documents.
- 2.1.13. Quality control:
  - 2.1.13.1. Implement a system of quality control to ensure compliance with Contract Documents.
  - 2.1.13.2. Notify Consultant of defects in the Work or departures from intent of Contract Documents that may occur during construction. Consultant will recommend appropriate corrective action in accordance with requirements of the Contract.

## **2.2. AVAILABILITY**

- 2.2.1. While it was the intent of the Bid Documents and procedures, and the goal of the competitive Bid process that led to the formation of this Contract, to Provide unlimited competition to Provide Products, certain Products specified or indicated are accompanied by reference to brand names, proprietary names, trade marks, catalogue numbers, or catalogue designations or symbols, indicated as "acceptable products," "acceptable materials," or "acceptable manufacturers". In such cases, the name of a distributor, supplier, or a dealer is sometimes given to assist the Contractor in finding a source of supply.
- 2.2.2. The naming of a source of supply does not relieve the Contractor of the responsibility of finding his or her own source of supply. If unable to obtain the specified Product, the Contractor shall supply a substitute Product equal to, or superior to, the Product specified and in accordance with the procedures and requirements of Section 01 25 00, which substitution will not be considered or approved as a change in the Work. Should the Contractor be unable to obtain a substitute Product equal to, or superior to, the specified Product, and the Owner accepts an inferior Product, the Contract Price shall be adjusted accordingly in an amount determined by the Consultant, in consultation with the Contractor, and in accordance with Section 01 26 00 Contract Modification Procedures.
- 2.2.3. The use of Product brand names, proprietary names, trade marks, catalogue numbers, or catalogue designations or symbols does not preclude the Contractor from proposing substitutions for the named Products, provided such proposals are in accordance with Section 01 25 00.

## **2.3. INSERTS, ANCHORS, AND FASTENERS**

- 2.3.1. Use only factory made, threaded or toggle type inserts as required for supports and anchors, properly sized for load to be carried.
- 2.3.2. Where inserts cannot be placed, use factory made expansion shields for light weights only.
- 2.3.3. Supply and locate inserts, holes, anchor bolts and sleeves during placement or fabrication of structural elements.
- 2.3.4. Fasteners stressed in withdrawal are not acceptable, except where otherwise indicated.
- 2.3.5. Metal fastenings shall be uniform to metals materials and components being anchored or of a metal which will not set up a galvanic action causing damage to the fastening or metal component under moist conditions.
- 2.3.6. Fastenings for prefinished materials shall be of concealed type unless otherwise indicated, and when exposed finish is required, of matching prefinishing materials.

- 2.3.7. Metal fastenings and accessories shall be same texture, colour and finish as material on which they occur, as selected by Consultant.
- 2.3.8. Power actuated fasteners:
  - 2.3.8.1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E1190-11 conducted by a qualified independent testing agency.
  - 2.3.8.2. Do not use power actuated fasteners which are stressed in withdrawal in finished work.
  - 2.3.8.3. Do not use power actuated fasteners within 100 mm (4") of the edge of concrete or masonry, unless otherwise accepted in writing by Consultant.
  - 2.3.8.4. Do not use power actuated fasteners in post-tensioned concrete.

### **3 PART 3 - EXECUTION**

#### **3.1. MANUFACTURER'S INSTRUCTIONS**

- 3.1.1. Unless otherwise indicated in the Contract Documents, install Products in accordance with manufacturer's printed installation or application instructions. Do not rely on labels or enclosures supplied with Products. Obtain printed instructions directly from manufacturers.
- 3.1.2. Notify the Consultant in writing, of conflicts between the Contract Documents and manufacturer's instructions.
- 3.1.3. Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no additional cost to the Owner.
- 3.1.4. Manufacturers' representatives shall have access to the Work at all times. The Contractor shall render assistance and facilities for such access in order that the manufacturers' representatives may properly perform their function.

#### **3.2. OVERLOADING**

- 3.2.1. Protect the existing building from loads which may cause permanent deformation.
- 3.2.2. Protect the Work from loads which may cause permanent deformation.

#### **3.3. GALVANIC/DISSIMILAR METAL CORROSION**

- 3.3.1. Insulate dissimilar metals from each other by suitable plastic strips, washers or sleeves to prevent galvanic corrosion where conductive liquid or electrolyte (rainwater or condensation) exists.

#### **3.4. PENETRATIONS**

- 3.4.1. Holes or voids created in assemblies or partitions for penetrating mechanical, electrical, or sprinkler service items, shall be of sufficient size to accommodate the penetrating item as well as additional required fill materials, such as sealants, firestopping and smoke sealants, insulation, and the like, without exceeding the maximum opening allowable by the manufacturer of the additional required fill material and design requirements appropriate for size of penetration.
  - 3.4.1.1. Finish penetrations in areas exposed to view to satisfaction of *Consultant*.

#### **3.5. PRODUCT INSTALLATION REQUIREMENTS**

- 3.5.1. General:
  - 3.5.1.1. Execute the Work using workers experienced and skilled in the respective duties for which they are employed.
  - 3.5.1.2. Do not employ an unfit person or anyone unskilled in their required duties.
  - 3.5.1.3. Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Consultant, whose decision is final.
  - 3.5.1.4. Upon request by the Consultant, submit proof, in the form of CCDC 11 - Contractor's Qualification Statement, of qualifications of Subcontractors to

- verify Subcontractor's qualifications and experience meet or exceed the requirements of the Contract Documents.
- (1) If, upon review of the *Contractor's* Qualification Statement, it is found that the *Subcontractor* does not meet the qualification requirements specified in the *Contract Documents* pertaining to the parts of the *Work* for which the *Subcontractor* has been retained, the *Contractor* shall replace the unqualified *Subcontractor* with a qualified *Subcontractor*, satisfactory to the *Contractor* and the *Owner*, at no additional cost to the *Owner* and at no increase in the *Contract Time*.
- 3.5.1.5. Remove *Products* or materials that have been broken, chipped, cracked, discoloured, abraded, or damaged during construction period and *Provide* undamaged *Products* or materials meeting the requirements of the *Contract Documents*.
- 3.5.2. Coordination:
- 3.5.2.1. Ensure cooperation of workers in layout of the *Work*. Maintain efficient and continuous supervision.
- 3.5.2.2. Be responsible for coordination and placement of openings, sleeves and accessories.
- 3.5.3. Backer plates:
- 3.5.3.1. Provide backer plates to support and provide anchorage base to carry loads from surface or recessed applied materials.
- 3.5.4. Concealment:
- 3.5.4.1. In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- 3.5.4.2. Before installation, inform the Consultant of any contradictory situation. Install as directed by the Consultant.
- 3.5.5. Cutting and remedial work:
- 3.5.5.1. Perform cutting and remedial work required to make parts of the *Work* come together. Coordinate the *Work* to ensure this requirement is maintained. Obtain permission from the Consultant before commencing any cutting. Refer also to requirements of Section 01 73 29.
- 3.5.6. Location of fixtures:
- 3.5.6.1. Consider location of fixtures, access panels, outlets and mechanical and electrical items indicated as approximate only. Locate fixtures, and the like approximately; architectural drawings will relate these items to known dimensions, such as ceiling tile grid or wall locations and the like.
- 3.5.6.2. Obtain the Consultant's acceptance for precise locations of fixtures, access panels, outlets, mechanical, and electrical items.
- 3.5.6.3. The Consultant reserves the right to relocate electrical outlets and mechanical fixtures at a later date, but prior to installation, without cost, provided that the relocation per outlet does not exceed 3050 mm (10') from the original location.
- 3.5.6.4. Inform the Consultant of conflicting installations. Install only as directed by the Consultant.
- 3.5.7. Fastenings:
- 3.5.7.1. Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- 3.5.7.2. Prevent electrolytic action and corrosion between dissimilar metals and materials.
- 3.5.8. Protection of work in progress:
- 3.5.8.1. Take reasonable and necessary measures, including those required by Authorities Having Jurisdiction, to *Provide* protection.
- 3.5.8.2. Adequately protect parts of the *Work* completed or in progress. Parts of the *Work* damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no additional cost to the *Owner*.

- 3.5.8.3. Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member without written permission of the Consultant, unless specifically indicated. Refer also to Section 01 73 29.
- 3.5.8.4. Adequately protect finished flooring from damage. Take special measures when moving heavy loads or equipment on them.
- 3.5.8.5. Keep floors free of oils, grease or other materials likely to discolour them or affect bond of applied surfaces.
- 3.5.8.6. Protect work of other Subcontractors from damage while doing subsequent work. Damaged work shall be made good by appropriate Subcontractors but at expense of those causing damage.
- 3.5.8.7. Protect existing buildings, curbs, roads and lanes. If, during the Work, any buildings, curbs, roads or lanes are damaged, bear costs for repairs.
- 3.5.9. Existing utilities:
  - 3.5.9.1. When breaking into or connecting to existing services or utilities, execute the Work at times approved by the Owner, with a minimum of disturbance to Owner's ongoing operations, the Work, and traffic.
  - 3.5.9.2. Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by Authority Having Jurisdiction and stake or otherwise record location of capped service.
- 3.5.10. Protection of mechanical and electrical Products or materials:
  - 3.5.10.1. Wrap in protective plastic and seal mechanical and electrical items of mechanical and electrical equipment prior to and during for shipment, storage at the Place of the Work and after installation.
  - 3.5.10.2. Remove protective coverings only to the extent required for installation of the items. Re-install protection immediately following installation.
  - 3.5.10.3. Remove protective coverings in stages, as work areas are completed, or when directed by the Consultant.
- 3.5.11. Operational requirements:
  - 3.5.11.1. Operable Products shall be provided fully operational and ready for intended use.
  - 3.5.11.2. Adjust operating hardware and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts for smooth squeak-free function, in accordance with manufacturer's instructions.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Submittals
- .4 1.4 Preparation
- .5 1.5 Performance Requirements

### **1.3. SUBMITTALS**

- 1.3.1. Submittal Items:
  - 1.3.1.1. Submit written request in advance of cutting, coring, and alteration that affects:
    - (1) Structural integrity of any element of Work.
    - (2) Integrity of weather-exposed or moisture-resistant elements.
    - (3) Efficiency, maintenance, or safety of any operational element.
    - (4) Visual qualities of sight-exposed elements.
    - (5) Owner or work of other contractors.
- 1.3.2. Include in the request:
  - 1.3.2.1. Identification of Project.
  - 1.3.2.2. Location and description of affected work.
  - 1.3.2.3. Statement on necessity for cutting or alteration.
  - 1.3.2.4. Description of proposed work, and Products to be used.
  - 1.3.2.5. Alternatives to cutting and patching.
  - 1.3.2.6. Effect on Owner or work of other contractors.
  - 1.3.2.7. Written permission of affected separate contractor.
  - 1.3.2.8. Date and time work will be performed.
  - 1.3.2.9. Non-destructive structural survey: Location of reinforcement in concrete structure confirmed by non-destructive, positive method other than X-ray.
- 1.3.3. Do not commence cutting, patching, or remedial work until request has been reviewed by *Consultant*.

### **1.4. PREPARATION**

- 1.4.1. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- 1.4.2. After uncovering, inspect conditions affecting the performance of the Work.
- 1.4.3. Beginning of cutting and patching shall be taken to mean acceptance of the existing conditions.
- 1.4.4. Provide supports to assure the structural integrity of the surrounding elements as well as devices and methods to protect other portions of the Work from damage.
- 1.4.5. Provide protection from weather for areas that may be exposed by uncovering work.
- 1.4.6. Where uncovering of area exposes local deterioration, cracking, evidence of water infiltration, structural settlement, previous modifications, or other unexpected conditions, advise *Consultant* immediately in writing and leave conditions exposed until receipt of *Consultant's* written instructions. If area is exposed to the Exterior, Provide temporary protection from inclement weather.

### **1.5. PERFORMANCE REQUIREMENTS**

- 1.5.1. Execute cutting, fitting, and patching to complete the Work. Under no circumstances will overcutting of corners of opening be accepted. Ensure corners of openings to be cut are predrilled or sawed.
- 1.5.2. Remove and replace defective and non-conforming work.
- 1.5.3. Remove samples of installed work for testing if directed by *Consultant*.

- 1.5.4. Shop drawings identifying precise locations and size of openings to be cored and cut are to be submitted for review by Consultant. Provide non-destructive structural survey of structural concrete to be cored or cut, for Consultant review. Coring and cutting work locations shall be reviewed by Consultant for acceptance before proceeding.
- 1.5.5. Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical work
- 1.5.6. Perform work by methods to avoid damage to other work, and which will Provide proper surfaces to receive patching and finishing.
- 1.5.7. Employ qualified installer with at least 3 years of relevant experience to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- 1.5.8. Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed to be used anywhere within existing buildings unless approved by Consultant.
- 1.5.9. Restore work with new Products in accordance with requirements of Contract Documents.
- 1.5.10. Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflection, expansion, contraction, and firestopping.
- 1.5.11. Enclose pipes, ducts, conduit and wires passing through floors at areas where faucets occur in a 100 mm (4") high metal sleeve and make air and watertight with water resistant firestopping.
- 1.5.12. Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping and smoke seals.
- 1.5.13. Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection. Refinish entire assembly units.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2 Section Includes
- .3 1.3 Environmental Controls
- .4 1.4 Materials
- .5 1.5 Cleaning During Construction

### **1.3. ENVIRONMENTAL CONTROLS**

- 1.3.1. Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws.
- 1.3.2. Store volatile wastes in covered metal containers and remove from Place of the Work daily.
- 1.3.3. Prevent accumulation of wastes which create hazardous conditions.
- 1.3.4. Provide adequate ventilation during use of volatile or noxious substances.

### **1.4. MATERIALS**

- 1.4.1. Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer.

### **1.5. CLEANING DURING CONSTRUCTION**

- 1.5.1. Clean-up the Place of the Work daily. Maintain clean and clear egress routes at all times.
- 1.5.2. Maintain Place of the Work, grounds and public properties free from accumulations of waste materials and rubbish.
- 1.5.3. Provide containers at the Place of the Work for collection of waste materials and rubbish. Remove waste materials and rubbish from the Place of the Work when containers become full.
- 1.5.4. Vacuum and clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until Substantial Performance of the Work.
- 1.5.5. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- 1.5.6. Promptly as the Work proceeds, on a daily basis and upon completion, clean up and remove rubbish, surplus materials and equipment.
- 1.5.7. Remove as the work of this section progresses, corrosive and foreign materials which may set or become difficult to remove at time of final cleaning or which may damage members.
- 1.5.8. Wash exposed surfaces with a cleaning solution approved by Product manufacturers.
- 1.5.9. Debris and waste not permitted within cavities of Work.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1 GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1 General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Definitions
- .5 1.5. Performance Requirements
- .6 1.6. Action Submittals
- .7 1.7. Informational Submittals
- .8 1.8. Quality Assurance
- .9 1.9. Waste Management Plan
- .10 1.10. Project Meetings
- .11 3.1. Plan Implementation
- .12 3.2. Salvaging Demolition Waste
- .13 3.3. Recycling Demolition And Construction Waste, General
- .14 3.4. Recycling Demolition Waste
- .15 3.5. Recycling Construction Waste
- .16 3.6. Disposal Of Waste

### **1.3. SUMMARY**

- 1.3.1. Section includes administrative and procedural requirements for the following:
  - 1.1.1.1. Salvaging nonhazardous demolition and construction waste.
  - 1.1.1.2. Recycling nonhazardous demolition and construction waste.
  - 1.1.1.3. Disposing of nonhazardous demolition and construction waste.

### **1.4. DEFINITIONS**

- 1.4.1. Alternative Daily Cover (ADC): Cover material other than soil placed on the surface of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.
- 1.4.2. Commingled Waste: Single-stream recycling of material waste, considered as one material waste stream unless diversion rates can be provided by the recycling facility for specific materials.
- 1.4.3. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging. Hazardous materials are not included.
- 1.4.4. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations. Hazardous materials are not included.
- 1.4.5. Disposal: Removal off-site of demolition and construction waste and subsequent deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- 1.4.6. Diversion: To remove, or have removed, from the site for recycling, reuse, salvage, or return of materials that might otherwise be sent to a landfill. Diversion from landfill does not include burning, incinerating, thermally destroying waste, or waste-to-energy processes.
- 1.4.7. Return: To send back reusable or unused products to vendors or manufacturers.
- 1.4.8. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- 1.4.9. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

- 1.4.10. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- 1.4.11. Segregation: To place similar waste materials together for collection in a designated site area, trash bin, or roll-off container.
- 1.4.12. Waste: Waste includes salvageable, returnable, recyclable and reusable material as well as material sent to landfill or incineration facilities. Hazardous materials are not included.
- 1.4.13. Waste Management Plan: A project-specific plan for the collection, transportation, recycling, salvage, and disposal of waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material that is disposed of in landfills or incineration facilities.
- 1.4.14. Waste Material Stream: A flow of materials from a job site into markets for building materials, comprised of a material category (or mixture of several material categories) combined with a diversion method. A material stream must constitute at least five percent (by weight or volume) of total diverted materials for the Project. Examples include source separated materials sent to specific recycling facilities, commingled waste sent to a mixed-waste recycling facility, deconstructed materials sent back to a manufacturer as part of a take-back program, or salvaged materials reused on site.
- 1.4.15. Waste-To-Energy: The conversion of non-recyclable waste materials into usable heat and/or fuel through a variety of processes such as combustion, not including the combustion of wood into wood-derived fuel.

## **1.5. PERFORMANCE REQUIREMENTS**

- 1.5.1. Project Diversion Goals: The Owner has established a goal to achieve the following total end-of-Project waste diversion rates (by weight or volume) of total non-hazardous solid waste generated by the demolition and construction Work:
  - 1.5.1.1. Required: Minimum 80 percent diversion
  - 1.5.1.2. Target: 95 percent diversion
- 1.5.2. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, as applicable to the Work:

## **1.6. ACTION SUBMITTALS**

- 1.6.1. Waste Management Plan: Submit plan prior to mobilization on site.
  - 1.6.1.1. Waste generated by on-site workers, such as plastic and metal beverage containers.
  - 1.6.1.2. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled.
- 1.6.2. Alternative Daily Cover: Alternative Daily Cover (ADC) may not be included as diverted material used to meet Project diversion rate goals.
- 1.6.3. Waste Management Plan: The Contractor shall be responsible for the development and implementation of a Construction Waste Management Plan for the Project.
  - 1.6.3.1. Final Construction Waste Management Plan: The plan shall contain the following:
    - (1) Estimate of the total proposed jobsite waste to be generated, including types and quantities.
    - (2) Proposed alternatives to Landfilling: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed destination for each material, and the projected amount (by weight or CY)
    - (3) Materials handling procedures: A description of the means by which any waste materials identified in Performance Requirements above will be separated (either sorted on-site or commingled on-site and sorted off-site) and protected from contamination, and the means to be employed in recycling the above materials consistent with the requirements for acceptance by recycling processors to be utilized.

- (4) If waste materials are sorted and separated on-site, include anticipated sizes and quantity of containers, container labeling, and location(s) on the Project site.
  - (5) List of documentation to be provided in Progress Reports.
  - (6) Identification of material streams, as defined in the Section.
- 1.6.3.2. Prior to request for Substantial Completion, provide final approved Waste Management Plan and summary table indicating site-separated waste, by diverted material type, that indicates the total percentage of construction waste diverted from landfill and the identified waste material streams.

## **1.7. INFORMATIONAL SUBMITTALS**

- 1.7.1. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit a monthly Waste Management Report including a current Waste Tracking Form. Contractor may use their own Waste Tracking Form format or a sample form can be provided upon request. Include the following information:
- 1.7.1.1. Project title, name of company completing report, and dates of period covered by the report
  - 1.7.1.2. Report on the disposal of all jobsite waste, including:
    - (1) Recycled materials. For each material stream, provide the following:
      - (A) Amount (in tonnes or cubic metres)
      - (B) Dates removed from the jobsite
      - (C) Receiving Party
    - (2) Reused or salvaged materials. For each material stream, provide the following:
      - (D) Amount (in tonnes or cubic metres)
      - (E) Description of intended or actual use
      - (F) Market value of materials
    - (3) Landfilled materials. Provide the following:
      - (G) Amount (in tonnes or cubic metres)
      - (H) Dates removed from the jobsite
      - (I) Identity of the transfer station or landfill
    - (4) Gross total quantity of waste generated during the period.
    - (5) Include a breakdown of diverted waste for each of the identified waste material streams and major material categories as follows:
      - (J) Concrete
      - (K) Steel or Metals
      - (L) Wood
      - (M) Gypsum Wallboard
      - (N) Crushed Asphalt
      - (O) Masonry
      - (P) Cardboard
      - (Q) Blue box
    - (6) Provide the quantity of land clearing debris and excavation soil. Note that these categories do not qualify as diverted waste.
    - (7) Provide the name and location of the recycling or disposal facility that accepted the material.
    - (8) Provide the percentage of total diverted waste generated as a percentage of total waste for the current period and cumulative project-to-date.
  - 1.7.1.3. Records:
    - (1) Legible copies of on-site logs, weight tickets and receipts. Receipts shall be from recycling, processing and/or disposal site operators who can legally accept the materials for the purpose of reuse, recycling or disposal.
    - (2) If mixed construction and demolition waste is sorted off-site, provide a letter from the processor stating that reported quantities will reflect actual project values, and not average percentage of mixed C&D waste they

- recycle. Subcontractor shall save such original documents (as above) for the life of the project plus seven (7) year(s).
- (3) Records of salvaged materials donated to charitable organizations. Indicate whether organization is tax-exempt.
- 1.7.1.4. Waste Reduction Final Report: Submit final report prior to the final Application for Payment.
- 1.7.2. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- 1.7.2.1. Exclude excavation soil, land clearing debris and hazardous material.
- 1.7.2.2. Calculations may be performed using either weight or volume, but shall be done consistently throughout the duration of the Project. Where exact materials weights or volumes are not available, use the following Conversion Factors:
- (1) .1 Cardboard 59 kg/m<sup>3</sup>
  - (2) .2 Gypsum wallboard 297 kg/m<sup>3</sup>
  - (3) .3 Mixed waste 208 kg/m<sup>3</sup>
  - (4) .4 Rubble 831 kg/m<sup>3</sup>
  - (5) .5 Steel 593 kg/m<sup>3</sup>
  - (6) .6 Wood 178 kg/m<sup>3</sup>
- 1.7.3. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- 1.7.4. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- 1.7.5. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- 1.7.6. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- 1.7.7. Records of Returns: Indicate receipt and acceptance by vendors or manufacturers who have accepted waste materials as part of their take-back programs. Include receipts.
- 1.7.8. Records of Commingled Waste: If mixed construction and/or demolition waste will be commingled on-site and separated, sorted, and diverted off-site, provide monthly summaries of diversion rates from Recycler/Processor based on one of the following:
- 1.7.8.1. Project-specific diversion rate based on actual measurement of each component waste material. Note that visual inspection is not an acceptable method of evaluation for documenting this percentage.
  - 1.7.8.2. If Recycler/Processor provides facility-wide aggregated, annual averaged diversion rates in lieu of Project-specific diversion rates, provide documentation that the Recycler/Processor's method of recording and calculating these rates is regulated by a local or state government authority.
- 1.7.9. Qualification Data: For refrigerant recovery technician (if applicable).
- 1.7.10. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

## **1.8. QUALITY ASSURANCE**

- 1.8.1. Waste Management Coordinator Qualifications: Experienced, with a record of successful waste management coordination of projects with similar requirements.
- 1.8.2. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- 1.8.3. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- 1.8.4. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review

methods and procedures related to waste management including, but not limited to, the following:

- 1.8.4.1. Review and discuss waste management plan including responsibilities of waste management coordinator.
- 1.8.4.2. Review requirements for documenting quantities of each type of waste and its disposition.
- 1.8.4.3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
- 1.8.4.4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
- 1.8.4.5. Review waste management requirements for each trade.
- 1.8.5. Project Meetings: The Waste Management Plan and implementation shall be discussed at the following meetings:
  - 1.8.5.1. Pre-construction meeting.
  - 1.8.5.2. Regular job-site meetings.
  - 1.8.5.3. Sub-contractor job-site coordination meetings.

## **1.9. WASTE MANAGEMENT PLAN**

- 1.9.1. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- 1.9.2. Waste Identification: Indicate all anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work, including identifying at least five (5) materials streams targeted for diversion on the Project. Include estimated quantities and assumptions for estimates.
- 1.9.3. Waste Reduction Work Plan: For each waste material stream, list the means of disposal and whether it will be diverted (salvaged, recycled, and/or reused) or sent to landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, identification or receiving facilities, and handling and transportation procedures.
  - 1.9.3.1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 1.9.3.2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 1.9.3.3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 1.9.3.4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 1.9.3.5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 1.9.3.6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
  - 1.9.3.7. Alternative Daily Cover: Include a statement affirming that alternative daily cover or other excluded materials were not included in calculations used to meet Project diversion rate goals.

## **1.10. PROJECT MEETINGS**

- 1.10.1. Waste management plans and implementation shall be discussed at the following meetings:



- 1.10.1.1. Pre-construction meeting
- 1.10.1.2. Regular job-site meetings
- 1.10.1.3. Subcontractor toolbox meetings

## **2 PRODUCTS (NOT USED)**

## **3 EXECUTION**

### **3.1. PLAN IMPLEMENTATION**

- 3.1.1. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 3.1.1.1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."
  - 3.1.1.2. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
  - 3.1.1.3. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
    - (1) Distribute waste management plan to everyone concerned within three days of submittal return.
    - (2) Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
  - 3.1.1.4. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
    - (1) Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
    - (2) Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
  - 3.1.1.5. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by distance determined by the Architect or more.

### **3.2. SALVAGING DEMOLITION WASTE**

- 3.2.1. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 3.2.1.1. Clean salvaged items.
  - 3.2.1.2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3.2.1.3. Store items in a secure area until installation.
  - 3.2.1.4. Protect items from damage during transport and storage.
  - 3.2.1.5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- 3.2.2. Salvaged Items for Sale and Donation: Not permitted on Project site, unless otherwise indicated.
- 3.2.3. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - 3.2.3.1. Salvage items indicated on the drawings.
  - 3.2.3.2. Clean salvaged items.
  - 3.2.3.3. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3.2.3.4. Store items in a secure area until delivery to Owner.
  - 3.2.3.5. Transport items to Owner's storage area off-site, designated by Owner.
  - 3.2.3.6. Protect items from damage during transport and storage.

- 3.2.4. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- 3.2.5. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- 3.2.6. Plumbing Fixtures: Separate by type and size.
- 3.2.7. Lighting Fixtures: Separate lamps by type and protect from breakage.
- 3.2.8. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### **3.3. RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL**

- 3.3.1. General: Recycle paper and beverage containers used by on-site workers.
- 3.3.2. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the Contractor.
- 3.3.3. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- 3.3.4. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 3.3.4.1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - (1) Inspect containers and bins for contamination and remove contaminated materials if found.
    - (2) .2 Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
    - (3) .3 Stockpile materials away from construction area. Do not store within drip line of remaining trees.
    - (4) .4 Store components off the ground and protect from the weather.
    - (5) .5 Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### **3.4. RECYCLING DEMOLITION WASTE**

- 3.4.1. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- 3.4.2. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- 3.4.3. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
- 3.4.4. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- 3.4.5. Metals: Separate metals by type.
  - 3.4.5.1. Structural Steel: Stack members according to size, type of member, and length.
  - 3.4.5.2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- 3.4.6. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- 3.4.7. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- 3.4.8. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- 3.4.9. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- 3.4.10. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

- 3.4.10.1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- 3.4.11. Carpet Tile: Remove debris, trash, and adhesive.
  - 3.4.11.1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- 3.4.12. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- 3.4.13. Conduit: Reduce conduit to straight lengths and store by type and size.

### **3.5. RECYCLING CONSTRUCTION WASTE**

- 3.5.1. Packaging:
  - 3.5.1.1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 3.5.1.2. Polystyrene Packaging: Separate and bag materials.
  - 3.5.1.3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 3.5.1.4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- 3.5.2. .2 Wood Materials:
  - 3.5.2.1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 3.5.2.2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
  - 3.5.2.3. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
    - (1) Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### **3.6. DISPOSAL OF WASTE**

- 3.6.1. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 3.6.1.1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 3.6.1.2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3.6.1.3. Burning: Do not burn waste materials.
  - 3.6.1.4. Disposal: Remove waste materials from Owner's property and legally dispose of them.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract and sections of Division 1.
- 1.1.2. No less than two percent (2%) of the Contract Price shall be assigned as the cost for the preparation and delivery to the Consultant of the Project Record Documents. This value shall be indicated on the schedule of values in accordance with Sections 01 29 73 and 01 33 00.
- 1.1.3. The review to determine Substantial Performance of the Work will not take place until the documents and products described in this section have been received by the Consultant.
- 1.1.4. The procedures for completing Contract and acceptance by the Owner shall be in accordance with the methods described in OAA/OGCA Document 100 (July 1, 2018, and reissued January 8, 2019) and any additional requirements described below.
- 1.1.5. Stages will be reviewed at the Contract start-up meeting to ensure that parties understand their responsibilities. Refer to Section 01 31 19 for procedures and requirements for Contract start-up meeting.
- 1.1.6. Within 4 weeks of commencement of the Work, submit to the Consultant a list of closeout submittals required by the Contract Documents.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Cleaning Prior to Substantial Performance of the Work
- .4 1.4. Final Cleaning
- .5 1.5. Project Record Documents
- .6 1.6. Spare Parts and Maintenance Materials
- .7 1.7. Systems Demonstration
- .8 1.8. Substantial Performance and Takeover Procedures
- .9 1.9. Warranty Period

### **1.3. CLEANING PRIOR TO SUBSTANTIAL PERFORMANCE OF THE WORK**

- 1.3.1. Immediately prior to Consultant's review to determine if Substantial Performance of the Work has been achieved, remove surplus Products and construction machinery and equipment not required for the performance of the remaining Work and clean as described under paragraph 1.4 - Final Cleaning to the greatest extent practicable given work remaining to be completed. The cleaning shall be to a sufficient extent to permit the Consultant's review to be performed properly and reasonably.

### **1.4. FINAL CLEANING**

- 1.4.1. Environmental controls:
  - 1.4.1.1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
  - 1.4.1.2. Store volatile wastes in covered metal containers and remove from Place of the Work daily.
  - 1.4.1.3. Prevent accumulation of wastes which create hazardous conditions.
  - 1.4.1.4. Provide adequate ventilation during use of volatile or noxious substances.
- 1.4.2. Materials:
  - 1.4.2.1. Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer.
- 1.4.3. Final cleaning:
  - 1.4.3.1. Remove waste Products and debris other than that caused by the Owner, and leave the Work clean and suitable for occupancy by Owner.
  - 1.4.3.2. When the Contract is completed, remove surplus Products, tools, construction machinery and equipment.

- 1.4.3.3. Clean glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, prefinished surfaces, and fixtures.
- 1.4.3.4. Remove stains, spots, marks and dirt from decorative parts of the Work, electrical and mechanical fixtures, furniture fittings, walls, and floors.
- 1.4.3.5. Vacuum clean and remove dust from building interiors, behind grilles, louvres, and screens. Vacuum clean interior of electrical equipment.
- 1.4.3.6. Clean floor finishes to recommendations of manufacturer.
- 1.4.3.7. Remove non-permanent labels.
- 1.4.3.8. Remove dirt and residue from surfaces.
- 1.4.3.9. Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- 1.4.3.10. At completion of the Work, remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratched or damaged work.
- 1.4.3.11. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.
- 1.4.3.12. Remove seal wrap on mechanical and electrical Products and materials and clean as required.
- 1.4.3.13. Clean and/or replace lamps, light fixtures, lenses, and grilles.
- 1.4.3.14. Remove protective covering and labels from lamps, hardware, and specialty items.
- 1.4.3.15. Under the direction of the Consultant, aim adjustable luminaires.

## **1.5. PROJECT RECORD DOCUMENTS**

- 1.5.1. Collect reviewed submittals, and assemble required closeout submittals executed by *Subcontractors*, *Suppliers*, and manufacturers. Prior to submitting closeout submittals to the *Consultant*, undertake the following:
  - 1.5.1.1. Review maintenance manual contents (operating, maintenance instructions, asbuilt drawings, materials) for completeness.
  - 1.5.1.2. Review supply and completeness of spare parts required by Contract Documents and manufacturers.
  - 1.5.1.3. Review in relation to Contract Price, Change Orders, Change Directives, holdbacks and other adjustments to the Contract Price.
  - 1.5.1.4. Review inspection and testing reports to verify conformance to intent of Contract Documents and that changes, repairs or replacements have been completed.
  - 1.5.1.5. Execute transition of performance bond and labour and materials payment bond to warranty period requirements.
  - 1.5.1.6. Submit a final statement of accounting giving total adjusted Contract Price, previous payments, and monies remaining at time of application for completion of the Contract. Consultant will issue a final change order reflecting approved adjustments to Contract Price not previously made.
- 1.5.2. No later than 20 Working Days prior to submitting request for Consultant's review to determine if Substantial Performance of the Work has been achieved, submit to the Consultant the closeout submittals specified in this section, including, but not limited to, reviewed shop drawings, Product data sheets, samples, operating instructions, as-built records, fully executed warranties and guarantees, reports recording demonstration and training provided to Owner for operation and maintenance of building systems, software required for operation and maintenance of building systems, maintenance materials, and keys.
- 1.5.3. For equipment put into use with Owner's permission during the Work, submit required closeout submittals within 10 Working Days after start-up
- 1.5.4. For items of the Work delayed materially beyond date of Substantial Performance of the Work, provide updated closeout submittals within 10 Working Days after acceptance, listing date of acceptance as start of warranty period.

- 1.5.5. Neither the Consultant's review to determine if Substantial Performance of the Work has been achieved, nor acceptance of the Work, will take place until receipt, by the Consultant, of acceptable copies of the closeout submittals required herein and by the Contract Documents.
- 1.5.6. Operation and Maintenance Manuals:
  - 1.5.6.1. Submit operation and maintenance manuals, consisting of the following general components:
    - .1 Operation and maintenance.
    - .2 Shop drawings.
    - .3 Warranties.
    - .4 Project data.
- 1.5.7. Submit Operation and Maintenance Manuals as follows:
  - 1.5.7.1. Fifteen (15) Days prior to applying for the review to determine Substantial Performance of the Work, the Contractor shall submit to the Consultant digital versions ("PDF" files) of operation and maintenance manuals. Files shall be original PDF files, not scanned, and shall be searchable.
  - 1.5.7.2. Submit using digital storage medium or transfer process acceptable to the Consultant and the Owner.
  - 1.5.7.3. If revisions to the Operation and Maintenance Manuals are required, comments will be provided by the Consultant team for re-submission prior to undertaking the review to determine Substantial Performance of the Work.
  - 1.5.7.4. Manuals are to be re-submitted to the Consultant for review once any required revisions have been made.
  - 1.5.7.5. Manuals shall contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules, and all other operation and maintenance information as required by the Contract Documents, including all warranties.
  - 1.5.7.6. Final Hard Copies, (3 Copies) shall be printed and submitted to the Owner. Contractor shall organize the data in the form of an instructional manual in binders of commercial quality, with hard covers, 8-1/2" x 11" in size, with a maximum ring size of 2". The following shall be followed:
    - .1 On the cover, identify each binder with the typed or printed title "Operation and Maintenance Manuals," listing also the title of the project, and identifying the subject matter of the contents.
    - .2 Arrange the contents into applicable categories of work, parallel to the sections of the specifications.
    - .3 When multiple binders are used, correlate data into consistent related groupings.
    - .4 Provide tabbed fly-leaf for each separate product and system, with typed description of product and major component parts of equipment.
    - .5 If drawings are included, Provide with reinforced punched binder tab, bind in with text, folding drawings of a larger size to size of text pages.
    - .6 For each Product or system, list names, addresses, and telephone numbers of Subcontractors and Suppliers, including a local source of supplies and replacement parts.
    - .7 Product Data: mark each sheet to clearly identify specific products and component parts, as well as data applicable to the installation, and delete inapplicable information.
- 1.5.8. As-Built *Documents*:
  - 1.5.8.1. Prior to the commencement of the Work, the Consultant will Provide the Contractor with a set of Contract Documents for the purpose of recording changes in the Work, as well as the actual locations of concealed services.
  - 1.5.8.2. Accurately and neatly record deviations from the Contract Documents caused by conditions at the Place of the Work and changes in the Work as the Work progresses.
  - 1.5.8.3. Record information by means of red felt-tip marker.

- 1.5.8.4. Record, without being limited to, the following:
  - .1 Survey of as-built conditions and survey logs prepared by the registered land surveyor responsible for setting out the work and field engineering.
  - .2 Depths of various elements of foundation in relation to survey datum.
  - .3 Horizontal and vertical location of utilities and appurtenances referenced to permanent surface improvement.
  - .4 Other underground installations and services set beneath slabs-on-grade referenced to visible and accessible features of structure.
  - .5 'As-built' elevations of paving, sidewalks, manholes and catchbasins.
  - .6 Field changes of dimensions/details.
  - .7 Changes by Change Orders, Change Directives, and Supplemental Instructions.
  - .8 Locations of interior mechanical and electrical equipment and distribution.
  - .9 Elevations and location depths of services. Identify type and size of service and materials used.
  - .10 Specification as-builts: Record as-built Products, including manufacturer, manufacturer's model or system number.
- 1.5.8.5. Identify each document as "As-Built Copy." Maintain in good condition in the Site office and make available for review by the Consultant and the Owner upon request.
- 1.5.8.6. In the specifications, legibly mark each item to record actual construction, including manufacturers, trade names, and catalogue number for each product actually installed, particularly optional items and substitute items.
- 1.5.8.7. Mechanical and electrical records shall be kept by the respective Subcontractors (who shall receive an extra copy each of the mechanical and electrical Drawings and specifications for this purpose from the Contractor), and shall be delivered to the Contractor who shall transfer the information to the As-Built Drawings.
- 1.5.8.8. Contractor shall Provide As-Built Survey once foundations are completed to ensure building is situated as required. Drawing shall be submitted in PDF and CAD Format. Contractor shall Provide As-Built Site survey upon the completion of the project in PDF and CAD format.
- 1.5.8.9. On completion of the construction work, and fifteen (15) Days prior to applying for the review to determine Substantial Performance of the Work, the Contractor shall submit to the Consultant the complete As-Built Documents.
- 1.5.8.10. Submit digital scanned copy ("PDF" files) of as-built documents. Submit using digital storage medium or transfer process acceptable to the Consultant and the Owner.
- 1.5.9. Shop *Drawings* and Inspection Reports:
  - 1.5.9.1. Fifteen (15) Days prior to applying for the review to determine Substantial Performance *of the Work*, the *Contractor* shall submit to the *Consultant* digital versions ("PDF" files) of all reviewed shop drawings including an inventory of the shop drawings submitted.
  - 1.5.9.2. Submit one copy of each final accepted shop drawing issued for the Work on which have been recorded changes made during fabrication and installation caused by unforeseen conditions
  - 1.5.9.3. Engineered shop drawings shall include copies of the certificate of insurance, the engineer's field review reports, and the engineer's letters of general conformity that were provided as part of the engineered submittal in accordance with Section 01 33 00 appended to the pertinent engineered shop drawing in the shop drawing manual.
  - 1.5.9.4. Fifteen (15) Days prior to applying for review to determine *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* digital

- versions ("PDF" files) of all inspection and testing reports bound together in one (1) volume and arranged in chronological sequence.
- 1.5.10. Warranties:
- 1.5.10.1. Submit copies of bonds, guarantees, warranties and extended warranties together in one report binder, complete with an indexed summary list of warranties and expiration dates. Warranties to be in accordance with Section 01 78 36.
- 1.5.11. Project data: shall include the following information supplemented by additional required data specified elsewhere in the *Contract Documents*:
- 1.5.11.1. Maintenance instructions for finished surfaces and materials.
- 1.5.11.2. Copy of hardware and paint schedules.
- 1.5.11.3. Names, addresses and phone numbers of Subcontractors and Suppliers, as applicable.
- 1.5.11.4. Additional material used in the Work listed under various sections showing name of manufacturer and source of supply.
- 1.5.11.5. Report recording demonstration and instruction provided to Owner for operation and maintenance of building systems as described below in this section.
- 1.5.11.6. Key construction photos.
- 1.5.11.7. Permits and forms:
- .1 Workplace Safety & Insurance Board certificate of clearance.
- .2 Certificates of approval of the Work by local building department (if available).
- .3 Electrical authority certificate of inspection.
- 1.5.12. Posted operating instructions
- 1.5.12.1. Prepare operating instructions in English for posting near equipment and systems. Posted instructions to be glass covered, framed and mounted.
- 1.5.12.2. Posted instructions to consist of simplified, consolidated equipment, control and power diagrams graphically representing the entire system, including concise instructions on how to start and stop systems, what settings and conditions are to be observed by the operators, and what control adjustments are to be made or maintained by the operator.
- 1.5.12.3. Posted instructions shall include control diagrams with added specific operating instructions, controls, interlocks, and the like.
- 1.5.12.4. Posted instructions shall include:
- .1 HVAC controls for each system;
- .2 One line schematic diagrams of water supply;
- .3 One line isometric diagrams of sanitary drainage;
- .4 One line diagrams of steam distribution, hot and cold water systems, including risers, valves, control devices, etc.

## **1.6. SPARE PARTS AND MAINTENANCE MATERIALS**

- 1.6.1. At the time of submission of the Project Record Documents, or earlier if acceptable to the Consultant and the Owner, the Contractor shall submit to the Owner maintenance equipment for the various items, pieces of equipment, systems, or accessories required by the Contract Documents.
- 1.6.2. At the time of submission of the Project Record Documents, or earlier if acceptable to the Consultant and the Owner, the Contractor shall submit to the Owner extra materials for the various items, pieces of equipment, systems, or accessories required by the Contract Documents.
- 1.6.3. Spare parts, maintenance materials, and extra materials provided shall be new, not damaged or defective, and of same quality, manufacture, and manufacturer as of the Products provided in the Work. If requested, the Contractor shall furnish evidence as to the type, source, and quality of the Products provided.
- 1.6.4. Defective Products will be rejected, regardless of previous inspections. The Contractor shall replace such Products and such replacement will not be considered or approved as a change in the Work.



- 1.6.5. Store spare parts and maintenance materials in a manner to prevent damage or deterioration.
- 1.6.6. Provide a typed inventory list of maintenance materials prior to Substantial Performance of the Work application. List all items, complete with quantities, and storage locations.
- 1.6.7. Establish a master list identifying maintenance materials and maintain a log of when materials are turned over to Owner and signing authority for acceptance of materials on behalf of Owner.

#### **1.7. SYSTEMS DEMONSTRATION**

- 1.7.1. Refer also to requirements of Divisions 21, 22, and 23 and Divisions 26, 27, and 28 with respect to commissioning for control systems, mechanical / electrical systems.
- 1.7.2. Perform system demonstration and commissioning work no later than 10 Working Days prior to submitting request for Consultant's review to determine if Substantial Performance of the Work has been achieved.
- 1.7.3. Submit required certificates of approval or acceptance from authorities having jurisdiction.
- 1.7.4. Meet with other consultants; structural, mechanical, electrical, to coordinate demonstration, instruction, commissioning and completion.
- 1.7.5. Review condition of equipment such as lighting, elevators and heating system, which has been used in the course of the Work to ensure turning over at completion in "as new condition" with warranties dated and certified from time specified.
- 1.7.6. When partial occupancy of uncompleted project is required by Owner, coordinate Owner's uses, requirements, access, and the like, with Contractor's requirements to complete the Work.
- 1.7.7. Preparation:
  - 1.7.7.1. Submit to both the Owner and the Consultant, a schedule of time and date for demonstration of each item of equipment and each system at least fifteen (15) Days prior to designated dates.
  - 1.7.7.2. Ensure that the services, apparatuses, and equipment are installed and complete, have been inspected, tested and adjusted, and are all in perfect operating condition.
  - 1.7.7.3. Verify the conditions for demonstration and instructions comply with requirements and that designated personnel are present.
- 1.7.8. Demonstration and Instructions:
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment to *Owner*.
  - .2 Instruct *Owner's* personnel in operation, adjustment and maintenance of equipment and systems, using operation and maintenance data provided as the basis for instructions. Arrange and coordinate instruction of *Owner's* staff in care, maintenance and operation of building systems and finishes.
  - .3 *Contractor*, manufacturer's representatives, and responsible personnel from *Subcontractors* whose work is being demonstrated shall be present at these demonstrations.
  - .4 Instruct *Owner's* representative on use of software required for operation and maintenance of building systems and provide a toll-free telephone number or website address for further assistance to the *Owner*.
  - .5 Prepare and insert additional data in the operation and maintenance data manuals when the need for additional data becomes apparent during demonstration or instruction.
- 1.7.9. Demonstration and instruction Report:
  - 1.7.9.1. Submit a written reports within five (5) *Working Days* after completion of demonstration, recording that demonstration and instructions have been satisfactorily completed. Report shall include time and date of each

demonstration, instruction, and commissioning activity, complete with a list of persons present.

1.7.10. Correct deficiencies and defects identified during demonstration, instruction, or commissioning.

1.7.11. Attend 'end-of-work' testing and break-in or start-up demonstration.

#### **1.8. SUBSTANTIAL PERFORMANCE AND TAKEOVER PROCEDURES**

1.8.1. A minimum of 60 Working Days prior to the anticipated Substantial Performance date, the Contractor (in writing) shall Provide a notice letter to the Owner of the anticipated Substantial Performance date.

1.8.2. The Contractor shall affirm the Substantial Performance date and Provide the Owner and the Consultant with a Notice Letter confirming the date, a minimum of 20 Working Days prior to the Substantial Performance date.

1.8.3. Deficiency review:

1.8.3.1. The Contractor shall conduct an inspection of the Work to identify deficiencies and defects, which shall be repaired as required. When the Contractor considers that the Work is substantially performed, the Contractor shall prepare and submit to the Consultant a comprehensive list of items to be completed or corrected and apply for a review by the Consultant to establish Substantial Performance of the Work. Failure to include an item on the list does not alter the responsibility of the Contractor to complete the Contract.

1.8.3.2. One week prior to the anticipated Substantial Performance date, the Consultant, the Owner and the Contractor will complete a deficiency walk through to confirm item 3 above. Consultant will Provide deficiency list with Value of Deficiency work to be complete.

1.8.3.3. Contractor assumes prime responsibility for ensuring that items shown and described in the Contract Documents are complete. Any deficiency reviews to approve the certificate of Substantial Performance of the Work will be immediately cancelled if it becomes obvious to the Consultant that extensive deficiencies are outstanding.

1.8.3.4. No later than ten (10) Working Days after the receipt of the Contractor's application, the Consultant and the Contractor will review the Work to identify any defect or deficiencies. If necessary, the Consultant will tabulate a list of deficiencies to be issued to the Contractor for correction of same.

1.8.3.5. The Contractor shall submit to the Owner and the Consultant a written Substantial Performance Application complete with all required documents. The application for Substantial Performance shall follow OAA/OGCA Take-Over-Procedures.

1.8.3.6. Neither the Consultant's review to determine if Substantial Performance of the Work has been achieved, nor acceptance of the Work, will take place until receipt, by the Consultant, of acceptable copies of the closeout submittals required herein and by the Contract Documents.

1.8.4. Certification of Substantial Performance of the Work:

1.8.4.1. When the Consultant considers that the deficiencies and defects have been completed and that it appears that the requirements of the Contract Documents (as may have been amended during the Work) have been substantially performed, the Consultant will issue a certificate of Substantial Performance of the Work to the Contractor, stating the date of Substantial Performance of the Work.

1.8.4.2. The Contractor must obtain the Owners approval of the Certificate of Substantial Performance prior to publication.

1.8.4.3. The certificate of Substantial Performance of the Work shall be prepared and issued in accordance with the Construction Act.

1.8.5. Final Inspection for completion of the *Contract*:

- 1.8.5.1. Deficiencies and defects shall be made good before the Contractor submits a written request for final review of the Work and before the Contract is considered complete.
- 1.8.5.2. When Contractor is satisfied that the Work is complete, and after the Contractor has reviewed the Work to verify its completion in accordance with the requirements of the Contract Documents, the Contractor shall submit a written request for a final review by the Consultant, who in turn will notify the Owner.
- 1.8.5.3. If there are any deficiencies identified as a result of this review, they shall be listed by the Consultant and submitted to the Contractor. This list shall be recognized as the final deficiency list for purposes of acceptance of the Work under the Contract.
- 1.8.5.4. Such deficiencies shall be corrected by a date mutually agreed upon between Consultant and the Contractor, unless a specific date is required by Contract, and a further review by the Consultant shall be called for by the Contractor following his own review to take place within 7 days from date of request.
- 1.8.5.5. Contractor shall thereafter submit invoice for final payment.
- 1.8.5.6. Money shall be withheld for deficiency work and will be released only when all deficiencies have been completed. No partial payment to be recognized until all work is completed.

#### **1.9. WARRANTY PERIOD**

- 1.9.1. The Warranty Period shall commence following the date of substantial performance for a duration of twelve months in accordance with the Agreement between Owner and Contractor.
- 1.9.2. Contractor shall provide on-going review and attendance to building call-back, maintenance, and repair problems during the warranty periods.
- 1.9.3. At the beginning of the 2nd last month of the Warranty Period, the Owner, Contractor and Consultant, along with key Subcontractors as designated, shall carry out a complete review of building and its systems to determine which deficiencies are to be rectified under the warranty. Contractor shall be responsible for timely written notification of Owner, and Consultant prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by Owner, and Consultant.

#### **2 PRODUCTS**

Not applicable.

#### **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Documents
- .4 1.4. Summary
- .5 1.5. Definitions
- .6 1.6. Closeout Submittals
- .7 2.1. Requirements For Operation, And Maintenance Manuals
- .8 2.2. Operation Data
- .9 2.3. Product Maintenance Data
- .10 2.4. Systems And Equipment Maintenance Data
- .11 3.1. Manual Preparation

### **1.3. RELATED DOCUMENTS**

- 1.3.1. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections and Contractor's Submission Schedule, apply to this Section.

### **1.4. SUMMARY**

- 1.4.1. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1.4.1.1. Operation and maintenance manual for systems, subsystems, and equipment.
  - 1.4.1.2. Product maintenance data.
  - 1.4.1.3. Systems and equipment maintenance data.
- 1.4.2. Related Sections:
  - 1.4.2.1. Section 01 33 00 – Submittal Procedures
  - 1.4.2.2. Section 01 77 00 – Contract Closeout Requirements
  - 1.4.2.3. Section 01 81 13 – Sustainable Design Requirements
  - 1.4.2.4. Section 01 91 13 – General Commissioning Requirements

### **1.5. DEFINITIONS**

- 1.5.1. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- 1.5.2. Subsystem: A portion of a system with characteristics similar to a system.

### **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Required Manuals: see Section 01 77 00 – Contract Closeout Requirements for additional requirements.
- 1.6.2. Format: Submit operations and maintenance manuals in the following format:
  - 1.6.2.1. 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to the Design Professional.
    - (1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - (2) Enable inserted reviewer comments on draft submittals.

## **2 PRODUCTS**

### **2.1. REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS**

- 2.1.1. Organization: Organize the manual into separate sections by CSI number based on the table of contents of the project manual, for each system and subsystem, and a separate section for each piece of equipment not part of a system. The manual shall contain the following materials, in the order listed:
  - 2.1.1.1. Title page.
  - 2.1.1.2. Table of contents.
  - 2.1.1.3. Manual contents:
    - (1) Operation data.
    - (2) Product maintenance data.
    - (3) Systems and equipment data
- 2.1.2. Title Page: Include the following information:
  - 2.1.2.1. Subject matter included in manual.
  - 2.1.2.2. Name and address of Project.
  - 2.1.2.3. Name and address of Owner.
  - 2.1.2.4. Date of submittal.
  - 2.1.2.5. Name and contact information for Contractor.
  - 2.1.2.6. Name and contact information for Construction Manager.
  - 2.1.2.7. Name and contact information for Design Professional.
  - 2.1.2.8. Name and contact information for Commissioning Agent.
  - 2.1.2.9. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
  - 2.1.2.10. Cross-reference to related systems in other operation and maintenance manuals.
- 2.1.3. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  - 2.1.3.1. If operation or maintenance documentation requires more than one media volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- 2.1.4. Manual Contents: Organize into sets of manageable size. Arrange contents by CSI Section number and then by system, subsystem, and equipment.
- 2.1.5. Manuals, Electronic Copy: Submit electronic (PDF) copy of the manual, to the Design Professional, concurrent with Action Submittal.

### **2.2. OPERATION DATA**

- 2.2.1. Content: In addition to requirements in this Section, include operation data required in individual Specification Section and the following information:
  - 2.2.1.1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2.2.1.2. Operating standards.
  - 2.2.1.3. Operating procedures.
  - 2.2.1.4. Operating logs.
  - 2.2.1.5. Wiring diagrams.
  - 2.2.1.6. Control diagrams.
  - 2.2.1.7. Piped system diagrams.
  - 2.2.1.8. Precautions against improper use.
  - 2.2.1.9. License requirements including inspection and renewal dates.
- 2.2.2. Descriptions: Include the following:
  - 2.2.2.1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2.2.2.2. Manufacturer's name.
  - 2.2.2.3. Equipment identification with serial number of each component.
  - 2.2.2.4. Equipment function.

- 2.2.2.5. Operating characteristics.
- 2.2.2.6. Limiting conditions.
- 2.2.2.7. Performance curves.
- 2.2.2.8. Engineering data and tests.
- 2.2.2.9. Complete nomenclature and number of replacement parts.
- 2.2.3. Operating Procedures: Include the following, as applicable:
  - 2.2.3.1. Startup procedures.
  - 2.2.3.2. Equipment or system break-in procedures.
  - 2.2.3.3. Routine and normal operating instructions.
  - 2.2.3.4. Regulation and control procedures.
  - 2.2.3.5. Instructions on stopping.
  - 2.2.3.6. Normal shutdown instructions.
  - 2.2.3.7. Seasonal and weekend operating instructions.
  - 2.2.3.8. Required sequences for electric or electronic systems.
  - 2.2.3.9. Special operating instructions and procedures.
- 2.2.4. D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- 2.2.5. E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

### **2.3. PRODUCT MAINTENANCE DATA**

- 2.3.1. Content: Organize data into a separate section, within the O & M Manual, for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- 2.3.2. Source Information: List each product included in section identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- 2.3.3. Product Information: Include the following, as applicable:
  - 2.3.3.1. Product name and model number.
  - 2.3.3.2. Manufacturer's name.
  - 2.3.3.3. Color, pattern, and texture.
  - 2.3.3.4. Material and chemical composition.
  - 2.3.3.5. Reordering information for specially manufactured products.
- 2.3.4. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 2.3.4.1. Inspection procedures.
  - 2.3.4.2. Types of cleaning agents to be used and methods of cleaning.
  - 2.3.4.3. List of cleaning agents and methods of cleaning detrimental to product.
  - 2.3.4.4. Schedule for routine cleaning and maintenance.
  - 2.3.4.5. Repair instructions.
- 2.3.5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- 2.3.6. Warranties and Guarantees: Include copies of warranties and guarantees lists of circumstances and conditions that would affect validity of warranties.
  - 2.3.6.1. Include procedures to follow and required notifications for warranty claims.

### **2.4. SYSTEMS AND EQUIPMENT MAINTENANCE DATA**

- 2.4.1. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- 2.4.2. Source Information: List each system, subsystem, and piece of equipment included in a separate section within the O & M Manual identified by product name and arranged to

- match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- 2.4.3. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
    - 2.4.3.1. Standard maintenance instructions and bulletins.
    - 2.4.3.2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
    - 2.4.3.3. Identification and nomenclature of parts and components.
    - 2.4.3.4. List of items recommended to be stocked as spare parts.
  - 2.4.4. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
    - 2.4.4.1. Test and inspection instructions.
    - 2.4.4.2. Troubleshooting guide.
    - 2.4.4.3. Precautions against improper maintenance.
    - 2.4.4.4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    - 2.4.4.5. Aligning, adjusting, and checking instructions.
    - 2.4.4.6. Demonstration and training video recording, if available.
  - 2.4.5. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
    - 2.4.5.1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
    - 2.4.5.2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
  - 2.4.6. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
  - 2.4.7. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.
    - 2.4.7.1. Include procedures to follow and required notifications for warranty claims.

### **3 EXECUTION**

#### **3.1. MANUAL PREPARATION**

- 3.1.1. Operation and Maintenance Documentation shall be provided for review, concurrent, with Action Submittal specified in Individual Specification Section.
  - 3.1.1.1. Correct or modify the manual to comply with the Design Professional's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Design Professional's and Commissioning Authority's comments and prior to commencing demonstration and training.
- 3.1.2. Product Maintenance Data: Assemble a complete set of maintenance data, in a separate section, within the O&M Manual, indicating care and maintenance of each product, material, and finish incorporated into the Work.
- 3.1.3. Operation and Maintenance Data: Assemble a complete set of operation and maintenance data, in a separate section, within the O&M Manual, indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 3.1.3.1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 3.1.3.2. Prepare a separate section within the O&M Manual, for each system and subsystem, in the form of an instructional manual for use by operating personnel.

- 3.1.4. Manufacturers' Data: Where manual contain manufacturers' standard printed data; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 3.1.4.1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- 3.1.5. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in As-built Drawings to ensure correct illustration of completed installation.
  - 3.1.5.1. Do not use original project record documents as part of operation and maintenance manuals.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. Section Includes
- .3 1.3. Warranties
- .4 1.4. Extended Warranties

### **1.3. WARRANTIES**

- 1.3.1. Refer to GC 12.3 of the Agreement between *Owner* and *Contractor* for the Warranty Periods provisions, and as follows:
  - 1.3.1.1. Warranties shall commence at date of Substantial Performance of the Work.
  - 1.3.1.2. Submit warranties for applicable items, signed by the applicable company responsible for each warranty.
  - 1.3.1.3. Submit warranties on form approved by Owner including, but not limited to, the following information:
    - (1) Name and address of Project.
    - (2) Warranty commencement date (date of Substantial Performance of the Work).
    - (3) Duration of warranty.
    - (4) Clear indication of what is being warranted and what remedial action will be taken under warranty.
    - (5) Authorized signature and seal of company providing each warranty.
- 1.3.2. Owner shall be named in manufacturer's Product warranties. Submit on relevant Product manufacturer's standard warranty or guarantee form.
- 1.3.3. The Owner will give prompt notice in writing to the Consultant of any defects noted during the warranty periods(s) and the Consultant shall notify the Contractor promptly requesting him to remedy such defects.
- 1.3.4. A minimum of 30 Working Days prior to the expiration of the Warranty Period stipulated in Contract between Owner and Contractor, the Owner, the Consultant and the Contractor shall conduct an inspection of the Work. The Contractor shall promptly remedy any defects due to faulty materials or workmanship.
- 1.3.5. Use of permanent heating system for temporary heat shall not affect requirement that all warranties start on the date specified in Article A-15 of the Agreement between Owner and Contractor.
- 1.3.6. Prior to application for Substantial Performance of the Work, the Contractor shall formally assign to the Owner all extended warranties given by Subcontractors for their Work on the project and such Subcontractors shall be formally advised of the assignment.

### **1.4. EXTENDED WARRANTIES**

- 1.4.1. Extended warranties shall be in accordance with the *Contract* and as follows:
  - 1.4.1.1. Where specifically identified in the Contract Documents, extended warranties shall be furnished by individual manufacturer for particular product / system / assembly or by Subcontractor for a particular product/system/assembly/section of the specifications.
  - 1.4.1.2. Extended warranties shall include for proper performance of the portion of the Work as defined by the scope of the applicable specification section to the extent that the design and Contract Documents permit such performance.
  - 1.4.1.3. Extended warranties shall be provided by Subcontractor unless warranty is specified to be provided by product manufacturer.

- 1.4.1.4. The Owner shall promptly give the warrantor notice in writing of observed defects and deficiencies which occur during the warranty period.
- 1.4.1.5. Extended warranties shall commence at date of Substantial Performance of the Work.
- 1.4.1.6. Extended warranties specified shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranty do not relieve Contractor of obligations under requirements of the Contract Documents.
- 1.4.1.7. Submit extended warranty on warrantor's standard form specifically endorsed by the warrantor to the Owner and shall include the following information:
  - (1) Name and address of Project.
  - (2) Warranty commencement date (date of Substantial Performance of the Work).
  - (3) Warranty period.
  - (4) Specific warranty terms as required in applicable portion of Contract Documents.
  - (5) Name and title of authorized signing officer and seal of warrantor.

## **2 PRODUCTS**

Not applicable.

## **3 EXECUTION**

Not applicable.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Documents
- .4 1.4. Summary
- .5 1.5. Closeout Submittals
- .6 2.1. As-Built Drawings
- .7 2.2. As-Built Specifications
- .8 2.3. As-Built Schedule
- .9 2.4. Record Product Data
- .10 2.5. Miscellaneous Record Submittals
- .11 3.1. Recording And Maintenance

### **1.3. RELATED DOCUMENTS**

- 1.3.1. The Contract Documents, including but not limited to, the Drawings and Individual Specification Sections, apply to this Section.

### **1.4. SUMMARY**

- 1.4.1. Section includes administrative and procedural requirements for As-built documents, including the following:
  - 1.4.1.1. As-built Drawings
  - 1.4.1.2. As-built Specifications
  - 1.4.1.3. As-built Schedule
  - 1.4.1.4. Record Product Data
  - 1.4.1.5. Miscellaneous record submittals
- 1.4.2. Related Sections:
  - 1.4.2.1. Section 01 32 00 – Construction Progress Documentation
  - 1.4.2.2. Section 01 33 00 – Submittal Procedure; Required Submittal List
  - 1.4.2.3. Section 01 77 00 – Contract Closeout Requirements
  - 1.4.2.4. Section 01 78 23 – Operation and Maintenance Manuals
- 1.4.3. Administrative and procedural requirements for contract turnover documents, including, but not limited to the following, as provided in Individual Specifications Sections.
  - 1.4.3.1. Sustainable Documents
  - 1.4.3.2. Commissioning Documents
  - 1.4.3.3. Hazardous Waste Documents

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Required Documents: Section 01 77 00 – Contract Closeout Requirements, describes administrative requirements for submission, number and type of copies required for contract closeout requirements.

## **2 PRODUCTS**

### **2.1. AS-BUILT DRAWINGS**

- 2.1.1. As-built Drawings: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings onsite. Review As-built Drawings and shop drawings monthly with the Owner, for approval.
  - 2.1.1.1. Preparation: Daily mark As-built Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or

similar entity, to provide information for preparation of corresponding marked-up As-built Drawings.

- (1) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - (2) Accurately record information in an acceptable drawing technique.
  - (3) Record data as soon as possible after obtaining it.
  - (4) Record and check the markup before enclosing concealed installations.
- 2.1.1.2. Content: Types of items requiring marking include, but are not limited to, the following:
- (1) Dimensional changes to Drawings.
  - (2) Revisions to details shown on Drawings.
  - (3) Depths of foundations below first floor.
  - (4) Locations and depths of underground utilities.
  - (5) Revisions to routing of piping and conduits.
  - (6) Revisions to electrical circuitry.
  - (7) Actual equipment locations.
  - (8) Duct size and routing.
  - (9) Locations of concealed internal utilities.
  - (10) Changes made by Change Order.
  - (11) Changes made by Bulletin.
  - (12) Changes made following the Owner's written orders.
  - (13) Details not on the original Contract Drawings.
  - (14) Field records for variable and concealed conditions.
  - (15) Record information on the Work that is shown only schematically.
- 2.1.1.3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up as-built prints.
- 2.1.1.4. Mark as-built sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 2.1.1.5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 2.1.1.6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

## **2.2. AS-BUILT SPECIFICATIONS**

- 2.2.1. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
- 2.2.1.1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2.2.1.2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 2.2.1.3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 2.2.1.4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  - 2.2.1.5. Note related Change Orders, record Product Data, and turnover Drawings where applicable.

## **2.3. AS-BUILT SCHEDULE**

- 2.3.1. Final Schedule: Submit to the Owner a final schedule update. The As-built Schedule shall reflect the exact manner in which the project was actually constructed including actual start and finish dates, activities, sequences and logic.

- 2.3.1.1. The Contractor shall certify the final schedule update as being a true reflection of the way the project was actually constructed.

## **2.4. RECORD PRODUCT DATA**

- 2.4.1. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 2.4.1.1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2.4.1.2. Include significant changes in the product delivered to the Project site and changes in manufacturer's written instructions for installation.
  - 2.4.1.3. Note related Change Orders, As-built Specifications, and As-built Drawings where applicable.

## **2.5. MISCELLANEOUS RECORD SUBMITTALS**

- 2.5.1. Assemble miscellaneous records required by Individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- 2.5.2. Format: Submit miscellaneous record submittals.
  - 2.5.2.1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

# **3 EXECUTION**

## **3.1. RECORDING AND MAINTENANCE**

- 3.1.1. Maintain Change Log: Maintain and submit written change log to the Owner, monthly for review indicating items incorporated in contract turnover documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.
- 3.1.2. Recording: Maintain one copy of each submittal during the construction period for contract turnover document purposes. Post changes and modifications to contract turnover documents as they occur; do not wait until the end of the Project.
- 3.1.3. Maintenance of Turnover Documents and Samples: Store turnover documents and Samples in the field office apart from the Contract Documents used for construction. Contract turnover documents are not to be used for construction purposes. Maintain turnover documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to contract turnover documents for the Owner's reference during normal working hours during performance of Contract.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. Section Includes
- .3 1.3. Administrative Requirements
- .4 1.4. Action And Informational Submittals
- .5 1.5. Quality Assurance

### **1.3. ADMINISTRATIVE REQUIREMENTS**

- 1.3.1. Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel weeks prior to date of substantial performance.
- 1.3.2. Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- 1.3.3. Preparation:
  - 1.3.3.1. Verify conditions for demonstration and instructions comply with requirements.
  - 1.3.3.2. Verify designated personnel are present.
  - 1.3.3.3. Ensure equipment has been inspected and put into operation in accordance with mechanical and electrical specifications.
  - 1.3.3.4. Ensure testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
- 1.3.4. Demonstration and Instructions:
  - 1.3.4.1. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
  - 1.3.4.2. Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - 1.3.4.3. Review contents of manual in detail to explain aspects of operation and maintenance.
  - 1.3.4.4. Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

### **1.4. ACTION AND INFORMATIONAL SUBMITTALS**

- 1.4.1. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4.2. Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Owner's approval.
- 1.4.3. Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- 1.4.4. Give time and date of each demonstration, with list of persons present.
- 1.4.5. Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - 1.5.1.1. Instruct Owner's personnel.
  - 1.5.1.2. Provide written report that demonstration and instructions have been completed.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Related Sections
- .5 1.5. Administrative Requirements
- .6 1.6. Quality Assurance
- .7 1.7. Submittals

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Administrative and procedural requirements for meeting the energy and air tightness targets established for this project
  - 1.3.1.2. Identification of construction activities and tasks related to energy efficiency and airtightness
  - 1.3.1.3. Monthly and project close-out reporting requirements

### **1.4. RELATED SECTIONS**

- 1.4.1. 01 40 00 – Quality Requirements
- 1.4.2. 07 05 23 – Air Tightness Testing
- 1.4.3. 20 06 11 – Testing, Adjusting, and Balancing (TAB) of Mechanical Systems

### **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Contractor Responsibilities
  - 1.5.1.1. Unless otherwise indicated as the responsibility of another identified entity, the Contractor shall provide coordination of the trades, and the sequence of construction to ensure all energy efficiency and air tightness requirements relating to construction activities and tasks have been met. Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
  - 1.5.1.2. The Contractor shall provide the necessary orientation for all subcontractors.
  - 1.5.1.3. The Contractor shall ensure that all applicable materials and products meet the requirements relating to energy efficiency and air tightness. Compliance shall be demonstrated by providing the documentation required in the corresponding specification section.
  - 1.5.1.4. The Contractor shall acquire photos throughout construction as requested by the Architect.
  - 1.5.1.5. The Contractor shall work with the Client, Architect, Commissioning Agent, and Mechanical Consultant to coordinate, schedule and accommodate all testing, inspection, and quality assurance activities. For reference, testing activities will include:
    - .1 Whole-building air tightness testing
    - .2 Heating, cooling and ventilation air distribution system measurement and balancing.
  - 1.5.1.6. The Contractor shall allow enough time for testing, evaluation, alterations and re- testing so as not to interrupt the Progress Schedule for the Project.

- 1.5.1.7. The Contractor shall cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following
  - .1 Provide access to the Work.
  - .2 Furnish incidental labour and facilities necessary to facilitate inspections and tests.
- 1.5.2. Subcontractors shall comply with all procedure and submittal requirements as detailed within the related specifications sections as they pertain to their scope of work.
- 1.5.3. Pre-Construction Meeting:
- 1.5.4. After award of contracts and prior to mobilization onsite, the Contractor shall schedule a meeting with the Consultant to discuss the execution and documentation requirements as detailed within the related specification sections. Please note that this meeting is separate from any training (e.g. air tightness) sessions that are required in other sections.
- 1.5.5. Site Review Report Responses:
  - 1.5.5.1. Consultant will conduct inspections intermittently throughout construction. Feedback will be provided to the Contractor in the form of Site Review reports. The Contractor shall respond to all high and medium priority issues identified in the report within 5 working days from the time it was issued. The response shall be in written format and correspond to the item numbers used in the original report. If required, the Contractor shall provide photos and/or other supporting documentation that has been requested to demonstrate that the identified issues have been addressed.

## **1.6. QUALITY ASSURANCE**

- 1.6.1. Materials and workmanship will be subject to inspection at any time. Cooperate in permitting access for inspection to all places where work is being done or stock is being stored. Refer to Section 01 40 00 and related Sections.
- 1.6.2. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- 1.6.3. Owner's quality control inspection and testing is specified in the technical sections and will be paid for directly by the Owner except as otherwise specified. Contractor to pay for inspections and re-testing to verify acceptability of corrected work.

## **1.7. SUBMITTALS**

- 1.7.1. Photographs
  - 1.7.1.1. Upon project completion, the Contractor shall upload all required photographs taken during construction to an FTP or Cloud-based site setup by the Architect.
- 1.7.2. Shop Drawings
  - 1.7.2.1. Provide the following shop drawings to the Project Team for review simultaneous to the Architect/Engineer of Record review.
    - .1 Windows and Doors (exterior)
    - .2 Plumbing Fixtures and Equipment including, but not limited to, water closets, urinals, faucets, showerheads and water heaters
    - .3 All HVAC Equipment including, but not limited to, roof-tops units, air handling units, fans, pumps, boilers, chillers, controls, cabinet heaters, unit heaters, fan coils, and heat pump (e.g. VRF equipment) etc.
    - .4 Refrigerant Containing Equipment – submit anticipated refrigerant charge.
    - .5 Lighting Equipment (both exterior and interior)

## **2 PRODUCTS - NOT USED**

## **3 EXECUTION- NOT USED**

**END OF SECTION**



## 1 GENERAL

### 1.1 SUMMARY

- 1.1.1 Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. The commissioning process begins in the design phase and continues through construction, acceptance, and the warranty period. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, functional testing, and training.
- 1.1.2 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
- 1.1.2.1 Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and industry best practices, and that they receive adequate operational checkout by installing contractors.
  - 1.1.2.2 Verify and document proper performance of equipment and systems.
  - 1.1.2.3 Verify that O&M documentation left on site is complete.
  - 1.1.2.4 Verify that the Owner's operating personnel are adequately trained.
- 1.1.3 The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

### 1.2 REFERENCES

- 1.2.1 2023 ASHRAE Handbook – HVAC Applications, Chapter 43 HVAC Commissioning.
- 1.2.2 ASHRAE Guideline 1.1-2007 – The HVAC&R Technical Requirements for the Commissioning Process.
- 1.2.3 ASHRAE Guideline 0–2013 – The Commissioning Process.
- 1.2.4 ASHRAE 202-2013, Commissioning Process for Buildings and Systems.
- 1.2.5 ASHRAE Guideline 4-2019, Preparation of O&M Documentation.
- 1.2.6 CSA Z320-11, Building Commissioning Standard, and Check Sheets.
- 1.2.7 CSA C282:19, Emergency Power Supply for Buildings.

### 1.3 ABBREVIATIONS AND ACRONYMS

- 1.3.1 The following are common abbreviations used in the Specifications and in the Commissioning Plan.

A/E-	Architect and Design Engineers	FT-	Functional performance test
CxP-	Commissioning Provider	GC-	General Contractor
CC	Controls Contractor	MC-	Mechanical Contractor
PM-	Project Manager	PC-	Pre-functional checklists
Cx-	Commissioning	Subs-	Subcontractors to General
Cx Plan-	Commissioning Plan document	TAB-	Test and Balance Contractor
EC-	Electrical Contractor	FM-	Facility Management
CM-	Construction Manager	CCR-	Contractor's Commissioning Representative

### 1.4 DEFINITIONS

- 1.4.1 Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
-

- 1.4.2 Architect / Engineer (A/E) - the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
  - 1.4.3 Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions, and methods chosen to meet the intent. The basis of design is the technical response to the design intent.
  - 1.4.4 Commissioning Provider (CxP) – The CxP works independent of the design and constructions teams. The CxP directs and coordinates the day-to-day commissioning activities. The CxP does not take an oversight role like the PM. The Contractor performs the duties associated with the commissioning for this Project.
  - 1.4.5 Commissioning Plan - an overall plan that provides the structure, schedule, and coordination planning for the commissioning process.
  - 1.4.6 Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).
  - 1.4.7 Contractor - the general contractor or authorized representative.
  - 1.4.8 Contractor's Commissioning Representative (CCR): An individual or a firm that is hired by the general contractor to manage the contractor's commissioning process related activities.
  - 1.4.9 Control system - the central building energy management control system.
  - 1.4.10 CxAlloy - A cloud-based web application for managing project and commissioning process quality and documentation during the design and construction phases of a building.
  - 1.4.11 Data-logging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data-loggers separate from the control system.
  - 1.4.12 Deferred Functional Tests – FT's that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.
  - 1.4.13 Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not compliant with the design intent).
  - 1.4.14 Design Intent (Owner's Project Requirements) - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
  - 1.4.15 Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.
  - 1.4.16 Factory Testing - testing of equipment on-site or at the factory (by factory personnel) with an Owner's representative present.
  - 1.4.17 Functional Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB
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Contractor's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Provider develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after pre-functional test sheets and startup are complete.

- 1.4.18 General Contractor (GC) - the prime contractor for this project. Generally, refers to all the GC's subcontractors as well. Also referred to as the Contractor in some contexts.
  - 1.4.19 Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
  - 1.4.20 Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.
  - 1.4.21 Non-Compliance - see Deficiency.
  - 1.4.22 Non-Conformance - see Deficiency.
  - 1.4.23 Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."
  - 1.4.24 Owner-Contracted Tests - tests paid for by the Owner outside the GC's contract and for which the CxP does not oversee. These tests will not be repeated during functional tests if properly documented.
  - 1.4.25 Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
  - 1.4.26 Pre-functional Tests (PFT's) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxP to the Sub. Pre-functional test sheets are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels satisfactory, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). Pre-functional refers to before functional testing and are to be completed by the installing contractor. Pre-functional test sheets augment and are combined with the manufacturer's start-up checklist. The CxP may choose to witness pre-functional tests for large/critical pieces of equipment.
  - 1.4.27 Project Manager (PM) - the Owner's representative in the day-to-day activities
  - 1.4.28 Sampling. - functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
  - 1.4.29 Seasonal Performance Tests - FT's that are deferred until the system(s) will experience conditions closer to their design conditions.
  - 1.4.30 Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
  - 1.4.31 Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance, or pressure to the transducer and DDC system to simulate a sensor value.
  - 1.4.32 Specifications - the construction specifications of the Contract Documents.
  - 1.4.33 Startup - the initial starting or activating of dynamic equipment, including executing pre-functional test sheets.
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- 1.4.34 Subs - the subcontractors to the GC who provide and install building components and systems.
- 1.4.35 Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxP.
- 1.4.36 Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents
- 1.4.37 Trending - monitoring using the building control system.
- 1.4.38 Vendor - supplier of equipment.
- 1.4.39 Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

## **1.5 COORDINATION**

- 1.5.1 Commissioning Team. The commissioning team consists of the representatives from the Owner, the Facility Management (FM) Staff, Commissioning Provider (CxP), the Project Manager (PM), the General Contractor (GC or Contractor), the Architect and Design Engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Testing and Balancing (TAB) Contractor, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment.
- 1.5.2 Management. The CxP is hired by the Owner and follows the rules of an Independent Commissioning Provider. The CxP directs and coordinates the commissioning activities and reports to the Owner or the Project Manager (PM). All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- 1.5.3 Scheduling. The CxP will work with the PM and GC according to established protocols to schedule the commissioning activities. The CxP will provide sufficient notice to the PM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The CxP will work with the GC to provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan provides a format for this schedule. As construction progresses more detailed schedules are developed by the GC and the CxP. The Commissioning Plan also provides a format for detailed schedules.

## **1.6 MEETINGS**

- 1.6.1 The CxP will schedule, plan, and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxP. Information gathered from this meeting will allow the CxP to create the Commissioning Plan to its "final" version, which will also be distributed to all parties.
- 1.6.2 Miscellaneous Meetings. Other meetings will be planned and conducted by the CxP as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CxP will plan these meetings and will minimize unnecessary time being spent by Subs.

## **1.7 SUBMITTALS**

- 1.7.1 Contractors will provide the CxP standard submittals required to facilitate the commissioning work. This process will be integrated into the normal submittal process and protocol of the construction team. At a minimum, the submittals will include equipment shop drawings, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance
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test procedures, control drawings, and details of owner contracted tests. In addition, the installation and checkout materials that are shipped inside the equipment and the field checkout forms to be used by the factory or field technicians shall be submitted to the CxP. All documentation requested by the CxP will be included by the Subs in their O&M manual contributions.

1.7.2 The commissioning process generates several written work products described in various parts of the Specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

1.7.2.1	Final commissioning plan	CxP
1.7.2.2	Commissioning Meeting Minutes	CxP
1.7.2.3	Commissioning Schedule	CxP with GC and PM
1.7.2.4	Equipment documentation submittals	Subs
1.7.2.5	Sequence clarifications	Subs and A/E as needed.
1.7.2.6	Pre-functional test sheets	CxP
1.7.2.7	Startup and initial checkout plan (compilation of existing documents)	Subs and CxP
1.7.2.8	Startup and initial checkout	Subs
1.7.2.9	Final TAB report	TAB Contractor
1.7.2.10	Issues log (deficiencies)	CxP
1.7.2.11	Commissioning Progress Record	CxP
1.7.2.12	Functional test forms	CxP
1.7.2.13	Filled out functional tests	CxP
1.7.2.14	O&M manuals	Subs
1.7.2.15	Final Commissioning Documentation	CxP
1.7.2.16	Overall training plan	CxP and PM
1.7.2.17	Specific training agendas	Subs
1.7.2.18	Final commissioning report	CxP
1.7.2.19	Misc. approvals	CxP

## 1.8 DOCUMENTATION REQUIREMENTS

1.8.1 The CxP will provide access to a cloud-based commissioning suite (CxAlloy) for all documentation requirements. The documentation is accessible 24/7 and can be accessed by multiple disciplines at the same time. Real time status of all commissioning activities is provided through the CxAlloy dashboard. The information for Contractors is available but not limited to the following:

- 1.8.1.1 People
  - (1) Commissioning Team member details will be provided by the CCR which will be entered into CxAlloy by the CxP. This will generate an invitation to the Commissioning Team members for access to CxAlloy for the project.
  - (2) Instruction on the use of CxAlloy will be provided by the CxP upon request.
- 1.8.1.2 Assets list
  - (1) An assets list will be entered into CxAlloy by the CxP based on provided design documentation, any changes to the assets list shall be provided by the CCR as soon as the information becomes available. CxAlloy will then be updated by the CxP.
  - (2) Contractors are required to select the current installation status of the equipment through the assets list.
- 1.8.1.3 Checklists
  - (1) Checklists will be allocated to the relative Contractors for completion.

- (2) Construction Installation – Provide the current status of installed equipment in preparation for Start-up.
  - (3) Construction Start-up – Equipment is now operational and ready for final testing or TAB activities to commence.
- 1.8.1.4 Tests
  - (1) Test sheets for all commissioned systems will be produced by the CxP, these test sheets are based on the approved automated sequences of operation. Where equipment is not automatically controlled, test procedures will be provided at the discretion of the CxP to verify operation.
  - (2) Tests will be allocated to the relative Contractors. Contractors will conduct tests and complete this documentation as a 1st attempt on 100% of the installed equipment.
  - (3) The CxP will conduct verification with the contractors through the 2nd attempt option in these tests to meet the sample rates dictated in this specification.
- 1.8.1.5 Issues
  - (1) Issues can be added by the contractors or members of the commissioning team at any stage of the commissioning process. Issues raised in Checklists or Tests and will be documented by CxAlloy through the Construction Issues section.
  - (2) The CxP will manage the Construction Issues based on priority so that the items are resolved in timely manner to minimize the impact on commissioning activities.
- 1.8.1.6 Files
  - (1) The CxP will create a filing structure for any additional contractor commissioning documentation.
- 1.8.2 The Contractor shall provide all relative additional commissioning documentation through the Files section of CxAlloy or directly into the specific checklist line items.

## **1.9 OPERATION AND MAINTENANCE DATA**

- 1.9.1 The specific content and format requirements for the standard O&M manuals are detailed in Mechanical and Electrical Specifications by the Design Engineers. ASHRAE Guideline 4-2008 is the recommended format.
  - 1.9.2 A/E Contribution The A/E will include in the beginning of the O&M manuals a separate section describing the systems including:
    - 1.9.2.1 The design intent narrative prepared by the A/E and provided as part of the bid documents, updated to as-built status by the A/E.
    - 1.9.2.2 Simplified professionally drawn single line system diagrams on 215.9 mm x 279.4 mm (8 ½" x 11") or 279.4 mm x 431.8 mm (11" x 17") sheets. These shall include chilled water system water system, heating system, steam system, supply air systems, exhaust systems, domestic hot water, and electrical single lines. These shall show major pieces of equipment.
  - 1.9.3 The CxP shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned and to verify compliance with the Specifications. The CxP will communicate deficiencies in the manuals to the PM or A/E. Upon a successful review of the corrections, the CxP recommends acceptance of these sections of the O&M manuals to the PM or A/E. The CxP also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.
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## 1.10 RELATED REQUIREMENTS

- 1.10.1 Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.

Section 01 91 13	Commissioning Requirements	Describes the commissioning process, responsibilities common to all parties, responsibilities of the A/E, CxP, GC/CM and Suppliers, focusing on the CxP. The unique MC, CC, TAB and EC (including the Contractors for the Special Systems) responsibilities are included in Division 21, Division 22, Division 23, Division 25, Division 26, Division 27 and Division 28.
Section 22 08 00 Section 23 08 00 Section 25 08 00	Plumbing Cx HVAC Cx Integrated Automation Cx	Describes the Cx responsibilities of the Plumbing, Mechanical, TAB, and Controls Contractors and the pre-functional testing and startup responsibilities of each. Points to 01 91 13 for functional testing requirements and provides the pre-functional and the specific functional testing requirements for Division 22, Division 23, and Division 25 equipment, for use on this project.
Section 26 08 00	Electrical Cx	Describes the Cx responsibilities of the Electrical, Contractor and the pre-functional testing and startup responsibilities. Provides the pre-functional and the specific functional testing requirements for Division 26, for use on this project. Points to Section 01 91 13.

## 1.11 SYSTEMS TO BE COMMISSIONED

- 1.11.1 Systems to be commissioned include but are not limited to the following:
- 1.11.1.1 Heat Pumps.
  - 1.11.1.2 Split AC
  - 1.11.1.3 Fan Coil Units.
  - 1.11.1.4 Domestic HW Heater.
  - 1.11.1.5 Electric Heaters.
  - 1.11.1.6 Energy Recovery Ventilator.
  - 1.11.1.7 Ventilation Fans.
  - 1.11.1.8 DHW pump.
  - 1.11.1.9 In-floor heating boiler and pumps.
  - 1.11.1.10 Building automation system.
  - 1.11.1.11 Lighting control.
  - 1.11.1.12 Solar PV products.

## 1.12 TEST EQUIPMENT

- 1.12.1 All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division Contractor for the equipment being tested. For example, the HVAC Contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls systems except for equipment specific to and used by TAB in their commissioning responsibilities.
- 1.12.2 Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents
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shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CxP.

- 1.12.3 Data-logging equipment and software required to test equipment will be provided by the CxP but shall not become the property of the Owner.
- 1.12.4 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to accuracy of 0.28°C (0.5°F) and a resolution of  $\pm 0.056^{\circ}\text{C}$  (0.1°F). Pressure sensors shall have an accuracy of  $\pm 2.0\%$  of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

### **1.13 BUILDING AUTOMATION SYSTEM (BAS) HARDWARE AND SOFTWARE SUPPORT**

- 1.13.1 The BAS Contractor shall provide the CxP with hardware and software needed to connect to, communicate with and command the BAS from both the front-end operator workstation and the field panels and controllers at no additional charge to the CxP. Use of hardware and software provided under this section may be limited to the duration of the commissioning process at the BAS Contractor's discretion but shall not be terminated until completion of the commissioning process including resolution of all outstanding construction phase issues and successful execution of occupancy phase commissioning activities.
- 1.13.2 Hardware and software covered under this requirement includes, but is not limited to:
  - 1.13.2.1 Communication modules, software keys, remote access and similar hardware needed for communication from a laptop computer or PDA to field panels or controllers.
  - 1.13.2.2 Proprietary cables required for communication between laptop computers or PDAs to field panels or controllers.
  - 1.13.2.3 Proprietary software needed to communicate to field panels or controllers such as HVAC Pro, Metasys, Commissioning Tool, etc.
  - 1.13.2.4 Passwords, access levels and similar software permissions necessary for execution of the Cx Process.
  - 1.13.2.5 Software and hardware manuals for all control system hardware and software provided to the CxP.
- 1.13.3 The BAS Contractor shall also provide technical support to the CxP as reasonably requested by the CxP regarding BAS hardware and software.

## **2 PRODUCTS – NOT USED**

## **3 EXECUTION**

### **3.1 COMMISSIONING PROCESS**

- 3.1.1 Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Following the commissioning scoping meeting, the CxP will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.
  - 3.1.2 Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
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- 3.1.2.1 Commissioning during construction begins with a scoping meeting conducted by the CxP where the commissioning process is reviewed with the commissioning team members.
- 3.1.2.2 Additional meetings will be required throughout construction, scheduled by the CxP with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
- 3.1.2.3 Equipment documentation is submitted to the CxP during normal submittals, including detailed start-up procedures and shop drawings.
- 3.1.2.4 The CxP works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional test sheets to be completed during the startup process.
- 3.1.2.5 In general, the checkout and performance verification proceeds from simple to complex; from component level, to equipment, to systems, and finally intersystem levels with pre-functional test sheets being completed before functional testing.
- 3.1.2.6 The Subs, under their own direction, execute and document the pre-functional test sheets and perform startup and initial checkout. The CxP documents that the test sheets and startup were completed according to the approved plans. This may include the CxP witnessing start-up of selected equipment.
- 3.1.2.7 The CxP develops specific equipment and system functional performance test procedures with the assistance of Subs as required. The Subs review the test procedures once prepared.
- 3.1.2.8 The procedures are executed by the Subs, under the direction of, and documented by the CxP.
- 3.1.2.9 Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
- 3.1.2.10 The CxP reviews the O&M documentation for completeness.
- 3.1.2.11 Commissioning is completed before Substantial Completion.
- 3.1.2.12 Deferred testing is conducted, as specified, or required.

### **3.2 GENERAL COMMISSIONING RESPONSIBILITIES**

- 3.2.1 The general responsibilities of various parties in the commissioning process are provided in Division 01 General Commissioning Requirements.
- 3.2.2 All members of the commissioning team shall attend the commissioning scoping meeting and additional meetings, as necessary.

### **3.3 ARCHITECT COMMISSIONING RESPONSIBILITIES**

- 3.3.1 Attend the commissioning scoping meeting and selected commissioning team meetings.
- 3.3.2 Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
- 3.3.3 Provide any design narrative documentation requested by the CxP.
- 3.3.4 Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
- 3.3.5 Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review the O&M manuals.
- 3.3.6 Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

### **3.4 MECHANICAL AND ELECTRICAL ENGINEERS COMMISSIONING RESPONSIBILITIES**

- 3.4.1 Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
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- 3.4.2 Provide any design narrative and sequences documentation requested by the CxP. The Designers shall assist (along with the Contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- 3.4.3 Attend commissioning scoping meetings and other selected commissioning team meetings.
- 3.4.4 Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
- 3.4.5 Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review the O&M manuals.
- 3.4.6 From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.
- 3.4.7 Provide a presentation at one of the training sessions for the Owner's personnel.
- 3.4.8 Witness testing of selected pieces of equipment and systems.
- 3.4.9 Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

### **3.5 COMMISSIONING PROVIDER RESPONSIBILITIES**

- 3.5.1 The CxP is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxP may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the A/E. The primary role of the CxP is to develop and coordinate the execution of a testing plan, observe and document performance that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxP.
  - 3.5.2 The CxP coordinates and directs the commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
  - 3.5.3 Coordinate the commissioning work and, with the GC ensure that commissioning activities are being scheduled into the master schedule.
  - 3.5.4 Develop and issue the Commissioning Plan.
  - 3.5.5 Plan and conduct a commissioning scoping meeting and other commissioning meetings.
  - 3.5.6 Before startup, review the current control sequences and interlocks and work with Contractors and Design Engineers until sufficient clarity has been obtained, in writing, to be able to write detailed functional testing procedures.
  - 3.5.7 Review Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
  - 3.5.8 Write and distribute pre-functional tests and test sheets.
  - 3.5.9 Coordinate with trades their start-up and initial systems checkout plan.
  - 3.5.10 Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.
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- Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
- 3.5.11 Witness part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Notify the owner and/or the PM of any deficiencies in results or procedures.
  - 3.5.12 Witness part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Notify the owner and/or the PM of any deficiencies in results or procedures.
  - 3.5.13 Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot checking.
  - 3.5.14 Approve systems start-up by reviewing start-up reports and by selected site observation.
  - 3.5.15 Review TAB execution plan.
  - 3.5.16 Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
  - 3.5.17 Review air and water systems balancing by spot testing, by reviewing completed reports, and by selected site observation.
  - 3.5.18 With necessary assistance and review from installing Contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone data-logger monitoring, or manual functional testing.
  - 3.5.19 Analyze any functional performance trend logs and monitoring data to verify performance.
  - 3.5.20 Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing with contractors on equipment to be commissioned.
  - 3.5.21 Maintain a master deficiency and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions.
  - 3.5.22 Witness performance testing of smoke control systems by others and all other owner contracted tests or tests by manufacturer's personnel over which the CxP may not have direct control. Document these tests and include this documentation in Commissioning Binders.
  - 3.5.23 Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
  - 3.5.24 Oversee and approve the training of the Owner's operating personnel. Compile and maintain a commissioning record book(s).
  - 3.5.25 Review the preparation of the O&M manuals. Provide a final commissioning report (as described in this section).

### **3.6 PROJECT MANAGER COMMISSIONING RESPONSIBILITIES**

- 3.6.1 Facilitate the coordination of the commissioning work by the CxP and ensure that commissioning activities are being scheduled into the master schedule.
  - 3.6.2 Review the final Commissioning Plan.
  - 3.6.3 Attend a commissioning scoping meeting and other commissioning team meetings.
  - 3.6.4 Include the cost of commissioning in the total contract price.
  - 3.6.5 Perform the normal review of Contractor submittals.
  - 3.6.6 Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxP.
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- 3.6.7 In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
- 3.6.8 Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
- 3.6.9 Observe and witness pre-functional test sheets, startup, and functional testing.
- 3.6.10 Review commissioning progress and deficiency reports.
- 3.6.11 Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
- 3.6.12 Sign-off on individual commissioning tests as completed and passing.
- 3.6.13 Coordinate the training of owner personnel.
- 3.6.14 Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Final Commissioning Program.
- 3.6.15 Assist the CxP as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.
- 3.6.16 Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CxP, according to the specifications.
- 3.6.17 Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

### **3.7 GENERAL CONTRACTOR'S RESPONSIBILITIES**

- 3.7.1 General
  - 3.7.1.1 Contractors providing and/or installing equipment and systems included but not limited to the 'Scope of Work' above are required to participate fully in the Commissioning Process.
  - 3.7.1.2 Participating Contractors shall include all requirements to complete the Cx process including all requirements of their Sub-Contractors, vendors, suppliers, materials, meetings, lifts, ladders, safety equipment, radios.
  - 3.7.1.3 Participating Contractors shall ensure acceptable representation, with the means and authority to prepare, coordinate and execute the Commissioning Process as described in the contract documents.
  - 3.7.1.4 Contractors shall participate in the resolution of system issues/deficiencies identified during the commissioning process. Contractors are responsible to address and resolve deficiencies/issues in compliance with the Contract Documents identified by the Cx team members during the construction, testing, verification and warranty periods.
  - 3.7.1.5 The Contractor works with the Sub-Contractor in each discipline in developing, coordinating and scheduling commissioning activities.
  - 3.7.1.6 The Contractor coordinates the Sub-Contractor's work schedules and staffing to ensure that the qualified technician(s) are available and present during the agreed upon schedules and for enough duration to complete procedures, tests, adjustments, and/or problem resolutions. Provisions to be made for the inclusion of Seasonal Testing.
  - 3.7.1.7 Contractors must test and document the equipment or systems deferred due to Seasonal conditions. And submit results if satisfactory to consultants and CxP for verification. Seasonal Testing requirements may change during the project which need to be reflected in the Commissioning Schedule.
- 3.7.2 Contractor's Commissioning Representative (CCR)
  - 3.7.2.1 Each Contractor participating in the commissioning process will each designate a single-point contact person to work with the CxP and the Commissioning Team to coordinate Installation, Testing, Startup, Functional Performance

- Testing and Functional Verification activities, ensure timely execution of Cx Procedures and prompt resolution of issues.
- 3.7.2.2 Contractor Commissioning Representative (CCR) shall submit names of sub-contractors (Mechanical, Electrical, Testing, Adjustment, and Balancing (TAB) and Building Automation Systems (BAS)) commissioning representatives to CxP in the early months of construction start.
  - 3.7.2.3 Contractor and Subcontractor commissioning representatives will attend and fully participate in Commissioning, Integrated Systems Testing (IST) and TAB related meetings.
  - 3.7.2.4 The CCR shall be the Contractor's Project Manager, Field Superintendent or similar with authority to do the following:
    - (1) Make decisions regarding commissioning activities and issues
    - (2) Schedule technicians for participation in commissioning activities
    - (3) Interface between the Commissioning Team and the Contractor's, vendors and suppliers.
    - (4) The Cx Team shall be notified of all start-up activity a minimum of 10 days in advance and reasonably coordinate for attendance. Start-ups will not be accepted if the Cx Team is not notified and given the opportunity to attend.
  - 3.7.2.5 The CCR will be responsible for coordinating the Contractor's participation in the Commissioning Process. As part of this role, the CCR shall:
    - (1) Schedule, facilitate and coordinate all Commissioning Meetings
    - (2) Keep the Mechanical and Electrical Consultants, and/or CxP apprised of the Contractor's progress, schedules and other matters impacting execution of the Commissioning Procedures.
    - (3) Coordinate the Contractor's work schedules and staffing to ensure that the qualified technician(s) are available and present during the agreed upon schedules and for enough duration to complete procedures, tests, adjustments, and/or problem resolutions.
    - (4) Confirm all BAS points, commands and responses reporting properly, and values reflect calibrated adjustments. Final reported values, when verified by the CxP, will serve as Functional Verification evidence.
  - 3.7.3 Field Technicians/Tradespersons
    - 3.7.3.1 Each Contractor shall provide qualified field technicians who are trained and familiar with installation, operation and troubleshooting of systems and equipment being commissioned for participation in the commissioning activities outlined in this document.
    - 3.7.3.2 Contractors shall arrange for and provide technicians from their Sub-Contractors, vendors and suppliers where specified and where Contractor's own personnel lack the required training or experience necessary to ensure that all commissioned equipment and systems are correctly installed and fully functional.

### **3.8 EQUIPMENT SUPPLIER COMMISSIONING RESPONSIBILITIES**

- 3.8.1 Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
  - 3.8.2 Assist in equipment testing per agreements with Subs, which may include factory tests and the development of associated reports.
  - 3.8.3 Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the
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base bid price to the Contractor, except for stand-alone data-logging equipment that may be used by the CxP.

- 3.8.4 Through the Contractors they supply products, analyze specified products, and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
- 3.8.5 Provide information requested by CxP regarding equipment sequence of operation and testing procedures.
- 3.8.6 Review test procedures for equipment installed by factory representatives.

### **3.9 REPORTING**

- 3.9.1 The CxP will provide regular reports to the PM and/or the owner, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the Commissioning Plan.
- 3.9.2 The CxP will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- 3.9.3 Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- 3.9.4 A final summary report developed by the CxP will be provided to the PM and/or the owner, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. Pre-functional test sheets and functional tests will not be part of the final report but will be stored in the Commissioning Binders.
- 3.9.5 The CxP will review submittals related to the commissioned equipment for conformance owner's project requirements as they relate to the commissioning process.
- 3.9.6 The CxP may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- 3.9.7 These submittals to the CxP do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxP will review them.

### **3.10 START-UP, PRE-FUNCTIONAL TEST SHEETS, AND INITIAL CHECKOUT**

- 3.10.1 The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery (e.g. electrical system power quality) may have very simplified PCs and startup.
  - 3.10.1.1 General. Pre-functional tests are a critical commissioning piece in order to ensure functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
  - 3.10.1.2 Start-up and Initial Checkout Plan. The primary role of the CxP in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for pre-functional test sheets and startup are identified in the commissioning scoping meeting and in the checklist forms. The parties responsible for executing functioning performance testing are detailed in specific commissioning specification sections (refer to Part 3 Article "START-UP, PRE-FUNCTIONAL TEST SHEETS, AND INITIAL CHECKOUT" for details).

- 3.10.1.3 Pre-functional test scripts are generally provided by the CxP to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
- 3.10.1.4 The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CxP's test sheets with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include test sheets and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
- (1) The CxP's pre-functional test sheets.
  - (2) The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
  - (3) The manufacturer's normally used field checkout sheets.
  - (4) The subcontractor submits the full startup plan to the CxP for review.
  - (5) The CxP reviews the procedures and the format for documenting them, noting any procedures that need to be added.
  - (6) The full start-up procedures and the approval form may be provided to the PM for review depending on management protocol.
- 3.10.1.5 Sensor and Actuator Calibration:
- (1) All field-installed temperature, relative humidity, CO/CO<sub>2</sub>, and pressure sensors/gauges, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if accepted by the Owner in advance. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
  - (2) All procedures used shall be fully documented on the pre-functional test sheets or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate, and final results.
- 3.10.1.6 Sensor Calibration Methods:
- (1) All Sensors Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure.
  - (2) Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gauge, or Building Automation System (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
  - (3) Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's
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resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

3.10.1.7 Execution of Pre-functional Test Sheets and Startup:

- (1) Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the PM, GC, and CxP. The performance of the pre-functional test sheets, startup and checkout are directed and executed by the Sub or vendor. When checking off pre-functional test sheets, signatures may be required of other Subs for verification of completion of their work.
- (2) The CxP shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as accepted by the PM).
- (3) For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CxP shall observe a sampling of the pre-functional and start-up procedures.
- (4) The Subs and vendors shall execute startup and provide the CxP with a signed and dated copy of the completed start-up and pre-functional tests and test sheets.
- (5) Only individuals that have direct knowledge and witnessed that a line-item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.10.2 Deficiencies, Non-Conformance and Approval in Test Sheets and Startup:

3.10.2.1 The Subs shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxP within two days of test completion.

3.10.2.2 The CxP reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CxP shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxP will involve the PM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the test sheets and tests in a timely manner and shall notify the CxP as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxP recommends approval of the execution of the test sheets and startup of each system to the PM using a standard form.

3.10.3 Contractor Functional Performance Testing (CFPT) (Post-Startup Testing) consists of normally specified contractor testing activities occurring after startup including test, adjust and balance (TAB) of ventilation and hydronic systems, control system point-to-point

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testing, testing of BAS sequences of operation and Electrical systems. At the discretion of the CxP, oversight may be provided during the execution and documentation of these tests. The BAS contractor shall complete the Test Sheets provided by the CxP.

- 3.10.3.1 CxP activities and requirements related to Contractor Post-startup Testing / procedures are in addition to the testing / procedure's requirements specified in other Divisions of these specifications. These do not reduce the Contractor's responsibility for successfully completing and documenting all testing / procedures requirements outlined elsewhere in these specifications.
- 3.10.3.2 All test forms shall be fully completed and maintained by the Contractor per the requirements of this specification.
- 3.10.3.3 Control Sequence Checkout. Contractor shall ensure that the control system programming matches the specified sequences of operation. For these checkouts, the Contractor shall simulate actual operating conditions for the various operating modes being tested (heating, cooling, etc.) by false-loading systems, adjusting setpoints and similar techniques.
- 3.10.3.4 Tune all Control Loops to obtain the fastest stable response without unreasonable hunting, offset or overshoot. Record tuning parameters and response test results for each control loop and provide trend reports to document results. Trend logs shall show both steady-state operation and response to setpoint changes.
- 3.10.3.5 Test All Alarms and Safeties. Record all alarm parameters and alarm messages. Document all alarms and safeties have been tested and are functioning properly.
- 3.10.3.6 The Contractor responsible for the BAS shall work with the TAB Contractor(s) to make sure that changes to the BAS made during TAB, such as flow coefficients, flow setpoints and duct areas, pressure differentials are permanently archived in the BAS and become the initial or default values for their respective controllers.
- 3.10.3.7 Contractor documentation which are deemed incomplete or illegible by the CxP or consultant shall be repeated by the Contractor at no additional costs to the Owner.
- 3.10.3.8 The Contractor shall provide all tools, test equipment and instrumentation required for completion of the Post-startup Testing / Procedures.
- 3.10.3.9 At the discretion of the CxP, if CxAlloy not being utilized, contractors shall be responsible for maintaining a tracking system to monitor the progress of their installation, start-up and functional performance testing activities. This tracking system shall be submitted to the CxP and shall include spreadsheet-based tracking forms and/or sets of drawings which shall be marked-up by the contractor to indicate status of specified activities.

### **3.11 SITE TESTS AND INSPECTIONS**

- 3.11.1 This sub-section applies to all commissioning functional testing for all divisions.
  - 3.11.2 Systems to be Commissioned: The list of equipment to be commissioned is detailed in specific commissioning specification sections (refer to Part 1 Article "SYSTEMS TO BE COMMISSIONED").
  - 3.11.3 Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation, and functioning of the systems.
  - 3.11.4 In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified
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system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

- 3.11.5 Development of Test Procedures: Before test procedures are written, the CxP shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in specific commissioning specification sections, the CxP shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CxP in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxP shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment, and warranty protection. The CxP may submit the tests to the A/E for review, if requested.
  - 3.11.6 The CxP shall review owner-contracted, factory testing or required owner acceptance tests which the CxP is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
  - 3.11.7 The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
  - 3.11.8 The test procedure forms developed by the CxP shall include (but not be limited to) the following information:
    - 3.11.8.1 System and equipment or component name(s).
    - 3.11.8.2 Equipment location and ID number.
    - 3.11.8.3 Date.
    - 3.11.8.4 Project name.
    - 3.11.8.5 Participating parties.
    - 3.11.8.6 A copy of the specification section describing the test requirements.
    - 3.11.8.7 A copy of the specific sequence of operations or other specified parameters being verified.
    - 3.11.8.8 Required pre-test field measurements (filled-up pre-functional tests).
    - 3.11.8.9 Instructions for setting up the test.
    - 3.11.8.10 Specific step-by-step procedures to execute the test, in a clear, sequential, and repeatable format.
    - 3.11.8.11 Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
    - 3.11.8.12 A section for comments.
    - 3.11.8.13 Signatures and date block for the CxP and all participating parties.
  - 3.11.9 Test Methods:
    - 3.11.9.1 Test Execution: Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data-loggers. The CxP may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the PM. This may require a change order and adjustment in charge to the Owner. The CxP will determine which method is most appropriate for tests that do not have a method specified.
    - 3.11.9.2 Simulated Conditions - Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
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- 3.11.9.3 Overwritten Values - Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers, and devices shall have been calibrated.
- 3.11.9.4 Simulated Signals - Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
- 3.11.9.5 Altering Setpoints - Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 2°F above the current outside air temperature.
- 3.11.9.6 Indirect Indicators - Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during pre-functional testing.
- 3.11.9.7 Setup - Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
- 3.11.9.8 Sampling - Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
- 3.11.9.9 A common sampling strategy referenced in the Specifications as the “xx% Sampling—yy% Failure Rule” is defined by the following example.
- (1) xx = the percent of the group of identical equipment to be included in each sample.
  - (2) yy = the percent of the sample that if failing, will require another sample to be tested.
- The example below describes a 20% Sampling—10% Failure Rule.
- 3.11.9.10 Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
- 3.11.9.11 If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
- 3.11.9.12 If 10% of the units in the second sample fail, test all remaining units in the whole group.
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- 3.11.9.13 If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxP will stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- 3.11.10 Coordination and Scheduling:
- 3.11.10.1 The Subs shall provide sufficient notice to the CxP regarding their completion schedule for the pre-functional test sheets and startup of all equipment and systems. The CxP will schedule functional tests through the PM, GC and affected Subs. The CxP shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
- 3.11.10.2 In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CxP before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
- 3.11.11 Test Equipment: Refer to Part 2 Article "TEST EQUIPMENT" for test equipment requirements.
- 3.11.12 Problem Solving: The CxP will recommend solutions to problems found; however, it is the responsibility of the A/E, subs, and the GC to solve, correct and retest problems.

### **3.12 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS**

- 3.12.1 Documentation: The CxP shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the PM and Subs for review. The CxP will include the filled-out forms in the Commissioning Binders.
- 3.12.2 Non-Conformance:
- 3.12.2.1 All deficiencies or non-conformance issues shall be noted and reported to the PM on a standard non-compliance form.
- 3.12.2.2 Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxP. In such cases the deficiency and resolution will be documented on the procedure form.
- 3.12.2.3 Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxP will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.
- 3.12.2.4 As tests progress and a deficiency is identified, the CxP discusses the issue with the executing contractor.
- (1) When there is no dispute on the deficiency and the Sub accepts responsibility to correct, the following course of action occurs:
- (2) The CxP documents the deficiency in deficiency tracking log and issues to the Project Team. The Sub corrects the issue and signs off on the deficiency tracking log indicating the issue has been resolved.
- (3) The CxP reschedules the test, and the test is repeated. If the test is successful, the CxP closes the item.
- 3.12.2.5 If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
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- (1) The deficiency shall be documented on the deficiency tracking log with the Sub's response and a copy given to the PM and to the Sub representative assumed to be responsible.
- (2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
- (3) The CxP documents the resolution process.
- (4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs off on the deficiency tracking log and provides it to the CxP. The CxP reschedules the test, and the test is repeated until satisfactory performance is achieved, at which time the CxP closes the item.

3.12.2.6 Cost of Retesting:

- (1) The cost for the Sub to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
- (2) For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxP will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CxP's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
- (3) The time for the CxP to direct any retesting required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the GC, who may choose to recover costs from the party responsible for executing the faulty pre-functional test.
- (4) Refer to the sampling section of Part 3 Article "SITE TESTS AND INSPECTIONS" for requirements for testing and retesting identical equipment.

3.12.2.7 The Contractor shall respond in writing to the CxP and PM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

3.12.2.8 The CxP retains the original deficiency tracking log until the end of the project.

3.12.2.9 Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

3.12.3 Approval:

3.12.3.1 The CxP notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxP and by the PM, if necessary. The CxP recommends acceptance of each test to the PM using a standard form. The PM gives final approval on each test using the same form, providing a signed copy to the CxP and the Contractor.

### 3.13 TRAINING

3.13.1 The General Contractor shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed.

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- 3.13.2 Operator demonstration/training will be reviewed by the Owner/CxP/Consultant to help verify that the Owner is adequately prepared to operate and maintain the facility at turnover.
  - 3.13.3 Scheduling of the demonstration is to be confirmed in writing no later than 30 days prior to Substantial Completion.
  - 3.13.4 Submit the specified training agenda to the Owner, Consultant and CxP for review 30 days prior to the scheduled demonstration/instruction date.
  - 3.13.5 The CxP shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CxP shall decide how rigorous the training should be for each piece of commissioned equipment. The CxP shall communicate the results to the Subs and vendors who have training responsibilities.
  - 3.13.6 Each Sub and vendor responsible for training will submit a written training plan to the CxP for review and approval prior to training. The plan will cover the following elements:
    - 3.13.6.1 Equipment (included in training).
    - 3.13.6.2 Intended audience.
    - 3.13.6.3 Location of training.
    - 3.13.6.4 Objectives.
    - 3.13.6.5 Subjects covered (description, duration of discussion, special methods, etc.).
    - 3.13.6.6 Duration of training on each subject.
    - 3.13.6.7 Instructor for each subject.
    - 3.13.6.8 Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.).
    - 3.13.6.9 Instructor and qualifications.
  - 3.13.7 For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
  - 3.13.8 The Contractor develops an overall training schedule with the PM and CxP. The CxP develops criteria for determining that the training was satisfactorily completed, including attending some of the training sessions. The CxP recommends approval of the training to the PM using a standard form. The PM also signs the approval form.
  - 3.13.9 The Mechanical and Electrical Design Engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, heating systems, air distribution system, control system strategies, electrical distribution, fire systems, etc.
  - 3.13.10 Training shall include the following:
    - 3.13.10.1 Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    - 3.13.10.2 A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The demonstration/instruction shall include start-up, operation in all modes possible, shut-down, seasonal changeover, as applicable, and any emergency procedures.
    - 3.13.10.3 The Contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
    - 3.13.10.4 Discussion of relevant health and safety issues and concerns.
    - 3.13.10.5 Discussion of warranties and guarantees.
    - 3.13.10.6 Common troubleshooting and maintenance issues, problems, and solutions.
    - 3.13.10.7 Explanatory information included in the O&M manuals and the location of all related plans and manuals in the facility.
    - 3.13.10.8 Discussion of any peculiarities of equipment installation or operation.
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- 3.13.10.9 Hands-on demonstration/instruction shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.
- 3.13.11 Demonstration/instruction shall occur after functional testing, piping and equipment labeling are complete.
- 3.13.12 Submit to CxP complete record of instructions as part of maintenance instructions and data book given. For each instructional period, include:
  - 3.13.12.1 Date.
  - 3.13.12.2 System and equipment involved.
  - 3.13.12.3 Names of persons giving instructions.
  - 3.13.12.4 Names of persons being instructed.
  - 3.13.12.5 Other persons present.
- 3.13.13 At the end of demonstration/instruction submit to the CxP, signed statement of Facility operator's attendance records.

### **3.14 DEFERRED TESTING**

- 3.14.1 Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of test sheets and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- 3.14.2 Seasonal Testing During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxP shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CxP witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SECTION INCLUDES**

- 1.1.1 Procedures for preparation of integrated systems testing and coordination of all sub-trades in the execution of this testing to ensure life safety systems meet code requirements.

### **1.2 RELATED REQUIREMENTS**

- 1.2.1 Division 08 – Openings.
- 1.2.2 Division 21 – Fire Suppression.
- 1.2.3 Division 23 – Heating, Ventilating, and Air Conditioning.
- 1.2.4 Division 26 – Electrical.
- 1.2.5 Section 28 46 13 – Fire-Alarm Systems.
- 1.2.6 This section describes requirements applicable to all Sections within Division 02 to Division 49.

### **1.3 REFERENCES**

- 1.3.1 CAN/ULC-S1001-11, Integrated Systems Testing of Fire Protection and Life Safety Systems.
- 1.3.2 2012 Ontario Building Code.

### **1.4 SUBMITTALS**

- 1.4.1 The Integrated Testing Report shall include all documentation described in Subsection 7.3 of CAN/ULC-S1001. This includes:
  - 1.4.1.1 The Integrated Testing Plan.
  - 1.4.1.2 Integrated Testing Forms.
  - 1.4.1.3 Integrated Testing Forms for Re-tests.
  - 1.4.1.4 Documentation required by Section 5.3 of CAN/ULC-S1001.

### **1.5 CLOSEOUT SUBMITTALS**

- 1.5.1 The Integrated Testing Report shall be provided to the following:
  - 1.5.1.1 The Consultant.
  - 1.5.1.2 The Owner.
  - 1.5.1.3 Municipal fire inspector as requested.
- 1.5.2 Maintain a copy of the CAN/ULC-S1001 functional test report on site.

### **1.6 QUALIFICATIONS**

- 1.6.1 Integrated Testing Coordinator:
    - 1.6.1.1 Must have all licenses and certifications required by contractual obligations, as well as those required by federal, provincial, and other regulations.
    - 1.6.1.2 Must have the competencies listed in CAN/ULC-S1001.
    - 1.6.1.3 Must prepare an Integrated Testing Plan.
    - 1.6.1.4 Must provide the Integrated Testing Plan to the professional designers for review/acceptance prior to the test.
    - 1.6.1.5 Collect the required pre-test documentation (e.g. confirmation from designers/installers/verifiers that systems are ready for testing, confirmation that building occupants have been notified and that safety measures are in place, etc.).
-



- 1.6.1.6 Determine what previous testing of the systems can be accepted to avoid duplication of testing.
- 1.6.1.7 Determine which parties are required to participate in the Integrated Systems Test.
- 1.6.1.8 Implement the Integrated Testing Plan (perform the tests) and record the results to show proper integration (ensure re-testing is performed as needed).
- 1.6.1.9 Compile all the documentation into an Integrated Testing Report and provide it to the building owner, Authority Having Jurisdiction (as required), and keep a copy on the building site.

## **2 PRODUCTS – NOT USED**

## **3 EXECUTION**

### **3.1 RESPONSIBILITY**

- 3.1.1 The General Contractor is responsible for coordinating integrated systems testing to meet the requirements of CAN/ULC-S1001. Time is to be allocated in the construction schedule for these tests, and the General Contractor is to ensure that the key sub-trades are a part of this testing.
- 3.1.2 Pre-requisites for integrated systems testing are individual verification reports such as fire alarm verification report, sprinkler sign off, elevator sign off, fire/smoke/life safety fan balancing reports, and others.
- 3.1.3 The intent is not to replicate the tests of each device, but to test the operation of the life safety system as a whole. Examples include but are not limited to the following:
  - 3.1.3.1 Fan shutdown on duct smoke detector.
  - 3.1.3.2 Activation of fans (stair pressurization, vestibule pressurization, smoke evacuation) on fire alarm.
  - 3.1.3.3 Successful integration of sprinkler devices, pre-action systems, etc.
  - 3.1.3.4 Proper operation of door hold-open devices, mag locks, fire shutters, etc.
  - 3.1.3.5 Elevators recall to home and alternate home floors.
  - 3.1.3.6 Operation of life safety systems upon loss of power or on generator power.
- 3.1.4 Based on the level of 3<sup>rd</sup> party commissioning hired by the Owner required for the project, the Commissioning Authority may require to witness these tests.

### **3.2 EXAMPLES FROM CAN/ULC-S1001 OF SYSTEMS THAT REQUIRE INTEGRATED TESTING**

- 3.2.1 Door Hardware:
    - 3.2.1.1 Electromagnetic hold-opens:
      - (1) Each door tested to ensure returns to closed and latched position upon signal from fire alarm or from actuation of local smoke detectors.
    - 3.2.1.2 Electromagnetic locks:
      - (1) Each must de-energize upon activation of the fire alarm system or from actuation of the local manual pull station.
    - 3.2.1.3 Fire shutter doors close upon activation of the fire alarm system.
    - 3.2.1.4 Power door operators on doors located on fire separations deactivate when fire alarm system is activated.
  - 3.2.2 Foodservice Equipment (Kitchen Fire Suppression):
    - 3.2.2.1 Cooking equipment fire suppression systems (release of agent not required).
  - 3.2.3 Elevators:
-

- 3.2.3.1 Automatic elevator recall: detection of smoke on the main level of a structure will result in the elevator recalling to the second (or alternate) level to ensure potential evacuees are not delivered into an active fire.
  - 3.2.4 Fire Suppression:
    - 3.2.4.1 Freeze Protection Systems: annunciates on fire alarm annunciator panel upon loss of power to heat tracing for sprinkler piping.
    - 3.2.4.2 Sprinkler systems:
      - (1) Flow switches and other water flow indicating devices annunciate as alarm on fire alarm control panel when water flow is detected.
      - (2) Supervised valves annunciate as supervisory on fire alarm control panel when valves are closed.
    - 3.2.4.3 Standpipe systems: Supervised valves annunciate as supervisory on fire alarm control panel when valves are closed.
    - 3.2.4.4 Fire pumps: Operate as required.
    - 3.2.4.5 Water supplies (test responses to pressure sensors, level sensors, etc.):
      - (1) Loss of pressure in sprinkler piping will trigger the fire alarm. This pressure loss indicates that either an active fire has started, or the integrity of the sprinkler piping has been compromised.
    - 3.2.4.6 Water supply control valves.
    - 3.2.4.7 Fixed fire suppression systems (release of suppression agent not required).
  - 3.2.5 HVAC:
    - 3.2.5.1 Smoke control systems.
    - 3.2.5.2 Emergency pressurization systems.
    - 3.2.5.3 Smoke exhaust systems.
    - 3.2.5.4 HVLS fans shut down on sprinkler flow.
    - 3.2.5.5 Parking garage ventilation system and controls.
    - 3.2.5.6 Confirm and document that the air handling unit disengages when fire or smoke is detected. Preventing the conveyance of smoke, ash, particulates, or the fire itself through the air system substantially strengthens a building resilience in an emergency, and protects personnel.
    - 3.2.5.7 Confirm and document that areas requiring pressurization (such as stairwells and other emergency routes) are functioning as designed during emergency conditions.
  - 3.2.6 Electrical:
    - 3.2.6.1 Emergency generators (e.g. startup test, loss of power simulations)
      - (1) Confirm and document that emergency generators engage, and alarm is announced during a fire or low-fuel conditions. It is critical to the functioning of all life safety systems that the backup power generation be capable of indicating when its operability has been compromised.
      - (2) Confirm and document that when primary power is interrupted the emergency generators engage and powers critical life saving systems such as alarms, sprinkler pumps, elevators, and air handling units. Ensuring backup power generation is timely, of sufficient strength and properly functioning can be the difference between an incident and a disaster.
    - 3.2.6.2 Automatic Transfer Switches: Operate as required.
    - 3.2.6.3 A/V and lighting control systems: Systems deactivate upon fire alarm signal.
  - 3.2.7 Public Address and Paging Systems: de-activate system upon actuation of the fire alarm system.
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- 3.2.8 Sound Masking System: de-active system upon actuation of the fire alarm system.
- 3.2.9 Fire Alarm System:
  - 3.2.9.1 Transmissions with fire signal receiving centre (e.g. receipt of signals).
    - (1) Confirm and document that the fire alarm monitoring centre is receiving these various alarms in a timely fashion. With legacy buildings, a risk exists that physical lines may have been cut and/or subscriptions have elapsed.
  - 3.2.9.2 Confirm and document that manual pull fire stations are functioning as designed. Quick action from the first person to notice a fire will minimize the impact to people and structures.
- 3.2.10 Smoke and carbon monoxide alarms.
- 3.2.11 Hazardous protection monitoring.

### **3.3 SITE TESTS AND INSPECTIONS**

- 3.3.1 In accordance with CAN/ULC-S1001.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL**

- 1.1.1. This section contains the Work for soil handling and management activities including:
  - 1.1.1.1. Sourcing and placing fill, including topsoil, and backfill material
  - 1.1.1.2. Where fill requirements are not met by soil from the Project Area, sourcing, placing, grading, and compacting imported fill
  - 1.1.1.3. Where soil is generated that cannot be reused at the Project Area, managing the removal of excess soil
- 1.1.2. The Contractor shall furnish all labour, materials, tools and equipment, and perform all operations necessary to furnish, deploy, install, and test soil and aggregate materials in the areas indicated on the Contract Documents and as specified herein.
- 1.1.3. The Contractor is responsible for managing all soil handling activities, including but not limited to: testing, tracking and documenting stockpiling; movement and transportation of soil within the Project Area; and importing and exporting excess soil to and from the Project Area. All soil handling activities shall be conducted in accordance with Ontario Regulation 406/19 and the City's guidance documents including SOPs.
- 1.1.4. In the event of any conflicts between this Section and the General Conditions, more stringent requirements shall govern.

### **1.2. REFERENCES**

- 1.2.1. Comply with the latest edition of the following applicable statutes, codes, and standards, and all amendments thereto, including but not limited to the following:
- 1.2.2. Canadian Standards Association (CSA):
  - 1.2.2.1. CSA A23.2-2A – Test Methods on Sieve Analysis of Fine and Coarse Aggregate.
  - 1.2.2.2. CSA A23.5-5A – Test Methods for the Amount of Material Finer than 80 micrometres (µm) in Aggregate.
- 1.2.3. Canadian General Standards
  - 1.2.3.1. CAN/CGSB-148.1 No. 10-94 – Filtration Opening Size
- 1.2.4. Ontario Provincial Standard Specification (OPSS):
  - 1.2.4.1. OPSS Municipal (MUNI) 180 - Management of Excess Material
  - 1.2.4.2. OPSS Municipal (MUNI) 206 – Construction Specification for Grading.
  - 1.2.4.3. OPSS Municipal (PROV) 209 - Construction Specification for Embankment Over Swamp and Compressible Soils
  - 1.2.4.4. OPSS MUNI 212 – Construction Specification for Borrow.
  - 1.2.4.5. OPSS MUNI 501 – Construction Specification for Compacting.
  - 1.2.4.6. OPSS MUNI & PROV 539 - Construction Specification for Temporary Protection System
  - 1.2.4.7. OPSS MUNI 805 – Construction Specification for Temporary Erosion and Sediment Control Measures.
  - 1.2.4.8. OPSS PROV 902 - Construction Specification for Excavating and Backfilling Structure
  - 1.2.4.9. OPSS MUNI 1001- Material Specification for Aggregates- General
  - 1.2.4.10. OPSS MUNI 1004 – Material Specification for Aggregates – Miscellaneous.
  - 1.2.4.11. OPSS MUNI 1010 – Material Specification for Aggregates – Granular A, B, M, and Select Subgrade Material.
  - 1.2.4.12. Regulations for Construction Projects, Ontario Regulation 213/91, made under the Occupational and Health Safety Act, Revised Statutes of Ontario 1990 Chapter 0.1.
- 1.2.5. ASTM International (ASTM):
  - 1.2.5.1. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - 1.2.5.2. D75, Standard Practice for Sampling Aggregates.
  - 1.2.5.3. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

- 1.2.5.4. D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
- 1.2.5.5. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 1.2.5.6. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
- 1.2.5.7. D3017, Standard Test Methods for Water Content of Soil and Rock in place by Nuclear Methods (Shallow Depth).
- 1.2.5.8. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- 1.2.5.9. D6913 / D6913M-17, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
- 1.2.5.10. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- 1.2.6. Ontario Ministry of the Environment, Conservation and Parks (MECP)
  - 1.2.6.1. Records of Site Condition – Part XV.1 of the Act. Environmental Protection Act. Ontario Regulation (O. Reg.) 153/04, as amended, 2011
  - 1.2.6.2. On-Site and Excess Soil Management made under Environmental Protection Act. O.Reg. 406/19, as amended (herein referred to as Excess Soil Regulation).
  - 1.2.6.3. Rules for Soil Management and Excess Soil Quality Standards adopted by reference in O. Reg. 406/19 made under the Environmental Protection Act, R.S.O. 1990, c. E.19 (EPA), as applicable, (herein referred to as Excess Soil Rules)
  - 1.2.6.4. General - Waste Management, RRO 1990, O. Reg 347
  - 1.2.6.5. Aggregate Resources Act, RSO. 19990, c A.8
  - 1.2.6.6. Fertilizer Act - Fertilizers Act, R.S.C., 1985, c. F-10 and Trade Memorandum T-4-93
  - 1.2.6.7. Nutrient Management Act, 2002 (NMA). The NMA protects Ontario's natural environment through the regulation and management of livestock manure and other nutrients that are stored on farm properties or applied to agricultural land; further details are found in the General Nutrient Management Regulation O. Reg. 267/03.
  - 1.2.6.8. Municipal Act, 2001, SO 2001, c 25
  - 1.2.6.9. Ontario Compost Quality Standards, Ministry of Environment, Conservation and Parks, July 25, 2012
- 1.2.7. City of Mississauga
  - 1.2.7.1. ESMC SOP 01 – Environmental Site Management and Compliance, Due-Diligence Soil Characterization, dated March 21, 2024
  - 1.2.7.2. ESMC SOP 02 – Environmental Site Management and Compliance, Excavation Procedure of Impacted Soils, dated April 5, 2024

### **1.3. RELATED SECTIONS**

- 1.3.1. All Division 1 Specifications
- 1.3.2. Section 31 23 13 – Site Grading

### **1.4. DEFINITIONS**

- 1.4.1. Agricultural Source Material – means treated or untreated materials that meet the requirements for Category AA, A or B compost in Part II of the Compost Standards such as manure as outlined in the General Nutrient Management Regulation O. Reg. 267/03.
- 1.4.2. ARA Topsoil – means topsoil produced in accordance with a permit issued under the Aggregate Resources Act (ARA) that is the property of the Crown or that is on land the surface rights of which are the property of the Crown or on designated land under the Aggregate Resources Act.
- 1.4.3. Assessment of Past Uses Report – means the O. Reg 406/19 report similar to a Phase One Environmental Site Assessment that fulfills the requirements of the Excess Soil Regulation.
- 1.4.4. Blended Soil – means soil blended with other materials to satisfy horticultural requirements; the blended soil is considered to meet the generic or site specific

- Standards of the Excess Soil Regulation if the blended soil meets in the mixed state or the constituents meet the requisite quality requirements prior to mixing. Blending could involve mixing soil with agricultural source material, compost, peat, ARA topsoil, aggregate or non-soil products.
- 1.4.5. Compost – means compost produced from a composting facility operating under an Environmental Compliance Approval for composting that meets the requirements for Category AA compost in PART II of the “Ontario Compost Quality Standards”, published by the MECP (and as may be amended in the future), and will not used as the principal constituent of blended soil (i.e. not more than 50% by volume).
- 1.4.6. Consultant – The Consultant is the professional service team hired by the Owner/Project Leader to provide consulting services with respect to the Project.
- 1.4.7. Contractor - Contractor(s) selected for all soil placement activities described in this Section.
- 1.4.8. Excavation Grade - The bottom of the excavation, including removal of deleterious material below the subgrade.
- 1.4.9. Excess Soil – means soil, crushed rock, or soil mixed with rock or crushed rock, that has been excavated as part of a project and removed from the Project Area for the project.
- 1.4.10. Excess Soil Registry or Registry – means the on-line Registry established by the MECP to register soil import or export by Owner, Operator or Project Leader. Exemptions and volume rules apply.
- 1.4.11. Excess Soil Site Condition Standard – means the Table 2.1 Full depth excess soil quality standards in a potable ground water condition for residential, parkland, institutional property use in the Excess Soil Rules, Part II: Excess Soil Quality Standards”, published by the Ministry of the Environment, Conservation and Parks (MECP) and dated December 29, 2022.
- 1.4.12. Imported Aggregate Fill - means consolidated or unconsolidated aggregate or recycled aggregate from a licensed Ministry of Natural Resource pit or quarry with a valid license number under the Aggregate Resources Act.
- 1.4.13. Imported Soil – means Soil or Blended Soil imported to the Project Area that meets the Excess Soil Site Condition Standards, that has origin and tracking documentation and has pH levels within the acceptable pH range, from 5.0 to 9.0 for surface soil and from 5.0 to 11.0 for subsurface soil unless otherwise indicated in the Contractor Documents or confirmed by a QP not to cause an adverse effect. Presence of electrical conductivity and sodium adsorption ratio (salt related compounds) are also permitted if certain conditions apply.
- 1.4.14. Non-Soil Products – means manufactured products that are used to support plant growth and could include bark fines, mulch, vermicompost, commercial fertilizer (such as pelletized gypsum), engineered wood-fibre (including poured in place rubber), or terraseed.
- 1.4.15. Owner, Project Leader: City of Mississauga, ON. Owner will hold the contract with the Contractor. Project Leader - means, in respect of a project, the person or persons who are ultimately responsible for making decisions relating to the planning and implementation of the project (Project Leader or City; herein used interchangeably).
- 1.4.16. Peat – means peat generated from a peat extraction operation.
- 1.4.17. Project Area - means, in respect of a project, a single property or adjoining properties on which the project is carried out and can include properties with different owners providing the Project Area is under the care and control of the Project Leader.
- 1.4.18. Project Area Soil Reuse – means soil that is reused within the Project Area.
- 1.4.19. Qualified Person (QP) - As defined by Section 5 of O. Reg. 153/04
- 1.4.20. Reuse Site Consent – means the written consent from the Owner or operator of the Reuse Site to receive the Excess Soil and agreement to deposit the Excess soil at the Reuse Site. If the Owner or operation of the Reuse Site is also the Project Leader at the source of the Excess Soil then no written consent is required.
- 1.4.21. Reuse Site –means a site at which excess soil is used for a beneficial purpose and does not include a Waste Disposal Site.
- 1.4.22. Reused Soil - means Excess Soil that is deposited at a Reuse Site for a beneficial purpose.

- 1.4.23. Site Specific Excess Soil Planning Documents – refers to the following project specific reports:
  - 1.4.23.1. Soil Characterization Report, City of Mississauga Fire Station 123, 3010 The Collegeway, Mississauga, Ontario, completed by G2S Consulting Inc. dated September 21, 2023
  - 1.4.23.2. Environmental Site Management and Compliance, Environmental Requirements and Submittals, File ESMC.TMPL.04, Project FS123 Construction, dated April 10, 2024
- 1.4.24. Soil - unconsolidated naturally occurring mineral particles and other naturally occurring materials resulting from the natural breakdown of rock or organic matter by physical, chemical or biological processes that are smaller than 2 millimetres in size or that pass the US #10 sieve.
- 1.4.25. Source Site – means a site at which Topsoil or Imported Soil is received from.
- 1.4.26. Topsoil - means the upper most horizons in a soil profile, commonly known as the “O” and the “A” horizons, typically containing higher organic content than lower horizons and includes deposits of partially decomposed organic matter such as peat. (see SubSection 142(1) of the Municipal Act).
- 1.4.27. Waste Disposal Site - means a Class 1 Soil Management Site, as defined in the Excess Soil Regulation, Landfill or Dump.
- 1.4.28. Waste Soil – means Excess Soil that is deposited at a Waste Disposal Site. This may include soil that is determined to be unsuitable for reuse or Excess Soil where an appropriate Reuse Site cannot be located.
- 1.4.29. Work – The construction related activities and work covered in this section.

#### **1.5. SUBMITTALS**

- 1.5.1. Item shall be read in conjunction with the requirements of OPSS 180, as well as the requirements of the Excess Soil Regulation. The work under this item involves support services by a Qualified Person for the Contractor (Contractor QP), with a minimum of five years experience as a QP to undertake soil sampling and management activities and deliverables as required
- 1.5.2. The Contractor is to refer, follow, and implement the Site Specific Excess Soil Planning Documents for guidance on the soil quality of the project area, identification of appropriate reuse sites based on the soil quality, additional testing requirements where appropriate and soil management requirements. These documents are appended to the Tender Documents.
- 1.5.3. Contractor to provide a Soil and Aggregate Management Plan to be submitted to the Consultant and City for review and approval a minimum of thirty (30) days before the movement of soil or Aggregate. The documentation shall demonstrate compliance and understanding of the requirements of the Excess Soil Regulation and the requirements in this Section, and in related Sections and Drawings. Soil exportation or importation cannot proceed without written approval from the Consultant.
- 1.5.4. The Contractor shall include a detailed narrative description; proposed sequencing, details, means and methods of transportation; data, specification sheets, and all other supporting data for proposed effort including, but not limited to, the following:
  - 1.5.4.1. Means and Methods for soil tracking, excavation, segregation and inspections including:
    - .1 Procedures to account for every load of excess soil to be deposited at the Reuse or Waste Disposal Site for final placement (including visual and olfactory evidence inspection of each load).
    - .2 Procedures to ensure that the storage of excess soil for final placement in respect of an undertaking at the Reuse Site does not cause an adverse effect.
    - .3 Locations, design and layout for temporary Project Area storage locations for imported material, to be coordinated with the Owner and including discussion on water management and dust and erosion control.
    - .4 Transportation routes for off-site haulage and list of carriers.
  - 1.5.4.2. Proposed sources of fill material and the Ministry of Natural Resources and Forestry Pit and Quarry License Number for sourced aggregates.

- 1.5.4.3. Proposed location(s) of Waste Disposal Site (include Environmental Compliance Approval and confirm material acceptability) or Reuse Site (include Beneficial Reuse Site Consent) for Excess Soil.
- 1.5.4.4. Anticipated difficulties and proposed resolutions including:
  - .1 Procedures to address off-spec material or rejected loads and described contingency measures to segregate and manage the off-spec material or rejected loads including any necessary updates to documentation and Registry notices.
- 1.5.4.5. Environmental documentation, where required, including:
  - .1 For Imported Soil: Assessment of Past Uses, Sampling and Analysis Plan, Excess Soil Characterization Report and Excess Soil Destination Assessment Report, where required. For Source Site that is exempted from Section 8 of O.Reg. 406/19, the City's Due-Diligence Soil Characterization requirements must be met (see ESMC SOP 01).
  - .2 For Reused Soil: Any reporting or soil quality testing as required by the Reuse Site's specific acceptance criteria, unless this data is available in the Specifications. Refer to the Site Specific Excess Soil Planning Documents.
  - .3 For Waste Soil: Any soil quality testing as required by Waste Disposal Site unless this data is available in the Specifications. Refer to the Site Specific Excess Soil Planning Documents.
  - .4 For Imported Soil and Reused Soil scenarios: Identification of Qualified Person lead (and resume demonstrating five years of soil experience) and accredited analytical laboratory who may be engaged if additional data and documentation is necessary.
- 1.5.4.6. Quality Control (QC) Plan
- 1.5.4.7. Forms referenced in the document should be included in an appendix to the plan.
- 1.5.5. Product data, manufacturers data, or certificates for demonstrating the origin and quality of the material:
  - 1.5.5.1. Imported fill materials such as aggregate
  - 1.5.5.2. Compost
  - 1.5.5.3. ARA Topsoil
  - 1.5.5.4. Topsoil
  - 1.5.5.5. Peat
- 1.5.6. Final Project Area Soil Records
  - 1.5.6.1. A post-construction summary of material disposition will be prepared right after construction.
    - .1 Summarize any deviations from the Soil and Aggregate Plan.
    - .2 Provide summary of any additional soil testing results and rationale for testing.
    - .3 Summary of the cumulative quantities, quality, rejected loads, off-spec material, exceptions, contingency implementation, and any relevant Project Area fill placement information.
    - .4 Attach daily logs as evidence of the visual inspections.
    - .5 Submit the Final Project Area Soil Records prior to Substantial Performance.
- 1.5.7. Daily Logs
  - 1.5.7.1. To be prepared by the Contractor and provided to the Consultant with 48 hours of the completed workday.
  - 1.5.7.2. Brief description of materials placed, including location, lifts, and material type.
  - 1.5.7.3. Documentation on visual contaminant assessment during excavation and importation of material.
  - 1.5.7.4. Details of any off-spec material, segregation and stockpiling and management processes (off-site disposal or otherwise).
  - 1.5.7.5. Details of any delays that may impact the project schedule, areas that need improvement, and proposed solutions.



#### **1.6. OWNER RESPONSIBILITIES**

- 1.6.1. As Project Leader, the Owner is the person or persons ultimately responsible for making decisions relating to the planning and implementation of the project.
- 1.6.2. Provide written consent to receive imported soil in a timely manner once approved by the Consultant.
- 1.6.3. Assist the Consultant for directing the Contractor on action if potential contamination is observed during excavation.
- 1.6.4. Develop operating protocols to manage imported soil that is placed in controlled areas, either due to salt related impacts or proximity to water body.
- 1.6.5. Retain Excess Soil Regulation documentation for seven years including the Soil and Aggregate Management Plan, Daily Logs, Summary Report, Excess Soil Planning Documents (including related Assessment of Past Uses, Sampling and Analysis Plan, Excess Soil Characterization Report, Excess Soil Destination Assessment Report and Source Site Assessment), if required, and any contracts relating to the management of excess soil to and from the Project Area, including the transporting of excess soil to and from the Project Area

#### **1.7. CONTRACTOR RESPONSIBILITIES**

- 1.7.1. The Contractor is responsible for completing the necessary additional soil testing for soil importation and exportation even if the soil is disposed of at a Waste Disposal Site unless sufficient data is already included in Specifications.
- 1.7.2. The Contractor develops procedures in the Soil and Aggregate Management Plan to account for every load of excess soil to be deposited at the Reuse Site for final placement (including inspection of each load) and applies these procedures.
- 1.7.3. The Contractor develops procedures in the Soil and Aggregate Management Plan to ensure that the storage of excess soil for final placement in respect of an undertaking at the Reuse Site does not cause an adverse effect and applies these procedures.
- 1.7.4. The Contractor shall ensure that their Qualified Person, if engaged, extends reliance to the City of Mississauga for any reporting, testing, or sampling under O. Reg 406/19 or O. Reg 153/09.
- 1.7.5. Retain Excess Soil Regulation documentation for seven years including the Soil and Aggregate Management Plan, Daily Logs, Summary Report, Excess Soil Planning Documents (including related Assessment of Past Uses, Sampling and Analysis Plan, Excess Soil Characterization Report, Excess Soil Destination Assessment Report and Source Site Assessment), if required, and any contracts relating to the management of excess soil to and from the Project Area, including the transporting of excess soil to and from the Project Area

#### **1.8. CONSULTANT RESPONSIBILITIES**

- 1.8.1. The Consultant and City shall review the soil quality data prior to importation and if satisfactory, provide documented approval of acceptability to the Contractor.
- 1.8.2. The Consultant must review and document approval of any deviations from this Specification.
- 1.8.3. Review daily, weekly and final soil records and if satisfactory, provide documented approval of acceptability.

#### **1.9. PROTECTION OF EXISTING FEATURES**

- 1.9.1. The protection of the existing features, underground utilities are the responsibility of the Contractor.

#### **1.10. QUALITY ASSURANCE**

- 1.10.1. Notify Consultant and City in the following cases:
  - 1.10.1.1. If fill material appears to be deviating from the specifications
- 1.10.2. Complete quality assurance/quality control (QA/QC) testing of soil prior to reuse for environmental parameters specified in the Soil and Aggregate Management Plan:
  - 1.10.2.1. Environmental quality parameters and sampling frequency applicable for exported reused soil or imported soil sources are specified in O Reg 406/19; due diligence sampling frequencies may be appropriate.
  - 1.10.2.2. QA/QC in accordance with practices outlined in O. Reg 153/04

### **1.11. WEATHER LIMITATIONS**

- 1.11.1. The Contractor is responsible to have proper plans and measures in place to carry out work during all seasons. Project schedule delays that negatively impact the overall Project schedule or other works will not be accepted.
- 1.11.2. Contractor to mitigate schedule risk by anticipating weather delays based on seasonal conditions and account for such delays in the detailed schedule

## **2 PRODUCTS**

### **2.1. GENERAL**

- 2.1.1. Soil and Aggregate Fill shall be free of materials containing hazardous or toxic constituents, hydrocarbons, and/or other contaminants. If the Consultant has a suspicion that contaminants may be present in the soils or aggregate, the Contractor shall be required to provide analytical testing data verifying that the materials do not have contaminants. Any Soil and Imported Aggregate Fill determined through analytical testing to contain contaminants shall be immediately removed from the site by the Contractor at the Contractor's expense and disposed of off-site in accordance with all relevant regulations in Section 1.3 of this Specification.

### **2.2. IMPORTED SOIL OR IMPORTED BLENDED SOIL**

- 2.2.1. Imported Soil or Blended Soil must meet the Excess Soil Site Condition Standards. Geotechnical and horticultural requirements may also apply.
- 2.2.2. At the excavation, each load must be inspected by the Contractor (or the Contractor's designate at the Imported Soil source site) for visual and olfactory evidence of contamination and documented on the truck tracking weigh bills.
- 2.2.3. If the Source Site of the Imported Soil or Blended Soil proves through the completion of Assessment of Past Uses Report to be a benign site (no potentially contaminating activities; agricultural, or park land uses) then the Contractor must complete a due diligence soil testing program in accordance with City's Due-Diligence Soil Characterization requirements (see ESMC SOP 01) for comparison to the Excess Soil Standards. The Assessment of Past Uses Report must include a Qualified Person declaration that the Source Site meets the criteria in the Excess Soil Regulation, is suitable for use at the Project area and no further testing is required. The Consultant may determine through review of this report and data that the sampling is insufficient and additional sampling will be required at the cost of the Contractor.
- 2.2.4. If the Source Site of the Imported Soil or Blended Soil requires a Sampling and Analysis Plan and Excess Soil Characterization Report, then the soil sampling frequency must follow the frequency described in the Excess Soil Rules and analyzed for the parameters listed in the Excess Soil Rules plus any additional contaminants of potential concern identified in the Assessment of Past Uses Report.
- 2.2.5. Soil tests, if deemed necessary by the Consultant or City, shall include the QA/QC procedures in accordance with the requirements of O.Reg. 153/04 and O.Reg. 406/19.
- 2.2.6. The Contractor is responsible for obtaining the documents described in this section which depending on the soil supplier, may necessitate that the Contractor engage a Qualified Person to complete the documentation on their behalf.
- 2.2.7. The City of Mississauga must provide written consent to receive the imported material prior to the shipment.

### **2.3. ON-SITE REUSE OF SOIL**

- 2.3.1. The Contractor shall perform testing or otherwise confirm that soil is suitable for reuse within the Project Area.
  - 2.3.1.1. Substandard materials shall be identified and rejected before reuse. O. Reg 406/19 also requires that all loads be inspected for visual and olfactory evidence of contamination. The results are to be included in daily logs. Substandard materials shall be segregated at the source and will not be used for reuse. Materials found to be substandard shall be removed from the Project Area by the Contractor and the rejected material and its disposition is to be documented in Daily Logs.

- 2.3.1.2. Soil tests, if deemed necessary by the Consultant or City, shall include the QA/QC procedures in accordance with the requirements of O.Reg. 153/04 and O.Reg. 406/19.

## **2.4. REUSED SOIL**

- 2.4.1. The Contractor shall perform testing or otherwise to confirm that excess soil is suitable for a beneficial off-site reuse unless the data is provided in the Specifications. Refer to the Site Specific Excess Soil Planning Documents.
- 2.4.2. The Reuse Site Operator may determine that the sampling data provide is insufficient and additional sampling will be required at the cost of the Contractor.
- 2.4.3. The Contractor must obtain written consent from the Reuse Site that they accept the exported material prior to the shipment.

## **2.5. WASTE SOIL**

- 2.5.1. The Contractor shall perform testing or otherwise to confirm that excess soil is suitable for the Waste Disposal Site, unless sufficient testing data is provided in the Specifications. Refer to the Site Specific Excess Soil Planning Documents”.
- 2.5.2. The Waste Disposal Site Operator may determine that the sampling data provide is insufficient and additional sampling will be required at the cost of the Contractor.

# **3 EXECUTION**

## **3.1. GENERAL**

- 3.1.1. Coordinate loading, hauling, and stockpiling supplied materials with the Consultant and City.
- 3.1.2. Keep prepared ground surfaces free of water, debris, and foreign material during the placement and compaction of fill and backfill materials.
- 3.1.3. Do not place fill if the work requirements cannot be satisfied due to severe weather condition, such as flooding conditions, where fill surfaces are submerged under water; during frozen conditions; or when fill surfaces are covered in snow.

## **3.2. ENVIRONMENTAL REQUIREMENTS FOR FILL**

- 3.2.1. Fill quality must be confirmed by the Consultant and City prior to reuse. Only place fill and backfill following written authorization from the Consultant. Materials found to be substandard shall be removed from the Work Area by the Contractor at their expense and placed in a location acceptable to the Consultant and the rejected material is to be documented in Daily Logs.
- 3.2.2. Contractor shall handle contaminated and substandard material per O. Reg 406/19.

## **3.3. PROTECTION**

- 3.3.1. The Contractor shall provide all protection required to safeguard existing structures.
- 3.3.2. Protect fill areas against erosion by tarps or other suitable means.
- 3.3.3. Protect benchmarks, layout markers, survey markers, instrumentation, and geodetic monuments.
- 3.3.4. Do not damage existing facilities and equipment situated on-site.

## **3.4. EXCAVATION**

- 3.4.1. The following procedure must be implemented for excavations within the Project Area. The results are to be documented in the Daily Records.
  - 3.4.1.1. During soil excavation, observations for any visual or olfactory signs of contamination must be undertaken and documented. These include observations such as oil staining, residue or sheen, construction material (rebar), waste drums, municipal waste, garbage, painted wood, shingles, cinder, ash, or discoloured earth.
  - 3.4.1.2. If a positive observation is made, then excavation operations must immediately cease and the Project Leader notified of the occurrence.
  - 3.4.1.3. Excavation operations may resume under the direction of a Qualified Person who will direct the segregation of the affected soil and identification of the extent of the affected soil. If the segregated soil is to stockpiled first prior to off-site disposal, then the stockpile will be placed on a liner. If the

segregated soil can be disposed of directly to a Waste Disposal Site, then the Section 2.5 applies.

- 3.4.1.4. Excess Soil Planning Documents, where applicable, may need to be updated by a Qualified Person before soil is transported off-site if observations of unexpected contamination are made.

### **3.5. STOCKPILING AND PROCESSING**

- 3.5.1. The Contractor must stockpile or temporarily store soil 30 m away from sensitive receptors including water bodies and flood limits; soil must also be stored more than 10 m away from the property line of the Project Area unless provisions as described in the Soil Rules are in place and approved by the Consultant. For Project Areas that are fully within 30 m of sensitive receptors, soil storage within the Project Area should be avoided; if unavoidable and providing it is approved by the Consultant, the soil storage should be limited to 500 m<sup>3</sup> for less than five business days behind a physical barrier (i.e. concrete jersey barriers) and erosion control measures should be placed between the soil storage and sensitive receptor.
- 3.5.2. The Contractor must stockpile or temporarily store soil in a manner that does not cause an adverse effect.
- 3.5.3. Water runoff from soil storage must be contained and managed.
- 3.5.4. Contaminated or potentially contaminated soil must be stored in such a manner as to prevent contaminants from leaching into the ground. This soil may be temporarily stockpiled on ground if the underlying soil is of similar disposition in terms of contamination (i.e. like-to-like) as approved by the Consultant. In other cases, contaminant leaching prevention can include an impermeable surface, liner or other engineered control as approved by the Consultant.
- 3.5.5. Stockpiles must be no more than 5 metres high, 70 degree slopes and contain no more than 2,500 m<sup>3</sup>. Height and slope restrictions are primarily to avoid bird nesting and can be modified by the Contractor if approved by the Consultant.
- 3.5.6. Soil of different quality or unknown quality must be stored in separate stockpiles.
- 3.5.7. No enhanced soil processing to reduce the contaminant levels in the soil is permitted in the Project Area unless approved by the Consultant and the system has the appropriate MECP operation permit. Soil processing such as passive aeration, passive dewatering, mixing (not diluting), soil turning, size- based sorting, debris removal sorting is permitted as outlined in O. Regulation 406/19.

### **3.6. TRANSPORTATION**

- 3.6.1. The Contractor must engage an experienced Hauler for the transport of soil.
- 3.6.2. The Contractor must ensure that the Hauler completes the mandatory Soil Tracking for each hauled load (during pick-up, transportation and delivery) and provides hauling records to the Contractor in accordance with the Excess Soil Regulation.
- 3.6.3. Loads are to be covered or tarped to prevent the emission of offensive odours, the release of dust or other airborne materials that may cause air pollution.
- 3.6.4. Trucks are to be free of soil, mud and debris so that material is not tracked onto public roadways. Trucks are to be leakproof when necessary.
- 3.6.5. The Contractor must inform the Hauler of the appropriate deposit site for the Excess Soil and provided required information to the Hauler

### **3.7. SOIL TRACKING**

- 3.7.1. Perform soil tracking as required in Excess Soil Regulation, Excess Soil Rules and the approved Soil and Aggregate Plan Submittal.
- 3.7.2. The Contractor shall implement a digital tracking system to track each all soil movement to and from the Project Area including soil transportation to a Reuse Site and Waste Disposal Site and from a Source Site. The tracking system will be reviewed and agreed upon between the Contractor, Owner and the Consultant.
- 3.7.3. Prior to soil being removed from or brought to the Project Area, the City must approve the proposed Reuse Site, Waste Disposal Site and Source Site, as applicable.
- 3.7.4. The Tracking system is to be in compliance with the Excess Soil Regulation requirements and shall provide:
- 3.7.4.1. The location at which the soils were loaded for transportation.

- 3.7.4.2. The date and time the soils were loaded for transportation.
- 3.7.4.3. The quantity of soils in the load.
- 3.7.4.4. The name of an individual who may be contacted to respond to inquiries regarding the load, including inquiries regarding the soil quality.
- 3.7.4.5. The name of the corporation, partnership or firm transporting the soils, the name of the driver of the vehicle and the number plates issued for the vehicle under the Highway Traffic Act.
- 3.7.4.6. The name and location of the Reuse, Waste Disposal or Source Site.
- 3.7.4.7. The date and time of the arrival of the load at the Reuse or Waste Disposal Site. If soil is being imported to the Project Area, the date and time of arrival of the load at the Project Area.
- 3.7.4.8. The volume (and/or tonnage) of soils received.
- 3.7.4.9. Documentation from the project area signed by the Contractor's QP including soil analytical results.
- 3.7.4.10. Written consent from the Reuse or Disposal site accepting and acknowledging that the incoming excess soils are acceptable for receipt at the site including the contact information of the person who acknowledged receipt of the load(s).
- 3.7.4.11. Rejections of any loads of excess soils due to visual inspection or review of analytical results.
- 3.7.5. Weekly reports on soil tracking are to be provided to the City or upon request. Additional procedures to verify the accuracy of the information are to be completed and documented, including:
  - 3.7.5.1. Automated check of truck travel times to verify appropriateness and documented review of outliers.
  - 3.7.5.2. Automated check of load volume and number of loads shipped and received and license plates outgoing and incoming and documented review of outliers.
  - 3.7.5.3. Documented review of any rejected loads at the Reuse Site or any complaints, traffic violations incurred by the transport company in the transport of the Project Area's excess soil.
  - 3.7.5.4. Final summary report (as part of the Final Project Area Soil Records submittal) on soil tracking to be provided to the City and Consultant prior to Substantial Performance to summarize the cumulative quantities, quality, rejected loads and any relevant Project Area fill placement information.
  - 3.7.5.5. Coordinate chain-of-custody and tracking with the City to generate complete records of soil movement, if required.

### **3.8. PLACEMENT**

- 3.8.1. The Contractor is to place soil in a manner that does not cause an environmental adverse affect in accordance with their procedures in the Soil and Aggregate Plan.

### **3.9. DUST CONTROL**

- 3.9.1. Throughout construction period, provide adequate dust control on the site by watering or use of other accepted dust control materials.
- 3.9.2. Provide continuous control of dust from drifting or blowing.

### **3.10. QUALITY ASSURANCE**

- 3.10.1. The placement of fill will be monitored by the Consultant. The Contractor shall assist the Consultant in every manner necessary for the proper performance of Construction Quality Assurance (CQA) activities.
- 3.10.2. Inspection and Testing
  - 3.10.2.1. QA/QC testing must be incorporated per O. Reg 406/09 into the original testing program. However, the Consultant may direct additional testing based on field observations that the Contractor must undertake under a testing allowance.

**END OF SECTION**

The below provides a summary of the Contractor's obligations with respect to the environmental requirements and associated submittals for this Project, including requirements, documents and submittals regarding Excess Soil. This document should not be regarded as a complete overview and is provided for reference purposes only and does not override, amend, restrict or qualify in any manner whatsoever the Contractor's obligations regarding environmental requirements, including Excess Soil, under the Contract Documents or otherwise at law. In the event of a conflict, omission, error or discrepancy as between the information provided in the below document and the terms outlined in the Contract Documents and as otherwise provided at law, the terms of the Contract Documents and requirements at law will control and prevail. The Contractor is advised to review the Contract Documents and relevant statutes and regulations in their entirety to properly ascertain and understand the Contractor's environmental obligations, including those related to Excess Soil. Except as additionally and otherwise provided for in this document, capitalized terms contained in this document shall have the same meaning as set out in the Contract Documents.

## 1 Application of the Regulation

Based on the environmental assessments and investigations completed to date for the Project Area (Project and Working Area), the following have been confirmed:

- The property is undeveloped parkland and historically was agricultural/other use. Further, the property is not currently and historically has never been used, in whole or in part, as an enhanced investigation property; and
- The undertaking is not for the purposes of remediation.

Based on the above, this project is exempt from Section 8 and other related sections (i.e. the Reuse Planning Documents, filing notice and tracking).

## 2 Onsite Management of Soil

The Contractor shall ensure that any excavation, stockpiling, storage and/or onsite management of soil is conducted in accordance with O. Reg. 406/19, Section C of the Rules for Soil Management and Excess Soil Quality Standards Document and the City's SOP - Excavation of Impacted Soil ([ESMC.SOP.02](#)).

## 3 Submittals

### 3.1 Pre-Construction

The Contractor is responsible for identifying and securing the appropriate Receiving Site(s), as well as developing or retaining a soil tracking system. At or prior to the pre-construction meeting, the Contractor is to submit to the Owner's QP and Contract Administrator:

- a letter (**Receiving Sites List**), listing the name(s), location(s) and contact detail(s) of all Receiving Site(s) and hauler(s) which the Contractor proposes to utilize to receive excavated soil from the Project and Working Area. This letter should confirm what quality of soil the Receiving Site(s) is permitted to receive and provide the associated Environmental Compliance Approval (ECA) (if applicable).

### 3.2 Construction Submittals

#### 3.2.1 Exporting Material

During the removal of Excess Soil from the Project and Work Area, the Contractor is to submit to the Owner's QP and Contract Administrator on a bi-weekly basis:

- **Hauling Records** and receipts/waybills for every load of excess soil (including topsoil) exported from and/or imported to the Project and Working Area. Hauling Records are to be completed using the City's Hauling Record template (ESMC.Form.01), or an approved equivalent if included as part of a commercial soil tracking system's features.  
*(To note, for excess soil (including topsoil) imported to the Project and Working Area, the Project and Working Area is considered the Receiving Site.)*

Wherever possible, obtain electronic versions of the above records, including a spreadsheet format that tabulates the data, to facilitate document sharing/retrieval and numerical/cost analysis.

#### 3.2.2 Importing Material

Prior to importing any fill, Excess Soil and/or backfill material (including topsoil) to the Project and Working Area, the Contractor is to submit to the Owner's QP and Contract Administrator a **Soil Certification Letter(s)** confirming that the imported material meets the applicable site condition standards (Table 8.1 RPI) and quality parameters. The Soil Certification Letter is to be completed in accordance with the City's SOP - Due Diligence Soil Characterization (ESMC.SOP.01).

This **Soil Certification Letter** is to be reviewed and approved by the Owner's QP/Contract Administrator prior to any material being imported to the Project and Working Area.

### 3.2.3 Component Specific Considerations

When importing soil and/or backfill material to the Project and Working Area, ensure that the soil and/or backfill material not only meets the applicable soil quality standards but also is suitable for the intended purpose (i.e. meets any geotechnical requirements), as applicable.

### 3.3 Post Construction Submittals

The Contractor is to submit to the Owner's QP and Contract Administrator:

- if a Reuse Site(s) is being used - a **Release Letter** signed by the owner or operator (or person authorized by the owner or operator) of the Reuse Site(s) used by the Contractor for disposal of excess soils from the project (see the City's Property Owner's Release Form ([ESMC.Form.02](#))).

## 4 Record Retention

### 4.1 Soil Management Documents

- All Contracts and associated documents (**Soil Management Documents**) relating to the management of excess soil are to be retained by all parties for a period of at least seven (7) years. These documents may include, but are not limited to:
  - Owner's QP Contract and Scope of Work/Proposal, including any and all amendments and change orders;
  - Contract and Specification Documents, including any and all amendments and change orders;
  - Soil Management Plan;
  - Soil Characterization Report(s);
  - Receiving Site(s) List;
  - Release letter from Receiving Site(s); and
  - Soil Certification Letter.

To note, the above list are examples of different types of documents that would be considered part of the Soil Management Documents for a Project. Depending on the Project specific requirements, some of these documents may not apply.



The Contractor is to submit to the Owner's QP and Contract Administrator a copy of all Soil Management Documents at or prior to the closing of the Contract.

#### 4.2 Hauling Records

- All **Hauling Records** are to be retained by all parties involved in the project for a period of at least two (2) years.

### 5 Submittals Checklist

Received	Document	Timing
<input type="checkbox"/>	Receiving Site(s) List	Pre-Construction Phase <i>(At the Pre-Construction meeting prior to soil being removed from the Project and Working Area)</i>
<input type="checkbox"/>	Hauling Records (ESMC.Form.01 or equivalent)	Construction Phase <i>(During soil removal/movement)</i>
<input type="checkbox"/>	Soil Certification Letter -for importing soil	Construction Phase <i>(prior to soil being imported to Project and Working Area)</i>
<input type="checkbox"/>	Release letter from Receiving Site(s) - (ESMC.Form.02)	Construction Phase <i>(prior to soil being removed from the Project and Working Area)</i>
<input type="checkbox"/>	Soil Management Documents	Post Construction

## 6 Attachments

Attachments included with this document are as follows:

- ESMC.Form.01 - Hauling Record Template
- ESMC.Form.02 - Property Owner's Release Form
- ESMC.SOP.01 - Due-Diligence Soil Characterization
- ESMC.SOP.02 – Excavation of Impacted Soil

## PART 1: LOADING DETAILS

To be completed prior to each load of soil leaving Source Site. Hauler must keep this record on them at all times during transportation.

Source Site (Project Area)	
<b>Site Location:</b> _____ <i>(Address, City, Province, Postal Code)</i>	
<b>Contact Name (Contractor):</b> _____	
<b>Tel:</b> _____	<b>Email:</b> _____
Load Details	
<b>Date/Time:</b> _____ (am/pm) <b>Quantity:</b> _____ (TN/m <sup>3</sup> ) <i>(YYYY-MM-DD, HH:MM)</i>	
<b>Quality of Material (if known):</b> _____	
<b>Receiving Site:</b> _____ <i>(Name (if available), Address, City, Province, Postal Code)</i>	
Hauler Details	
<b>Transport Company:</b> _____ <b>Truck License Plate No:</b> _____	
<b>Driver Name:</b> _____ <b>Driver Signature</b> _____	

## PART 2: RECEIVING DETAILS

To be completed upon arrival and acceptance at Receiving Site. Copy of this document to be provided to Receiving Site representative.

Deposit Details	
<b>Date/Time:</b> _____ (am/pm) <b>Ticket No.:</b> _____ <i>(YYYY-MM-DD, HH:MM)</i>	
I, _____ <i>(name of Receiving Site Representative)</i> , declare the foregoing information is true and correct and acknowledge and consent to the deposit of the excess soil described above at the receiving site noted above.	
<b>Date:</b> _____ <i>(YYYY-MM-DD)</i>	<b>Signature</b> _____
<b>Tel:</b> _____	<b>Email:</b> _____

## Property Owner's Release Form

To be completed prior to excess soil being received by the Reuse Site.

Soil Origin	
<b>Contract No.</b>	
<b>Legal name of Contractor</b>	
<b>Source Site Location</b> <i>(Address, City, Province, Postal Code)</i>	
<b>Work Description</b>	
Reuse Site	
<b>Reuse Site Location</b> <i>(Address, City, Province, Postal Code)</i>	
<b>Estimated Quantity to be deposited</b>	
<b>Excess Soil Quality Standards (or other site-specific standards) applicable to the Reuse Site</b>	
<b>Is the site governed by a site-specific instrument? (if yes, provide a copy of the instrument)</b>	
<b>Property use of the reuse site for the undertaking for which the excess soil is required</b>	
<b>Beneficial use for which the excess soil is being received</b>	
<b>Have any soil management or fill management plans been developed for the site? (if yes, provide a copy)</b>	

### Acknowledgement and Release

I, \_\_\_\_\_ (*name of Reuse Site Representative*), being the owner(s)/operator(s)/person(s) authorized by the owner or operator of:

\_\_\_\_\_ (the "Property"),  
(*Name (if available), Address, City, Province, Postal Code*)

confirm the acceptance of excess soil from the above-noted contract with the above-noted quality for placement on the Property with my/our permission. Soil to be placed at this Property shall meet the above-noted Excess Soil Quality Standards and/or Property-Specific Standards, and will be placed and managed in accordance with the requirements of O.Reg. 406/19 On-Site and Excess Soil Management made under the Environmental Protection Act, R.S.O. 1990, c. E.19.

Where excess soil is to be managed for beneficial reuse, I/we agree to be responsible for any subsequent relocation and management of the excess soil so placed.

Where excess soil is to be managed on a temporary basis, I/we agree that the stockpiles will be removed by

\_\_\_\_\_ (date) to \_\_\_\_\_ ,  
(YYYY-MM-DD) (Name (if available), Address, City, Province, Postal Code)

(the "Final Receiving Site"). A copy of the completed Property Owner's Release Form for the Final Receiving Site is attached.

I/We hereby irrevocably release The Corporation of the City of Mississauga, the Contractor, and their respective elected or appointed officials, employees, agents, contractors and representatives, from and against any and all claims, demands, obligations, actions, causes of action, losses, costs and damages of any nature whatsoever, arising from or relating to the deposit of the above noted excess soils on the above noted Property by the Contractor carried out in accordance with this Release.

**Reuse Property Representative's Role (circle one):**

Owner

Operator

Person authorized by the Owner  
or Operator

**Reuse Property Representative (print name):** \_\_\_\_\_

**Date:** \_\_\_\_\_ **Signature:** \_\_\_\_\_  
(YYYY-MM-DD)

**Contractor's Field Representative (print name):** \_\_\_\_\_

**Date:** \_\_\_\_\_ **Signature:** \_\_\_\_\_  
(YYYY-MM-DD)

# Due-Diligence Soil Characterization

## 1 Description and Application

The purpose of this document is to outline the City's best management practices for soil characterization and reporting for the excavation, removal, disposal and importation of excess soil.

This document is to only be applied to projects that are exempt from Section 8 of Ontario Regulation (O. Reg.) 406/19. If a project is not exempt or you are unsure if a project is exempt from Section 8 of O. Reg. 406/19, please reach out to T&W Environmental Services Section ([Env.Inquiries@mississauga.ca](mailto:Env.Inquiries@mississauga.ca)) for further direction. Except as additionally and otherwise provided for in this document, capitalized terms contained in this document shall have the same meaning as set out in the Contract Documents.

## 2 Excavation, Removal and Disposal of Excess Soil

Prior to any removal of excess soil from a Project and Working Area (herein referred to as the Project Area), due-diligence soil characterization shall be completed. The best management practices that apply to a project are dependent on the volume and receiving destination of the excess soil. For ease of reference, projects have been divided into two (2) scenarios and are defined as follows:

- |             |   |
|-------------|---|
| Scenario 1. | Projects where less than 100 m <sup>3</sup> of excess soil is being removed (equivalent to 200 metric tonnes (MT) or 10 truckloads) AND is directly transported to a waste disposal site (that is not a Class 2 soil management site); or |
| Scenario 2. | All other projects that do not meet the criteria of Scenario 1.   |

Please select the scenario that best fits the project and refer to scenario specific requirements outlined below.

### 2.1 Scenario 1 Projects

A Scenario 1 project is when both of the following circumstances apply:

1. The amount of soil to be removed from the Project Area is less than 100 m<sup>3</sup>; and
2. The excess soil is directly transported to a waste disposal site that is not a Class 2 soil management site.

#### 2.1.1 Sampling and Analysis

Soil characterization shall include, but is not limited to, the following:

- Collection of a soil sample for waste characterization purpose for laboratory analysis using the Toxicity Characterization Leaching Procedure (TCLP) method in accordance with O. Reg. 347 for the following parameters:

- Metals and Inorganics;
  - Volatile Organic Compounds (VOCs); and
  - Any additional contaminants of concern or as required by the Receiving Site.
- Collection of bulk soil samples as required by the Receiving Site.

### 2.1.2 Reporting

Unless otherwise indicated by the Receiving Site, no formal report is required. A copy of the laboratory certificate of analysis shall be provided to the Contract Manager.

## 2.2 Scenario 2 Projects

A Scenario 2 project is when one (1) of the following circumstances apply:

1. The amount of soil to be removed from the Project Area is greater than 100 m<sup>3</sup>; and/or
2. The excess soil is not directly transported to a waste disposal site that is not a Class 2 soil management site.

### 2.2.1 Sampling and Analysis

Soil characterization shall include, but is not limited to, the following:

- Collection of soil samples, including the applicable Quality Assurance and Quality Control (QA/QC) samples, at a frequency that ensures an appropriate level of sampling and analysis is carried out to determine the concentrations of contaminants in the excavated excess soil. Sampling frequency shall meet the following minimum requirements, plus applicable QA/QC samples:
  - Minimum of three (3) samples if less than 1,000 m<sup>3</sup> of excess soil;
  - Minimum of four (4) samples plus one (1) additional sample for each additional 1,000 m<sup>3</sup> exceeding 1,000 m<sup>3</sup> up to 10,000 m<sup>3</sup> of excess soil; and
  - One (1) additional sample for each additional 5,000 m<sup>3</sup> exceeding 10,000 m<sup>3</sup> of excess soil.
- Conduct soil analysis in accordance with O. Reg. 406/19 and O. Reg. 153/04, as amended, for the following parameters:
  - Petroleum Hydrocarbons (PHCs) F1-F4 including benzene, toluene, ethylbenzene and xylenes (BTEX);
  - Metals and hydride-forming metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium and zinc);
  - Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC);
  - Semi-Volatile Organic Compounds (SVOCs) and VOCs; and
  - Any additional contaminants of concern that have been identified through a review of past and current uses or as required by the chosen Receiving Site.
- Collection of soil samples for waste characterization purpose for laboratory analysis using the TCLP method in accordance with O. Reg. 347.
- All environmental samples shall be submitted to a laboratory accredited with the Canadian Association for Laboratory Accreditation (CALA) for analysis.

- All soil samples must be compared to the appropriate tables as outlined in the Ministry of the Environment, Conservation and Parks (MECP)'s O. Reg. 406/19, Rules for Soil Management and Excess Soil Quality Standards, Appendix 1 & 2; and the MECP's O. Reg. 153/04 *Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, as applicable.

The soil characterization can be completed concurrently with a Geotechnical Investigation, if applicable and feasible.

#### 2.2.2 Reporting (can be combined with Geotechnical Report or Soil Management Plan)

The Soil Characterization Report shall include, but is not limited to, the following:

- Background information, including the purpose of the project, location of work, etc.;
- A summary of the quantity of samples and type of analysis conducted;
- Estimated volume of soil to be removed, reused and/or imported to/from the Project Area, if applicable;
- Sampling and QA/QC methodology;
- Copy of the Laboratory's Certificate of Analysis;
- Borehole logs;
- Drawing/map of the Project Area showing excavation locations and limits and temporary on-site storage areas, if applicable;
- Identify the applicable site condition standards and sampling and analysis requirements for imported soil in accordance with applicable law and the City's due-diligence requirements (see Section 3 Importation of Excess Soil), if applicable;
- Details regarding temporary on-site storage including segregation of various types and quality of soil and materials, if applicable;
- Tables of results, compared to the applicable MECP standards (i.e. Excess Soil Quality Standards and O. Reg. 153/04 standards); and
- Summary of the results and conclusions of the soil characterization, including recommendations for the handling, importation, reuse and/or disposal options, as required.

The report is to be completed in general accordance with O. Reg. 406/19, as amended, and must be signed and sealed by a Qualified Person (QP) as defined by O. Reg. 153/04, as amended. The report will also act as a soil management plan to address the handling, disposal, reuse and importation practices and identify site specific requirements and can be combined with a Geotechnical Report, if applicable and feasible.



### 3 Importation of Excess Soil

Prior to importing any fill, excess soil and/or backfill material (including topsoil), soil quality shall be confirmed to ensure that the material meets the applicable soil quality standards and is suitable for reuse at the Project Area. The best management practices that apply are dependent on the type and source of excess soil. For ease of reference, importation requirements have been divided into two (2) scenarios and are defined as follows:

- |             |  |
|-------------|--|
| Scenario 1. | Importation of topsoil; or   |
| Scenario 2. | Importation of backfill material (excluding topsoil or engineered fill). |

Please select the scenario that best fits the project and refer to scenario specific requirements outlined below.

Note, when importing soil and/or backfill material to a Project Area, ensure that the soil and/or backfill material not only meets the applicable soil quality standards but also is suitable for the intended purpose (i.e. meets any geotechnical requirements), as applicable.

#### 3.1 Scenario 1 – Topsoil

##### 3.1.1 Sampling and Analysis

Soil characterization shall be completed in accordance with the project specifications (as applicable) and shall include, but is not limited to, the following environmental sampling and analysis:

- Collection of soil samples, at a frequency that ensures an appropriate level of sampling and analysis is carried out to determine the concentrations of contaminants in the imported excess soil. Each composite sample shall be an amalgamation of at least three sub-samples randomly taken from the source. Samples will be mixed together prior to testing, labelled and otherwise documented prior to delivery to the testing laboratory. Sampling frequency shall meet the following minimum requirements, plus applicable QA/QC samples:
  - Minimum of one (1) composite sample per 250 m<sup>3</sup> up to the first 1,000 m<sup>3</sup> of excess soil;
  - One (1) additional composite sample for each additional 1,000 m<sup>3</sup> up to 10,000 m<sup>3</sup> of excess soil; and
  - One (1) additional composite sample for each additional 5,000 m<sup>3</sup> exceeding 10,000 m<sup>3</sup> of excess soil.
- Conduct soil analysis in accordance with O. Reg. 406/19 and O. Reg. 153/04, as amended, for the following parameters:
  - Metals and hydride-forming metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium and zinc); and
  - SAR and EC.

- Topsoil shall consist of 7% to 20% clay, 3% to 7% organic matter (by weight) and 8% combined stone and gravel content, unless otherwise stated in the project specifications.
- Topsoil shall be entirely free of all contaminants and deleterious materials such as litter, construction materials, stones greater than 50mm in diameter, wood materials greater than 25mm in diameter, plant or soil pests, subsoil, or any other contaminants that may damage or otherwise impair plants or plant growth.
- All environmental samples shall be submitted to a laboratory accredited with CALA for analysis.
- All environmental samples must be compared to the appropriate tables as outlined in the MECP's O. Reg. 406/19, Rules for Soil Management and Excess Soil Quality Standards, Appendix 1 & 2; and the MECP's O. Reg. 153/04 *Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, as applicable.

### 3.1.2 Reporting

**Soil Certification Letter(s)** confirming that the imported material meets the applicable soil condition standards and quality parameters. Written confirmation shall include but not be limited to:

- Supplier information (address, owner, contact information) and copy of the supplier's Certificate of Approval (C of A) or other environmental compliance approvals, if applicable (C of A or equivalent are required if the supplier is a Class 1 Soil Management Site, as defined by O. Reg. 406/19);
- Type, quantity and source/depot address (if different from the supplier address) of material being imported. If supplier has multiple source/depot locations include type and quantity of material per location. );
- Sampling methodology (sampling and analysis plan per the frequency requirements)
- Results of the sampling, including the parameters analysed and the total number of samples collected per location(s) based on the volume(s) to be imported;
- Laboratory certificates of analysis or analytical reports for all samples analysed; and
- Signed and sealed by a QP.

## 3.2 Scenario 2 – Backfill Material (Excluding Topsoil and Engineered Fill)

### 3.2.1 Sampling and Analysis

Soil characterization shall include, but are not limited to, the following:

- Collection of soil samples, including the applicable QA/QC samples, at a frequency that ensures an appropriate level of sampling and analysis is carried out to determine the concentrations of contaminants in the imported excess soil. Sampling frequency shall meet the following minimum requirements, plus applicable QA/QC samples:
  - Minimum of three (3) samples if less than 1,000 m<sup>3</sup> of excess soil;

- Minimum of four (4) samples plus one (1) additional sample for each additional 1,000 m<sup>3</sup> exceeding 1,000 m<sup>3</sup> up to 10,000 m<sup>3</sup> of excess soil; and
  - One (1) additional sample for each additional 5,000 m<sup>3</sup> exceeding 10,000 m<sup>3</sup> of excess soil.
- Conduct soil analysis in accordance with O. Reg. 406/19 and O. Reg. 153/04, as amended, for the following parameters:
  - PHCs F1-F4 including BTEX;
  - Metals and hydride-forming metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium and zinc);
  - SAR and EC;
  - SVOCs and VOCs; and
  - Any additional contaminants of concern that have been identified through a review of past and current uses or as indicated by the Contract Manager.
- Collection of soil samples for waste characterization purpose for laboratory analysis using the TCLP method in accordance with O. Reg. 347.
- All environmental samples shall be submitted to a laboratory accredited with CALA for analysis.
- All environmental samples must be compared to the appropriate tables as outlined in the MECP's O. Reg. 406/19, Rules for Soil Management and Excess Soil Quality Standards, Appendix 1 & 2; and the MECP's O. Reg. 153/04 *Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, as applicable.

### 3.2.2 Reporting

**Soil Certification Letter(s)** confirming that the imported material meets the applicable soil condition standards and quality parameters. Written confirmation shall include but not be limited to:

- Supplier information (address, owner, contact information) and copy of the supplier's Certificate of Approval (C of A) or other environmental compliance approvals, if applicable (C of A or equivalent are required if the supplier is a Class 1 Soil Management Site, as defined by O. Reg. 406/19);
- Type, quantity and source/depot address (if different from the supplier address) of material being imported. If supplier has multiple source/depot locations include type and quantity of material per location;
- Sampling methodology (sampling and analysis plan per the frequency requirements)
- Results of the sampling, including the parameters analysed and the total number of samples collected per location(s) based on the volume(s) to be imported;
- Laboratory certificates of analysis or analytical reports for all samples analysed; and
- Signed and sealed by a QP.

#### 4 Revision History

Rev. #	Date Revised	Author	Description of Changes
1.0	April 3, 2023	Katrina MacDonald	Original Release
2.0	April 13, 2023	Katrina MacDonald	Updated to include contact details
3.0	March 21, 2024	Katrina MacDonald	Updated parameter analysis requirements for VOCs and SVOCs

# Excavation Procedure of Impacted Soils

## 1 Description and Application

The purpose of this document is to outline the City's best management practices for the discovery of impacted soils during excavation undertakings.

## 2 Excavation Procedure

During excavation of soil at the Project and Working Areas, should any visual or olfactory observations (i.e. staining, odours, free product etc.) be made that may suggest that the soil being excavated may be impacted the following should be completed:

1. Soil excavation in the Project Area must cease immediately upon the observation being made until the City/Project Leader directs that soil excavation may resume.
2. The City/Project Leader must be notified immediately by the Contractor that impacted soil may have been encountered during construction activities.
3. Before the City/Project Leader can direct that the excavation work can resume, the necessary steps must be taken to ensure:
  - All potentially impacted soil is segregated from other excavated soil in the project area;
  - The limits of the Project Area that may be impacted is determined; and
  - Any excess soil from the portion of the Project Area that is potentially impacted is characterized and disposed of in accordance with O.Reg. 406/19. This may include transport to a reuse site, or if heavily impacted, to a licensed disposal/treatment facility.

A Qualified Person (QP) under O.Reg. 153/04 should be retained to assist with ensuring impacted soil is segregated, characterized, delineated, and disposed of in accordance with O.Reg. 406/19.

In the event that impacts are identified to extend beyond the Project Area excavation limits, it is recommended that the City/Project Leader, in coordination with the QP, reach out to T&W Environmental Services Section ([Env.Inquiries@mississauga.ca](mailto:Env.Inquiries@mississauga.ca)) for further direction prior to undertaking any remedial activities.

4. The Contractor will be required to assist the City/Project Leader and QP, if applicable, with the work required to characterize and delineate the area of potential

contamination. This may include provision of an excavator and operator to complete test pits and assist with sample collection.

5. Delineation will be undertaken by stepping out from the area of potential impacts until the impacts are no longer observable within the Project Area. Sample intervals will be determined by the QP, and clean limits will be verified by laboratory analysis.
6. Following characterization and delineation, the QP shall provide a plan to the City/Project Leader and Contractor for managing the potentially impacted soil. This will include the handling and disposal requirements. The City/Project Leader will direct the Contractor to resume excavation works in accordance with the plan.
7. If the potentially impacted soil requires disposal at a Receiving Site not identified at the outset of the project (i.e. a different reuse or disposal facility), the Contractor will be required to coordinate all necessary agreements to allow such disposal. No soil shall be hauled to a Receiving Site without prior written authorization from the Receiving Site.
8. If necessary and applicable, the QP will be required to update the Sampling and Analysis Plan, Soil Characterization Report and Excess Soil Destination Assessment Report (ESDAR) documents for the Project Area.

### 3 Revision History

Rev. #	Date Revised	Author	Description of Changes
1.0	April 3, 2023	Katrina MacDonald	Original Release
2.0	April 5, 2024	Katrina MacDonald	Revisions to excavation procedure

## **1 GENERAL**

### **1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

### **1.2 Related Requirements**

- .1 Section 03 20 00 – Concrete Reinforcing
- .2 Section 03 30 00 – Cast-In-Place Concrete

### **1.3 References**

- .1 All referenced standards shall be the current edition, or the edition referenced by the Ontario Building Code indicated that formed the basis for the building permit for the project.
- .2 CSA Group (CSA):
  - .1 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86, Engineering Design in Wood.
  - .3 CSA O121, Douglas Fir Plywood.
  - .4 CSA O151, Canadian Softwood Plywood.
  - .5 CSA O153, Poplar Plywood.
  - .6 CAN/CSA-O325.0, Construction Sheathing.
  - .7 CSA O437 Series, Standards for OSB and Waferboard.
  - .8 CSA S269.1, Falsework and Formwork.
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

### **1.4 Action and Informational Submittals**

- .1 Submittals in accordance with Section 01 33 00 – Submittals & Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings signed and sealed by professional engineer licensed in Province of Ontario, Canada.
  - .2 Prepare shop drawings in accordance with CSA S269.1.

- .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.

## 1.5 **Quality Assurance**

- .1 In accordance with Section 01 45 00 – Quality Control.
- .2 Qualifications
  - .1 Engage a Professional Engineer licensed in the Province of Ontario to be responsible for design and installation of all formwork, falsework and re-shoring.
  - .2 Retain a professional engineer licensed in the Province of Ontario, Canada, with experience in formwork and falsework design of comparable complexity and scope, to perform following services as part of Work of this Section:
    - .1 Design of formwork and falsework:
    - .2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.
    - .3 Conduct on-site inspections and prepare and submit inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings. Perform inspections a minimum of [once per month].

## 1.6 **Delivery, Storage and Handling**

- .1 Deliver, store, and handle materials in accordance with Section [01 61 00 - Common Product Requirements] and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect formwork from damages.
  - .3 Replace defective or damaged materials with new.

## 2 **PRODUCTS**

### 2.1 **Design Requirements**

- .1 Design in accordance with CSA S269.1.



- .2 Structural design of formwork, falsework and re-shoring will not be reviewed by the Consultant.

## 2.2 Materials

- .1 Formwork materials: to CSA S269.1
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series and/or CSA-O153 as appropriate.
  - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
  - .3 Rigid insulation board: to CAN/ULC-S701.
  - .4 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
    - .1 Spiral pattern not to show in hardened concrete unless specifically noted on the architectural drawings.
  - .5 Form ties:
    - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm (1") diameter in concrete surface.
    - .2 For concrete exposed to view, use snap ties complete with plastic cones and light grey concrete plugs.
- .2 Form liner:
  - .1 Non-Architectural Finish:
    - .1 Plywood: to CSA O151.
    - .2 Waferboard: to CAN/CSA-O325.0.
- .3 Form release agent: non-toxic, biodegradable and low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm<sup>2</sup>/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 00 - Sealants.
- .7 Void Form: Cellular cardboard with minimum compressive strength of 62 kPa (9 psi) designed to carry weight of wet concrete and loads associated with placing concrete and also designed to disintegrate and create an air space below the fully hardened concrete.
- .8 Compressible Material: Ceramar by W. R. Meadows or equivalent.

### 3 EXECUTION

#### 3.1 Fabrication and Erection

- .1 Conform to CSA A23.1 and the following:
  - .1 Fabricate and erect falsework in accordance with CSA S269.1.
  - .2 Verify lines, levels and centres before proceeding with formwork / falsework and ensure dimensions agree with drawings.
  - .3 Do not use earth forms unless specifically noted on the structural drawings or approved by the Consultant.
  - .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
  - .5 Do not place shores and mud sills on frozen ground.
  - .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
  - .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2. Cambers required for hardened concrete are shown on the Drawings and are measured relative to member supports.
  - .8 Align form joints and make watertight.
    - .1 Keep form joints to minimum.
  - .9 Locate horizontal form joints for exposed columns 2400 mm (8'-0") above finished floor elevation.
  - .10 Use 25 mm (1") chamfer strips on external corners and/or 25 mm (1") fillets at interior corners, joints, unless specified otherwise.
  - .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
  - .12 Do not substitute round concrete column forms in lieu of rectangular column forms unless specifically approved by the Consultant.
  - .13 Use internal form ties.
  - .14 Do not permit loads from formwork to be transmitted to adjacent existing structure.
  - .15 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
    - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
  - .16 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.
  - .17 Do not close formwork before reinforcing steel has been reviewed.
  - .18 Void form:

- .1 Conform to manufacturer's recommendations.
- .2 Place on sand leveling bed.
- .3 Protect from moisture until concrete is about to be placed.
- .4 Protect from excessive construction loads.
- .5 If void form collapses during construction, remove and replace affected area.

### 3.2 Removal and Reshoring

- .1 Conform to CSA A23.1.
- .2 Remove formwork when concrete has reached 75 % of its design strength. Replace immediately with adequate reshoring where applicable.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3000 mm (10'-0") apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

### 3.3 Field Quality Control

- .1 Refer to Section 01 45 00 Quality Control.
- .2 The Contractor and their Engineer are duly responsible to perform General Review of the formwork, falsework and reshoring (as applicable).
- .3 The Consultant will not review the suitability or dimensional accuracy of any formwork, falsework or reshoring while performing General Review of the Work.

## 4 END OF SECTION

**1 GENERAL**

**1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

**1.2 Related Requirements**

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 30 00 – Cast-In-Place Concrete
- .3 Division 04 – Masonry

**1.3 References**

- .1 All referenced standards shall be the current edition or the edition referenced by the Ontario Building Code in force at the time of building permit application.
- .2 American Society for Testing and Materials (ASTM International):
  - .1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Canadian Standards Association (CSA International):
  - .1 CSA-A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3, Design of Concrete Structures.
  - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC):
  - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.4 **Quality Assurance**

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications
  - .1 Welding of reinforcing steel to be performed by welders certified under CSA W186.

1.5 **Quality Control**

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Source Quality Control Submittals:
  - .1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
  - .2 Upon request, inform Consultant of proposed source of reinforcement material to be supplied.
  - .3 Upon request, provide the Consultant with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.
  - .4 Upon request, provide the Consultant with a copy of manufacturer's instructions for patching factory applied epoxy coating.
- .3 Bring to the attention of the Consultant any defects or deficiencies in the work together with a proposal for remedy. The Consultant will decide what corrective action may be taken, and will issue the necessary instructions.
- .4 Construction Review:
  - .1 General review during construction by the Consultant will be carried out by examination of representative samples of the work.
  - .2 Do not close forms or pour concrete before reinforcing steel is reviewed.
  - .3 Construction review reports will outline any deficiencies found.

1.6 **Action and Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 – Submittals & Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
  - .1 Submit drawings indicating the placement of reinforcement and:
    - .1 Bar bending details.
    - .2 Bar Lists.
    - .3 Quantities of reinforcement.

- .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Concrete cover.
- .6 Splice lengths.
- .7 Standard hook lengths.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
  - .1 Provide Class B tension lap splices unless otherwise indicated.
- .3 Provide 90° or 180° standard hooks to CAN/CSA-A23.3. Do not shorten hooks to accommodate member dimensions but rather rotate hooks in the member to maintain hook dimensions and adequate concrete cover.

#### 1.7 **Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with this Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### 2 **PRODUCTS**

#### 2.1 **Materials**

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .2 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .4 Welded steel wire fabric: to ASTM A185/A185M.
  - .1 Provide in flat sheets only.
- .5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices: to develop 120% of the specified yield strength of the reinforcing bar, subject to approval of the Consultant.

- .8 Plain round bars: to CSA-G40.20/G40.21.
- .9 Substitute different size bars only if permitted in writing by the Consultant.

### 3 EXECUTION

#### 3.1 Fabrication

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain the Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of the Consultant, weld reinforcement in accordance with CSA W186. Unless otherwise noted, weld to develop the yield force of the specified bar.
- .4 Epoxy Coated Reinforcing Steel
  - .1 Fabricate epoxy coated reinforcing steel in accordance with ASTM D3963/D3963M. Plants to be certified by the Concrete Reinforcing Steel Institute (CRSI) for epoxy coated steel. Provide colour to contrast sharply with reinforcing steel and rust colour.
  - .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
  - .3 Ship epoxy coated bars in accordance with ASTM A775A/A775M.
- .5 Stagger mechanical splices 750mm (2'-6") unless otherwise noted on drawings.

#### 3.2 Field Bending

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Consultant.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Unless specifically noted, the Contractor is responsible to retain the services of a qualified inspector to review the condition of field bent reinforcement not indicated on the Contract Documents.
  - .1 Replace bars, which develop cracks or splits at no cost.

#### 3.3 Placing Reinforcement

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Remove all loose scale, dirt, oil or other coatings which would reduce bond.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

- .4 Turn ends of tie wire towards the interior of concrete.
- .5 Use bar supports for beams and slabs.
- .6 Do not drive or force reinforcement into fresh concrete.
- .7 Prior to placing concrete, obtain the Consultant's General Review of reinforcing material and placement.
- .8 Ensure cover to reinforcement is maintained during concrete pour. Use side form spacers for walls and columns.
- .9 Do not splice reinforcing at locations other than shown on placing drawings without Consultant's written approval.
- .10 Do not cut reinforcement without Consultant's written approval.
- .11 Provide concrete chairs where supports rest on the ground.
  - .1 Space chairs at 600 mm (2'-0") centres to support welded wire fabric in slabs-on-grade.
  - .2 Do not lift reinforcement during slab-on-grade concrete placement.
- .12 Exposed concrete surfaces:
  - .1 Use plastic or plastic tipped bar supports and spacer with colour to match concrete.
- .13 Epoxy Coated Reinforcement
  - .1 Protect epoxy coated portions of bars with covering during transportation and handling.
  - .2 Do not weld epoxy coated reinforcement.
  - .3 Use plastic bar supports, epoxy coated support bars and plastic coated tie wire
- .14 Use plain round bars as slip dowels in concrete.
  - .1 Paint portion of dowel intended to move within hardened concrete with [one coat of asphalt paint].
  - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .15 Where drawings refer to welded deformed reinforcing bars, conform to CSA W186.

#### 3.4 **Field Touch-Up**

- .1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**



**1 GENERAL**

**1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

**1.2 Related Requirements**

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 35 00 – Concrete Floor Finishing

**1.3 References**

- .1 All referenced standards shall be the current edition, or the edition referenced by the Ontario Building Code indicated that formed the basis for the building permit for the project.
- .2 American Society for Testing and Materials (ASTM International):
  - .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
  - .4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .7 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .8 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

- .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Canadian Standards Association (CSA International):

- .1 CSA A23.1 / A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
- .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.4 **Administrative Requirements**

- .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works to verify project requirements. Ensure key personnel, site supervisor, speciality contractors (finishing, forming... etc.), concrete producer and testing laboratories attend.
- .2 Concrete Delivery Tickets: keep all concrete delivery tickets on site until building is complete. Record on each ticket when and where concrete was placed.
- .3 Batch Logs: keep record of each batch delivered to the site.
- .4 Record Drawings: Record on a set of Structural Drawings the extent of each pour including the pour date and falsework removal date. Record all field changes including footing elevations.

1.5 **Quality Assurance**

- .1 In accordance with Section 01 45 00 - Quality Control.
- .2 Provide the Consultant, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Concrete supplier to have a valid "Certificate of Ready Mixed Concrete Production Facilities" issued by the relevant Ready Mixed Concrete Association.
  - .2 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

1.6 **Quality Control**

- .1 Submit in accordance with Section 01 45 00 - Quality Control.
- .2 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by the Consultant on the following items:

- .1 Hot weather concrete.
- .2 Cold weather concrete.
- .3 Curing.
- .4 Finishes.
- .5 Joints.
- .4 Sustainability Standards Certification:
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, and air temperature and test samples taken.

**1.7 Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittals & Procedures.
- .2 Minimum four weeks prior to starting concrete work, provide valid certificate from plant delivering concrete and quality control plan.
- .3 Minimum 2 weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.
- .4 Minimum 2 weeks prior to placing concrete, submit drawings showing locations of all construction joints and slab on grade control joints.
- .5 Minimum submission requirements for each concrete mix design shall include the following:
  - .1 Minimum specified compressive strength at 28 day.
  - .2 Maximum aggregate size.
  - .3 Aggregate type (if not normal density).
  - .4 Concrete density range, wet and dry (if not normal density).
  - .5 CSA exposure class.
  - .6 Cement type (if not type GU).
  - .7 Percentage and type of supplemental cementing materials.
  - .8 Maximum water/cementitious ratio.
  - .9 Assumed method of placement of concrete.
  - .10 Corrosion inhibitor (name and quantity, if applicable).
  - .11 Alkali-aggregate resistance.
  - .12 Maximum time from batching to placing concrete (if retarding admixtures are used).
- .6 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in Execution.

- .7 Concrete hauling time: provide for review by the Consultant deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .8 On completion of the concrete works, provide written report to the Consultant verifying compliance that concrete in place meets performance requirements of concrete as established in Products.

1.8 **Delivery, Storage and Handling**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
    - .1 Do not modify maximum time limit without receipt of prior written agreement from the Consultant and concrete producer as described in CSA A23.1/A23.2.
    - .2 Deviations to be submitted for review by the Consultant.
  - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

2 **PRODUCTS**

2.1 **Design Criteria**

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in Materials.

2.2 **Performance Criteria**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by the Consultant and provide verification of compliance as described in Quality Assurance.

2.3 **Materials**

- .1 Portland Cement: to CSA A3001.
- .2 Supplementary cementing materials (SCM):
  - .1 Cementitious hydraulic slag: to CSA A3000
  - .2 Fly Ash: to CSA A3001, Type CI.
  - .3 Minimum two weeks prior to placing concrete, Concrete Supplier to provide written recommendation to reduce SCM content to accommodate anticipated environmental conditions.
- .3 Water: to CSA A23.1.
- .4 Aggregates: to CSA A23.1/A23.2. Do not use recycled concrete as aggregate.

- .5     Admixtures:
  - .1     Air entraining admixture: to ASTM C260.
  - .2     Chemical admixture: to ASTM C494.
  - .3     Corrosion-inhibiting admixture: ASTM C 494 Type C and shall contain minimum 30% calcium nitrite solution.
  - .4     Not to contain chlorides.
  - .5     Manufacturer shall have ISO 9001 Quality Certification. To ensure compatibility, all admixtures shall be from the same manufacturer.
- .6     Shrinkage compensating (non-shrink) grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1     Compressive strength: 40 MPa at 28 days.
- .7     Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand
  - .1     Compressive strength: 50 MPa at 28 days.
- .8     Curing compound: to CSA A23.1/A23.2 and ASTM C309 to be coordinated and compatible with surface floor hardeners where used.
- .9     Floor surface hardener: Non-metallic, natural grey colour (unless other colour is requested by the Architect), premixed, Mohs Hardness 7 or better.
- .10    Premoulded joint fillers:
  - .1     Bituminous impregnated fiber board: to ASTM D1751.
- .11    Weep hole tubes: plastic.
- .12    Bonding adhesive: Portland Cement grout
- .13    Bonding adhesive: Synthetic latex.
- .14    Vapour barrier: 0.25mm polyethylene to CAN/CGSB-51.34.
- .15    Rigid insulation: Extruded polystyrene boards per ASTM C578, structural grade, compressive strength 100 psi (690 kPa).
- .16    Control joint filler: semi-rigid filler to protect against slab edge breakdown:
  - .1     For sawcuts made with "Soff-Cut" saw: two component epoxy.
  - .2     For conventional sawcuts in interior slab: two component epoxy urethane.
  - .3     For conventional sawcuts in exterior slabs: two or multi component polyurethane based elastomeric.

- .17 Crack Filler: low viscosity epoxy resin.
- .18 Post-installed anchors and reinforcing steel: Hilti Canada.

## 2.4 **Mixes**

- .1 Use ready-mix concrete. Proportion concrete in accordance with Alternative 1 - Performance Method for specifying concrete to meet the Consultants performance criteria and to CSA A23.1/A23.2, whichever is more stringent.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
  - .2 Provide concrete mix to meet following plastic state requirements:
    - .1 Workability: free of surface blemishes, loss of mortar, colour variations (in exposed elements) and segregation.
    - .2 As required by the trades placing and finishing the concrete.
  - .3 Provide concrete mixes to meet following hard state requirements:
    - .1 Durability and class of exposure: as indicated on the structural drawings.
    - .2 Compressive strength at 28 days (minimum): as indicated on the structural drawings. For elements not noted on the structural drawings such as curbs and sidewalks, provide minimum A23.1 requirements.
    - .3 Intended application: as indicated on the structural drawings.
    - .4 Aggregate size 20 mm (3/4") maximum unless otherwise noted on the structural drawings.
  - .4 Supplementary cementing materials (SCM):
    - .1 Conform to CSA A23.1.
    - .2 Minimum 20% replacement, by mass of total cementitious materials to CSA A3001 for concrete that is not architecturally exposed. Maximize SCM content in foundations, walls and columns where rapid strength gain is not critical to the project schedule.
    - .3 Follow slag and fly ash manufacturers' directions for proportioning and mixing of concrete.
    - .4 Do not use SCM in architecturally exposed concrete.
    - .5 Fly ash not to exceed more than 15% of total cementitious material.
    - .6 Limit SCM content for floors with special finishes (such as Retroplate), to be compatible with the finish.

## 3 **EXECUTION**

### 3.1 **Preparation**

- .1 Obtain written approval of each foundation bearing surface by the Geotechnical Consultant prior to placing concrete. Remove water and disturbed soil from excavations before placing concrete.
- .2 Provide 24 hours minimum notice prior to placing of concrete.

- .3 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .4 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .5 Pumping of concrete is permitted only after approval of equipment and review of the proposed mix by the Concrete Supplier.
- .6 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
  - .1 Place steel dowels of deformed steel reinforcing bars grouted with Hilti HIT HY-200 (or approved alternate) with standard embedment unless noted otherwise on the structural drawings.
- .11 Before placing slab-on-grade, confirm that subgrade and backfill meet specifications and are free of frost and surface water.
- .12 Provide vapour barrier under slabs placed on the ground including slabs-on-grade and framed slabs as described by the Architectural specifications.
  - .1 Lap minimum 150 mm at joints and seal.
  - .2 Seal all punctures before placing concrete.
  - .3 Use patching material at least 150 mm larger than puncture and seal.

### 3.2 **Installation/Applications**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Refer to Notes on Structural Drawings for maximum size and minimum spacing of embedded conduits.
- .3 Refer also to concrete floor finishing requirements in accordance with Section 03 35 00 - Concrete Floor Finishing.
- .4 Sleeves and inserts:

- .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by the Consultant.
  - .2 Where approved by the Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm (4" x 4") not indicated must be reviewed by the Consultant.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from the Consultant before placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .5 Joints
- .1 Refer to typical details and drawings notes for detailing and maximum spacing requirements.
  - .2 Construction joints:
    - .1 Formed slab: Locate joints near slab / beam / girder midspans unless a beam intersects a girder at this point. In that case offset the girder joint twice the beam width and provide additional shear reinforcement to the acceptance of the Consultant.
    - .2 Slabs on steel deck not supported by composite steel beams: Locate joints in slabs at centre of supports unless there are composite beams.
    - .3 Slabs on steel deck on composite steel beams: Locate joints parallel to purlins at middle of span of slabs and so that joints cross over girders near their supports. Locate construction joints parallel to girders at 1200mm (4'-0") from centre line of girders and so that these girders are not included in the earlier pour.
    - .4 Walls: locate joints with PVC waterstops at least 300mm (12") away from wall corners and wall intersections.
  - .3 Provide evenly spaced vertical control joints in walls.
  - .4 Provide expansion joints where shown on Structural Drawings. Remove all forming and filler material used during construction and provide clear space between structural elements equal to width specified.
  - .5 Provide construction gaps where shown on Structural Drawings.
- .6 Anchor rods:
- .1 Set anchor rods to templates in co-ordination with appropriate trade prior to placing concrete.
  - .2 Locate each anchor rod group to within 6mm (1/4") of required location.



- .3 Grout anchor rods in holes drilled after concrete has set only after receipt of written approval from the Consultant.
  - .1 Drilled holes: to adhesive manufacturers' recommendations.
- .4 Protect anchor rod holes from water accumulations, snow and ice build-ups.
- .7 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .8 Dovetail anchor slots: in accordance with Division 4 - Masonry.
  - .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
  - .2 Install continuous vertical anchor slots at 800 mm (2'-6") on centre where concrete walls are masonry faced.
- .9 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .10 Joint fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.
  - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .3 Locate and form isolation, construction and expansion joints as indicated.
  - .4 Install joint filler.
  - .5 Use 12 mm (1/2") thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to finished slab surface unless indicated otherwise.

### 3.3 **Placing Concrete**

- .1 Place concrete in accordance with CSA A23.1.
- .2 Delivery and place concrete with minimum re-handling.
- .3 Do not overload forms.
- .4 Use rubber tipped vibrators for concrete containing epoxy coated reinforcement

- .5 Cast slabs with a top surface that is level or sloping as required by the Drawings. Allow for cambering where required. Set top of slab below finished floor level by the distance required for the type of applied finish.
- .6 Where cambered steel beams are used, ensure that slab thickness is as specified. Measure from top of steel to control thickness.
- .7 Construction Gaps:
  - .1 Do not fill beam and slab construction gaps until all concrete at that level is at least 28 days old.
  - .2 Do not fill wall construction gaps until all adjoining framed slabs, above and below, are at least 28 days old.

### 3.4

#### **Finishing**

- .1 Finish concrete to CSA A23.1/A23.2.
- .2 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .4 Finish concrete floor to CSA A23.1/A23.2. Class A.
- .2 Finishing Flatwork:
  - .1 See Section 03 35 00 - Concrete Floor Finishing.
  - .2 Protect concrete during finishing process. Use evaporation reducer during severe drying conditions.
  - .3 Provide final finish in accordance with proposed use and as follows:
    - .1 Screeded and bull floated for: mud slabs and footings/pile caps.
    - .2 Screeded and bull floated with scratch finish for: base slabs which receive mortar setting beds or bonded toppings.
    - .3 Powered float finish for: roofs (except future floors) and slabs which receive a membrane.
    - .4 Wood float finish with brooming for: exterior exposed slabs.
    - .5 Powered steel trowel finish for: interior exposed slabs, slabs which receive resilient flooring, carpet, epoxy-based finishes, thin-set tiles, etc. and future floors. Do not trowel air entrained concrete.
    - .6 Steel trowel exposed interior concrete floors at least twice. Provide final spin trowelling when non-slip finish is required.
  - .4 Surface hardeners:
    - .1 Provide where hardened concrete is required by Architectural Drawings or Specifications.

- .2 Use only liquid hardeners on air entrained concrete; do not use dry-shake applied surface hardeners.
  - .3 Incorporate hardener into the surface of the concrete while concrete is still plastic.
  - .4 Follow manufacturer's recommendations for dosage and application procedure.
  - .5 Where coloured hardeners are required, colour will be selected from available colours by Consultant.
  - .6 Hold pre-construction meeting with hardener technical representative and finisher to ensure proper application, curing and protection.
- .3 Finishing Formed Surfaces:
- .1 Completely fill holes left by through-bolts with grout.
  - .2 Do not patch surfaces until instructed in writing by Consultant.
  - .3 Concrete exposed to view:
    - .1 Provide smooth-form finish.
    - .2 Rub exposed sharp edges with carborundum to produce 3 mm (1/8") radius edges unless otherwise indicated.
- .4 Concrete exposed to view:
- .1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.
  - .2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the Consultant.
- .5 Toppings:
- .1 Topping mixture to meet minimum requirements as follows: Bonded overlay of a thickness noted on the structural drawings.
  - .2 Make allowance for bonded overlay topping thickness when pouring base course.
  - .3 Apply cement/sand grout to base course to CSA A23.1/A23.2.
  - .4 Place bonded topping to CSA A23.1/A23.2 and topping manufacturer's recommendations.
  - .5 Ensure that joints in topping are of same material as those in base course. Also ensure that their locations precisely match those in base course.

### 3.5 Surface Tolerance

- .1 Concrete surface tolerance to CSA A23.1, Straightedge Method.
- .2 Finish concrete floor to CSA A23.1/A23.2. Class A.

### 3.6 Concrete Curing and Protection

- .1 At a minimum cure and protect concrete in accordance with CSA A23.1
- .2 Extend curing and protection period until concrete has reached following strength levels for structural safety:
  - .1 Framed slabs and beams: 75% of specified 28 day strength.
  - .2 Columns, walls, piers and footings: 50% of specified 28 day strength
- .3 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.
- .4 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted, use a curing compound compatible with applied finishes.
- .5 Do not use curing compound on parking garage slabs and where bonded topping is to be applied. Cover slab surfaces with absorptive mat or fabric and keep continuously wet.
- .6 Slabs on grade and structural slabs receiving resilient floor or other moisture sensitive finishes:
  - .1 Apply 24 hours of wet curing. Start curing immediately after finishing slab.
  - .2 Cover slab for at least 72 hours using plastic sheets with joints taped and free edges covered.
  - .3 Protect finished and cured slab from surface water (i.e. rain, snow).
  - .4 Refer to Architectural Specifications for required testing methods prior to placing floor finishes.
- .7 Concrete exposed to view:
  - .1 Protect during construction period from wear, damage, marking, discolouration, staining and becoming coated with concrete leakage.
  - .2 Unless rejected, repair damage and remove marks and stains to the approval of the Consultant.

### 3.7 Slabs on Grade

- .1 Construction joints and sawcut joints:
  - .1 Refer to drawing notes for maximum spacing requirements.
  - .2 Saw cut depth to be equal to one quarter of the concrete thickness.
  - .3 Locate joints on column lines wherever possible and on intermediate lines, which result in approximately square panels, without re-entrant corners.
  - .4 Do not create "L" shaped panels nor "T" shaped joint intersections.

- .5 Protect edges of sawcuts from breakage.
  - .6 Clean out sawcuts in exposed concrete and fill with control joint filler after concrete is at least 120 days old.
  - .7 Sawcut top 25 mm (1") at construction joints in exposed concrete for a width of 5 mm (3/16") and fill with control joint filler after concrete is at least 120 days old.
  - .8 Clean out sawcuts in other concrete and fill with a sand-cement paste one month prior to installing floor coverings.
- .2 Isolation Joints:
- .1 Unless otherwise shown on structural drawings, provide min. 10mm (3/8") thick premoulded joint filler of the same depth as the thickness of the concrete wherever slabs-on-grade abut foundation walls, columns and piers. Omit if slab is chased or dowelled into structure.
  - .2 Furnish filler for each joint in single piece for depth and width required for joint,
  - .3 When more than one piece of filler is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .3 Cracks in Slabs-on-Grade:
- .1 Extensive cracking of slabs-on-grade or cracks in excess of 3mm (1/8") in width may be cause for rejection of slab or portion of slab at Consultant's discretion.
  - .2 Protect edges of cracks in slabs-on-grade from breakage.
  - .3 Exposed slab on grade: Unless slab is rejected, repair cracks that are over 0.4 mm (0.016") wide:
    - .1 Fill cracks with a sand-cement grout after concrete is at least 120 days old.
    - .2 Seven days later, cut out top 20 mm (3/4") of crack for a width of 5 mm (3/16") and fill with control joint filler.

### 3.8 **Field Quality Control**

- .1 Site tests:
- .1 Frequency and number of tests to be performed in accordance with CSA A23.1/A23.2.
  - .2 Conduct tests as follows and submit reports as described in Action and Informational Submittals.
    - .1 Concrete pours.
    - .2 Slump.
    - .3 Air content.
    - .4 Compressive strength at 7 and 28 days.
    - .5 Air and concrete temperature.
    - .6 Fresh density (for low or semi-low density concrete).

- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Consultant for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.
- .4 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Inspection or testing by the Consultant will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. The General Conditions of the Contract, Supplementary Conditions, and the General Requirements of Division 1, form part of this section, and must be read in conjunction with the requirements of this section. The work of this section shall comply with all requirements of Division 1 – General Requirements.
- 1.1.2. The Contractor shall, together with any and all Subcontractors involved in the work of this section, examine all surfaces or conditions relating to the Work, in order to determine the acceptability of such surfaces or conditions for the work of this section to commence.
- 1.1.3. Subcontractors shall report in writing, any observed defects or deficiencies in any surfaces or conditions that would adversely affect the work of this section, to the Contractor for correction prior to commencing the work of this section.
- 1.1.4. Commencement of the work of this section shall imply acceptance of all surfaces and conditions.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. Section Includes
- .3 1.3. Related Sections
- .4 1.4. Quality Assurance
- .5 1.5. Protection
- .6 2.1. Materials
- .7 3.1. Quality Of Work
- .8 3.2. Finishing
- .9 3.3. Schedule

### **1.3. RELATED SECTIONS**

- 1.3.1. Polished Concrete Floor Finish Section 03 35 43

### **1.4. QUALITY ASSURANCE**

- 1.4.1. Manufacturer/Fabricator
  - 1.4.1.1. Manufacturers or fabricators providing Products under this Section shall have sufficient plant, equipment and competent personnel to provide the Products, in accordance with the Contract Documents. Firm(s) shall have past experience in the manufacture or fabrication of the Products specified herein, and shall have successfully completed Projects of similar scope and type.
- 1.4.2. Installation/Application
  - 1.4.2.1. Installers or applicators of the Products specified herein, shall be competent in the skills required to perform such tasks. Installation/application shall be performed in accordance with industry standards specified herein, warranty requirements, and in accordance with generally accepted, industry best practices.
- 1.4.3. Documentation
  - 1.4.3.1. If requested by the Consultant, submit documentation to support the competency of firms and personnel.

### **1.5. PROTECTION**

- 1.5.1. Keep traffic which would affect or disturb the curing procedures off the finished surfaces for a period of 7 days minimum the minimum period of cure time specified for the concrete mix proposed by the Subcontractor and concrete supplier and as reviewed and approved by the Construction Manager.
- 1.5.2. Protect exposed concrete finishes against damage.

- 1.5.3. Protect floors which are to receive applied coatings and finishes against contamination by oil, paint or other deleterious materials.
- 1.5.4. Protect items set into floors from damage and ensure that alignment is not disturbed.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Curing membrane: Laminated waterproof paper consisting of laminations of kraft paper and water resistant materials capable of retaining the moisture in the concrete and tough enough to remain intact for the specified curing time.
- 2.1.2. Curing and sealing compound: to ASTM C309, Type 1, Class B.
- 2.1.3. Filler for exposed and concealed control joints: Load bearing, epoxy-urethane filler, 'Loadflex' by Sika Canada Ltd. <http://www.can.sika.com/or> other approved manufacture.

## **3 EXECUTION**

### **3.1. QUALITY OF WORK**

- 3.1.1. General
  - 3.1.1.1. Comply with the requirements of section 01 60 00.
  - 3.1.1.2. Comply with the requirements of CAN/CSA A23.1, except where greater requirements are specified herein.
  - 3.1.1.3. Comply with requirements of section 03 30 00, as applicable, and except where greater requirements are specified herein.
  - 3.1.1.4. Ensure surfaces are free of trowel marks and wash-boarding.
  - 3.1.1.5. Use compatible curing compounds, additives, admixtures, sealers and hardeners.
  - 3.1.1.6. Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.
  - 3.1.1.7. Curing methods and materials shall be compatible with subsequent applied finishes.
- 3.1.2. Tolerances
  - 3.1.2.1. Completed surfaces shall not vary more than 6mm in 3000mm from dead level except where slopes, and slopes to drains are required.

### **3.2. FINISHING**

- 3.2.1. Control Joints
  - 3.2.1.1. Provide sawcut control joints to a depth of 1/4 of slab thickness in concrete slabs and toppings, located on column centre lines, unless closer spacing is indicated.
  - 3.2.1.2. Fill control joints with epoxy type filler.
  - 3.2.1.3. Rake out dirt in joints with an appropriate tool. Blow dirt out of joints with compressed air. Clean the floor surface by vacuuming with industrial type vacuum cleaner.
  - 3.2.1.4. Apply filler full depth of joint in accordance with manufacturer's instructions, using the recommended application method except at electrostatic dissipation flooring.
  - 3.2.1.5. Keep joints clean
- 3.2.2. Moist/Wet Curing
  - 3.2.2.1. All new concrete shall be wet cured where scheduled as such, as follows:
    - (1) Curing Procedure: All interior concrete slabs shall be protected from premature drying for a minimum of five days, as required in ACI 301, using moisture-retaining cover. Previously used cover material that is clean, in good condition, and free of tears can be reused. Cover concrete surfaces with moisture-retaining cover, placed in widest practical width with sides



and ends lapped at least 75mm and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Remove curing cover and allow concrete to air dry for at least twelve (12) hours prior to applying liquid densifier/sealer.

(A) Acceptable Moisture-Retaining Cover:

- (a) "Transguard EG" by Reef Industries
- (b) "Hydrasorb 2" by Firstline Corp.
- (c) "UltraCure NCF" by McDonald Technology Group

3.2.3. Curing and Sealing Compounds

3.2.3.1. Apply curing and sealing compounds in accordance with manufacturer's directions and as required to properly cure and seal the surfaces.

3.2.3.2. Apply curing compounds immediately after final finishing.

3.2.4. Levelling and Floating

3.2.4.1. Strike off concrete after it is placed, level and flush and then level and consolidate with a wooden Darby or bullfloat. Complete levelling and consolidation before free moisture (bleeding) rises to surface.

3.2.4.2. When concrete has stiffened sufficiently to sustain foot pressure and after removing free bleed water, float concrete with hand or power float.

3.2.5. Steel Trowel Finish

3.2.5.1. After floating, trowel surface with steel hand or float trowel keeping blade flat at first and raising blade angle a little more on subsequent passes. Leave surface smooth, dense, of fine uniform texture without a swirl.

3.2.6. Slip Resistant Swirl Finish

3.2.6.1. During final trowelling, impart a slightly rough and textured surface to the concrete by spin trowelling, moving the trowel in a "swirling" or circular motion in such a way as to produce a spin trowelled (swirled) texture or pattern on the surface.

3.2.7. Broom Finish for Slip Resistance

3.2.7.1. After steel trowelling, lightly broom the surface with a bristle push broom to obtain a fine even texture finish.

### 3.3. SCHEDULE

3.3.1. .1 Following curing methods and finishes to be applied to corresponding surfaces:

SURFACE	CURING METHOD	CONCRETE FINISH
Exposed concrete floors and toppings and mechanical and electrical bases	Curing and sealing compound	Steel Trowel
Concrete to receive resilient flooring	Curing and sealing compound	Steel Trowel, Class A to CSA A23.1
Concrete to receive ceramic tile applied with thin-set bed or adhesive methods	Wet Cure (refer to 3.2.3)	Steel Trowel, Class A to CSA A23.1
Concrete to receive ceramic tile, brick/stone/precast concrete paving and flooring applied over mortar bed system; and to receive concrete topping	Wet cure (refer to 3.2.3)	wood float Class B to CSA A23.1
Concrete to receive special flooring, seamless flooring and similar, thin, fluid applied finishes including paint	Wet cure (refer to 3.2.3)	steel trowel, Class A to CSA A23.1
Concrete to receive carpet	curing and sealing compound	steel trowel, Class A to CSA A23.1
Concrete to receive roofing and waterproofing membranes except hot rubberized asphalt	Wet cure (refer to 3.2.3)	steel trowel, Class B to CSA A23.1

Concrete to receive hot rubberized asphalt membranes	curing and sealing compound	wood float Class B to CSA A23.1
Exposed concrete stair treads and landings	curing and sealing compound	Steel Trowel
Concrete to receive cementitious waterproofing	Wet cure (refer to 3.2.3)	Wood Float
Concrete to receive water repellent coatings	Wet cure (refer to 3.2.3)	Fine textured float
Exterior concrete paving	curing and sealing compound	Wood float finish with tooled edges and joints. Broom finish across ramped areas.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. The General Conditions of the Contract, Supplementary Conditions, and the General Requirements of Division 1, form part of this section, and must be read in conjunction with the requirements of this section. The work of this section shall comply with all requirements of Division 1 – General Requirements.
- 1.1.2. The Contractor shall, together with any and all Subcontractors involved in the work of this section, examine all surfaces or conditions relating to the Work, in order to determine the acceptability of such surfaces or conditions for the work of this section to commence.
- 1.1.3. Subcontractors shall report in writing, any observed defects or deficiencies in any surfaces or conditions that would adversely affect the work of this section, to the Contractor for correction prior to commencing the work of this section.
- 1.1.4. Commencement of the work of this section shall imply acceptance of all surfaces and conditions.

### **1.2. 1.2 SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. 1.2 Section Includes
- .3 1.3. 1.3 References
- .4 1.4. 1.4 Submittals
- .5 1.5. 1.5 Quality Assurance
- .6 1.6. Delivery, Storage And Handling
- .7 1.7. Project Conditions
- .8 2.1. Acceptable Manufacturers
- .9 2.2. Materials
- .10 2.3. Accessories
- .11 3.1. Acceptable Installers
- .12 3.2. Surface Conditions
- .13 3.3. Application
- .14 3.4. Workmanship And Cleaning
- .15 3.5. Protection

### **1.3. 1.3 REFERENCES**

- 1.3.1. ASTM-C779; Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
- 1.3.2. ASTM G23; Ultraviolet Light & Water Spray
- 1.3.3. ASTM C805; Impact Strength
- 1.3.4. ACI 302. 1R; Guide for Concrete Floor and Slab Construction

### **1.4. 1.4 SUBMITTALS**

- 1.4.1. Comply with provisions of Section 01 30 00.
- 1.4.2. Product Data
  - 1.4.2.1. Submit special concrete finishes manufacturer's specifications and test data.
  - 1.4.2.2. Submit special concrete finishes describing product to be provided, giving manufacturer's name and product name for the specified material proposed to be provided under this section.
  - 1.4.2.3. Submit special concrete finishes manufacturer's recommended installation procedures; which when approved by the Consultant, will become the basis for accepting or rejecting actual installation procedures used on the work.
  - 1.4.2.4. Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.

- 1.4.2.5. Submit special concrete finishes manufacturer's Material Safety Data Sheet (MSDS) and other safety requirements.
- 1.4.2.6. Follow all special concrete finishes published manufacturer's installation instructions.
- 1.4.3. Samples
  - 1.4.3.1. Submit samples of finishes, indicating levels of texture and sheen for approval by the Consultant.
- 1.4.4. Test Reports:
  - 1.4.4.1. Provide certified test reports, prepared by an independent testing laboratory, confirming compliance with specified performance criteria.

## **1.5. 1.5 QUALITY ASSURANCE**

- 1.5.1. Installer Qualifications:
  - 1.5.1.1. Use an experienced installer and adequate number of skilled workers thoroughly trained and experienced in the necessary craft.
  - 1.5.1.2. The special concrete finish manufacturer shall certify applicator.
  - 1.5.1.3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.
- 1.5.2. Manufacturer's Certification:
  - 1.5.2.1. Provide letter of certification from concrete finish manufacturer stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and installation requirements required by the manufacturer.
- 1.5.3. Mock-ups:
  - 1.5.3.1. Apply mock-ups of each type finish, to demonstrate typical joints, surface finish, color variation (if any), and standard of workmanship.
  - 1.5.3.2. Build mock-ups approximately 50 square feet in the location indicated or if not indicated, as directed by the Consultant.
  - 1.5.3.3. Notify Consultant seven days in advance of dates and times when mock-ups will be constructed.
  - 1.5.3.4. Obtain from the Consultant approval of mock-ups before starting construction.
  - 1.5.3.5. If the Consultant determines that mock-ups do not meet requirements, demolish and remove them from the site and cast others until mock-ups are approved.
  - 1.5.3.6. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.
  - 1.5.3.7. Approved mock-ups may become part of the completed work if undisturbed at time of substantial completion.
- 1.5.4. Protection
  - 1.5.4.1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from concrete surface. Prevention is essential.
  - 1.5.4.2. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
  - 1.5.4.3. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
  - 1.5.4.4. No pipe cutting machine will be used on the inside floor slab.
  - 1.5.4.5. Steel will not be placed on interior slab to avoid rust staining.
  - 1.5.4.6. Acids and acidic detergents will not come into contact with slab.
  - 1.5.4.7. All trades informed that the slab must be protected at all times.
- 1.5.5. Pre-Installation Conference:
  - 1.5.5.1. Conduct conference at project site to comply with Division 01.

## **1.6. DELIVERY, STORAGE AND HANDLING**

- 1.6.1. Deliver materials in original containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage.

- 1.6.2. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

## **1.7. PROJECT CONDITIONS**

- 1.7.1. Environmental Limitations:
  - 1.7.1.1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
  - 1.7.1.2. Concrete Floor Flatness rating recommended at least 40, where possible.
  - 1.7.1.3. Concrete Floor Levelness rating recommended at least 30, where possible.
  - 1.7.1.4. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before application of Retro Plate can begin.
- 1.7.2. Application of Retro-Plate shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.
- 1.7.3. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

## **2 PRODUCTS**

### **2.1. ACCEPTABLE MANUFACTURERS**

- 2.1.1. Advanced Floor Products, Inc., Provo, Utah (801-812-3420)

### **2.2. MATERIALS**

- 2.2.1. Hardening/Sealing Agent
  - 2.2.1.1. .1 Retro-Plate 99, by Advanced Floor Products, Inc.;
    - (1) Abrasion Resistance: ASTM C779 – Up to 400% increase in abrasion resistance.
    - (2) Impact Strength: ASTM C805 – Up to 21% increase impact strength.
    - (3) Ultra Violet Light and Water Spray: ASTM G23-81 – No adverse effect to ultra violet and water spray.
    - (4) Reflectivity: Up to 30% increase in reflectivity.
    - (5) Finish: grinding and polishing to 1500 grit.

### **2.3. ACCESSORIES**

- 2.3.1. Neutralizing Agent: Tri-sodium Phosphate
- 2.3.2. Water: Potable

## **3 EXECUTION**

### **3.1. ACCEPTABLE INSTALLERS**

- 3.1.1. Sentinel, 410 Industrial Rd., London, ON, or approved equivalent.

### **3.2. SURFACE CONDITIONS**

- 3.2.1. Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.
- 3.2.2. Verify that base slab meet finish and surface profile requirements in Project Conditions above.
- 3.2.3. Prior to application, verify that floor surfaces are free of construction latents.

### **3.3. APPLICATION**

- 3.3.1. Start any of the floor finish applications in presence of manufacturer's technical representative.
- 3.3.2. Sealing, Hardening and Polishing of Concrete Surface
- 3.3.3. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.

- 3.3.4. Application is to take place at least 10 days prior to racking and other in-store accessory installation, thus providing a complete, uninhibited concrete slab for application
- 3.3.5. Only a certified applicator shall apply Retro-Plate 99. Applicable procedures must be followed as recommended by the product manufacturer and as required to match approved test sample.
- 3.3.6. Achieve waterproofing, hardening, dust-proofing, and abrasion resistance of the surface without changing the natural appearance of the concrete, except for the sheen.
- 3.3.7. Polish to sheen level to match approved sample.

**3.4. WORKMANSHIP AND CLEANING**

- 3.4.1. The premises shall be kept clean and free of debris at all times.
- 3.4.2. Remove spatter from adjoining surfaces, as necessary.
- 3.4.3. Repair damages to surface caused by cleaning operations.
- 3.4.4. Remove debris from jobsite. Dispose of materials in separate, closed containers in accordance with local regulations.

**3.5. PROTECTION**

- 3.5.1. Protect finished work until fully cured in accordance with manufacturer's recommendations.

**END OF SECTION**

## **1 PART 1 – GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, and Handling
- .7 1.7. Field Conditions
- .8 1.8. Warranty
- .9 2.1. Materials
- .10 3.1. Workmanship
- .11 3.2. General Erection Tolerances
- .12 3.3. Laying Masonry Units
- .13 3.4. Exposed Masonry
- .14 3.5. Jointing
- .15 3.6. Built-In Work
- .16 3.7. Reinforced Masonry
- .17 3.8. Provision for Movement
- .18 3.9. Loose Lintels
- .19 3.10. Lateral Supports
- .20 3.11. Movement (Control) Joints
- .21 3.12. Temporary Bracing
- .22 3.13. Field Quality Control
- .23 3.14. Adjusting and Cleaning
- .24 3.15. Protection

### **1.3. SUMMARY**

- 1.3.1. Masonry procedures for masonry work.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
- 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in masonry assemblies.
- 1.4.3. Shop drawings:
- 1.4.3.1. Submit shop drawings for masonry unit wall assemblies indicating:
    - (1) Proposed locations of movement (control) joints.
    - (2) Types of masonry units, grade, texture, typical dimensions, colours, special shapes and shape dimensions.
    - (3) Layout/coursing for each type of masonry unit. Units are not to be cut without approval of the Consultant: Layout using full brick masonry units.
  - 1.4.3.2. Submit engineered shop drawings for the following:
    - (1) Masonry Reinforcement
    - (2) Masonry ties and connectors
- 1.4.4. Samples:
- 1.4.4.1. 2 of each type of brick masonry unit specified.
  - 1.4.4.2. 2 of each type of concrete masonry unit specified.
  - 1.4.4.3. 2 of each type of architectural concrete masonry unit specified including corner units and in varying degrees of "roughness" or texture.

- 1.4.4.4. 1 of each type of masonry accessory specified
- 1.4.4.5. 1 of each type of masonry reinforcement and tie proposed for use.
- 1.4.4.6. Pigmented mortar samples of each mortar color for colour match verification by Consultant
- 1.4.5. Masonry reinforcing and connector certification: Submit manufacturer's written certification that masonry reinforcing and connector Products supplied for the masonry parts of the *Work*, comply with CAN/CSA A370-15. Certification shall be typewritten and signed on manufacturer's letterhead and shall include lists and quantities of reinforcing and connector Products provided in the *Work*.

## 1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications:
  - 1.5.1.1. Installers / applicators / erectors:
    - (1) Provide work of this section, executed by competent installers with a minimum 5 years' experience in application of Products, systems and assemblies specified and with approval of *Product* manufacturers.
  - 1.5.1.2. Masonry Contractor's qualifications:
    - (1) Membership in good standing in Canadian Masonry Contractors Association (CMCA).
- 1.5.2. Mock-ups:
  - 1.5.2.1. Mortar colour selection mock-ups:
    - (1) Construct sample panels approximately 900 mm x 900 mm (36" x 36") of exterior masonry faced assemblies to determine acceptable mortar colour.
  - 1.5.2.2. Concrete block partition mock-ups; for partitions with transparent sealer or paint finishes:
    - (1) Construct sample panels approximately 900 mm x 900 mm (36" x 36") of concrete masonry partition assemblies.
  - 1.5.2.3. Quality control mock-ups for masonry veneer walls:
    - (1) Construct mock-up panel of each type of masonry veneered wall construction 3000 mm x 3000 mm (10' x 10') at locations designated by Consultant showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, mortar colours and workmanship.
    - (2) Select masonry units for use in mock-ups that represent the maximum variation in texture and colour.
    - (3) Mock-up shall remain in place until acceptance of masonry and as directed by the Consultant.
- 1.5.3. Accepted mock-ups may not remain as part of the completed *Work*.

## 1.6. DELIVERY, STORAGE, AND HANDLING

- 1.6.1. Deliver materials to the Place of the Work in dry condition.
- 1.6.2. Keep materials dry until use.
- 1.6.3. Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

## 1.7. FIELD CONDITIONS

- 1.7.1. Cold weather construction requirements:
  - 1.7.1.1. Comply with requirements of CAN/CSA A371-04, and as follows:

Air Temperature, °C	General requirements during construction
0 to 4	Sand or mixing water shall be heated to a minimum of 20°C and a maximum of 70°C.
-4 to 0	Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C.
-7 to -4	(1) Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C.



	(2) Source heat shall be provided on both sides of the walls under construction. (3) Windbreaks shall be employed when the wind speed exceeds 25 km/h.
-7 and below	(1) Sand and mixing water shall be heated to a minimum of 20°C and a maximum of 70°C. (2) Enclosures and supplementary heat shall be provided to maintain an air temperature above 0°C. (3) The temperature of the unit when laid shall be not less than 7°C

- 1.7.1.2. Grout shall be placed in masonry at a minimum temperature of 20°C and a maximum temperature of 50°C.
- 1.7.1.3. Mortar temperature shall not exceed 50°C to avoid flash set.
- 1.7.1.4. Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in winter.
- 1.7.2. Cold weather protection requirements:
  - 1.7.2.1. Comply with requirements of CAN/CSA A371-14, and Provide protection requirements for completed masonry or sections not in progress shall be as follows:

Mean daily air temperature, °C	Protection
0 to 4	Masonry shall be protected from rain or snow for 48 h
-4 to 0	Masonry shall be protected from rain or snow for 48 h
-7 to -4	Masonry shall be completely covered with insulating blankets for 48 h
-7 and below	The masonry temperature shall be maintained above 0°C for 48 h by enclosure and supplementary heat

- 1.7.3. Hot weather construction requirements:
  - 1.7.3.1. Comply with requirements of CAN/CSA A371-14, and as follows:
    - (1) The spreading of mortar beds shall be limited to 1.2 m, and the masonry units shall be set within 1 minute of spreading the mortar, when the air temperature is above:
      - (A) 38°C; or
      - (B) 32°C, with a wind velocity greater than 13 km/h.
  - 1.7.3.2. Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
- 1.7.4. Masonry units, cementitious materials, and sand stored on site shall be protected from contaminants and shall not be wetted by rain, snow, or groundwater. Other materials and components to be installed by the mason shall be handled and stored in accordance with the manufacturer's instructions.
- 1.7.5. When work is not in progress, the exposed top surfaces of masonry shall be covered to prevent intrusion of precipitation with non-staining coverings. The cover shall extend a minimum of 600 mm (24") down both sides and shall be held securely in place until masonry work is protected by flashings or other permanent construction. Ensure that coverings are secured to resist wind loads.

## 1.8. WARRANTY

- 1.8.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.8.2. Extended warranty:
  - 1.8.2.1. Labour, materials, and workmanship for work of this section.
  - 1.8.2.2. Duration: 2 years.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Mortar and grout for masonry: in accordance with Section 04 05 13.
- 2.1.2. Masonry reinforcement and connectors: in accordance with Section 04 05 19.
- 2.1.3. Masonry accessories: in accordance with Section 04 05 23.
- 2.1.4. Brick masonry units: in accordance with Section 04 21 00.
- 2.1.5. Concrete masonry units: in accordance with Section 04 22 00.
- 2.1.6. Architectural concrete masonry units: in accordance with Section 04 22 00.

## **3 EXECUTION**

### **3.1. WORKMANSHIP**

- 3.1.1. Build masonry plumb, level, and true to line, with vertical joints in proper alignment. Lay masonry to tolerances specified in CAN/CSA A371-14.
- 3.1.2. Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- 3.1.3. Masonry mortar and grout work: CAN/CSA A179-14 except where specified otherwise.
- 3.1.4. Masonry work: CSA S304.1-14, CAN/CSA A370-14 and CAN/CSA A371-14 except where specified otherwise.

### **3.2. GENERAL ERECTION TOLERANCES**

- 3.2.1. Lay masonry units with required mortar joint thickness specified below, not to exceed 12.7 mm (1/2").
- 3.2.2. Construction tolerances:
  - 3.2.2.1. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arrises:
    - (1) 6.4 mm (1/4") in 3 m (10').
    - (2) 9.6 mm (3/8") in a storey height not to exceed 6 m (20').
    - (3) 12.7 mm (1/2") in 12 m (40') or more.
  - 3.2.2.2. Maximum variation from plumb for external corners, expansion joints and other conspicuous lines:
    - (1) 6.4 mm (1/4") in any story or 6 m (20') maximum.
    - (2) 12.7 mm (1/2") in 12 m (40') or more.
  - 3.2.2.3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
    - (1) 6.4 mm (1/4") in any bay or 6 m (20').
    - (2) 12.7 mm (1/2") in 12 m (40') or more.
  - 3.2.2.4. Maximum variation from plan location of related portions of columns, walls and partitions:
    - (1) 12.7 mm (1/2") in any bay or 6 m (20').
    - (2) 19 mm (3/4") in 12 m (40') or more.
  - 3.2.2.5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on drawings:
    - (1) Minus 6.4 mm (1/4").
    - (2) Plus 12.7 mm (1/2").
  - 3.2.2.6. Where masonry surfaces serve as substrate for thin-set tile and direct applied and insulated finish coatings, build to tolerance of 3.2 mm in 2440 mm (1/8" in any 8') under a straight edge.

### **3.3. LAYING MASONRY UNITS**

- 3.3.1. Coursing design:
  - 3.3.1.1. Brick masonry units: Fifty percent running bond.
  - 3.3.1.2. Concrete masonry units: 1/3 running bond.
  - 3.3.1.3. Architectural concrete masonry units: Fifty percent running bond.
- 3.3.2. Installation and materials shall meet or exceed that of accepted samples and mock-up.

- 3.3.3. Units shall be cut only upon acceptance of the Consultant. Walls are to be laid-up with full size masonry units.
- 3.3.4. Keep cavity space at cavity and/or veneer walls clear of mortar droppings and debris.
- 3.3.5. Remove loose and foreign materials from supporting bed surfaces to ensure bonding.
- 3.3.6. Do not tooth at wall terminations. Rake back ½ unit length where stop-off occurs in horizontal run of masonry.
- 3.3.7. Do not install masonry units with face or faces exhibiting chips, cracks, blemishes, texture variation, and other imperfections detracting from appearance when viewed from distance of 4600 mm (15').
- 3.3.8. Do not install defective, cracked, and broken masonry units.
- 3.3.9. Mixing and blending: Mix units from a minimum of 3 pallets to ensure uniform blend of colour and texture and comply with manufacturer's recommended installation instructions. Distribute masonry units of varying textures to avoid spotty appearance over wall surfaces exposed to view. Do not use units which contrast too greatly with overall range.
- 3.3.10. Maintain bracing of walls and piers continuously during construction until structure provides support.
- 3.3.11. Locate bearings and piers as indicated. Provide solid masonry units at bearings. Grout under bearing plates installed on masonry with non-shrink grout.
- 3.3.12. Extend masonry and partitions to deck, slab or structural members, as applicable, except where otherwise noted in the Contract Documents. Incorporate both lateral support and deflection space at termination of walls as required by this Section.
- 3.3.13. Grouted reinforced masonry: incorporate reinforcing steel and construct masonry to indicated requirements.
- 3.3.14. Lay masonry level, true to line, square, plumb, and as indicated. Lay masonry courses in vertical alignment to ensure vertical joints align for full height of masonry and full height of building face.
- 3.3.15. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.
- 3.3.16. Fully bond intersections, and external corners.
- 3.3.17. Do not adjust masonry units after placement. Where resetting of masonry is required, remove units, clean and reset in new mortar.
- 3.3.18. Cut masonry around obstructions, leaving maximum joint size as specified in this section (below).
- 3.3.19. Build chases, do not cut them.
- 3.3.20. Lay hollow concrete masonry units so that shells rest and align.
- 3.3.21. Exposed cuts shall be made clean and true with a suitable masonry saw.

#### **3.4. EXPOSED MASONRY**

- 3.4.1. Do not lay chipped, cracked, blemished, and otherwise damaged units in exposed masonry.
- 3.4.2. Do not lay chipped, cracked, and otherwise damaged units in concealed masonry.
- 3.4.3. Do not lay concrete masonry units that will appear smooth or slick where exposed to view, whether painted or not finished.
- 3.4.4. Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
- 3.4.5. Maintain and control water-to-cement ratio, rate of hydration, environmental conditions, tooling of the mortar joints, and cleaning procedures, to produce masonry of uniform appearance matching accepted mock-up.

#### **3.5. JOINTING**

- 3.5.1. Form tooled mortar joints whenever exposed to view, and behind cabinets, fitments, and wall accessories. Tool when mortar is thumb-print hard by tools having long bearing surface to avoid uneven depressions. Close cracks and crevices.
- 3.5.2. Tool with non-staining pointing tool to Provide smooth, compressed, uniformly formed joints as follows:
  - 3.5.2.1. For exposed brick masonry: Concave.

- 3.5.2.2. For exposed concrete unit masonry: Concave.
- 3.5.2.3. For exposed architectural concrete unit masonry: Concave.
- 3.5.2.4. For concealed masonry: strike flush joints concealed in walls and joints in walls to receive plaster, stucco, tile, insulation, resilient bases, or other applied material except paint or similar thin finish coating. Ensure that no mortar protrudes from joints on wall surfaces to receive materials and coatings.
- 3.5.2.5. Joint thickness:
  - (1) Maintain mortar joint thickness of 10 mm (3/8"), unless otherwise specified or indicated.
  - (2) At masonry cut around obstructions: maximum joint size of 13 mm (1/2").
- 3.5.3. Make joints of uniform thickness with vertical joints in alignment.
- 3.5.4. Trowel point joints in unparged masonry at below grade locations in contact with earth.
- 3.5.5. Form reglets where indicated for metal flashing in masonry.
- 3.5.6. Remove loose or defective mortar when masonry is removed and replace.
- 3.5.7. Rake out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed. These joints shall be sealed in accordance with Section 07 92 00.

### **3.6. BUILT-IN WORK**

- 3.6.1. Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- 3.6.2. Coordinate and cooperate in the provisions for setting, anchorage and alignment of built-in work.
- 3.6.3. Metal door frames:
  - 3.6.3.1. Build masonry around metal door frames.
  - 3.6.3.2. Ensure that anchors are secured solidly, and that frames are true and plumb.
  - 3.6.3.3. Fill back void of frames with Type N or S mortar unless otherwise indicated.
  - 3.6.3.4. Protect frame with protective covering and leave no mortar on exposed frame faces.

### **3.7. REINFORCED MASONRY**

- 3.7.1. Conform to requirements of CAN/CSA A371-14.
- 3.7.2. Grout beneath bearing plates: Fill voids beneath steel bases bearing on masonry with approved non-shrink grout having minimum compressive strength at 28 Days cure time of 35 MPa. In addition, use non-ferrous grout where grout is exposed to view, in-service moisture conditions, and weather.
- 3.7.3. Reinforced block lintels:
  - 3.7.3.1. Install reinforced block lintels over doorways, other openings and recesses as indicated.
  - 3.7.3.2. Support masonry units of reinforced block lintels built in place. Provide a level platform, true to the proper elevation and of sufficient strength to support the load without visible deflection. Maintain supports in place for a minimum of 7 Days and for a period sufficient to permit the concrete to cure and gain sufficient strength to safely support all loads.
  - 3.7.3.3. Lay masonry units with full mortar coverage on abutting edges with joints shoved tight. Where masonry construction is continued above the lintel, place the first course of masonry units on the lintel in full mortar bed.
  - 3.7.3.4. Fill voids of masonry units that form the fill depth of lintel beams at one time per beam, with grout having minimum compressive strength at 28 Days curing time of 35 MPa.

### **3.8. PROVISION FOR MOVEMENT**

- 3.8.1. Deflection space:
  - 3.8.1.1. Incorporate deflection space between tops of non-load-bearing walls/partitions and structure to prevent transference of structural loads to masonry.
    - (1) Exterior masonry wall deflection space: 12.7 mm (1/2").

(2) Interior masonry partition deflection space: 25 mm (1").

3.8.2. Coordinate work of this section with installation of lateral supports.

### **3.9. LOOSE LINTELS**

3.9.1. Loose lintels: Install loose lintels as required to suit required openings. Set and level lintels, centred over opening width, on a 20 mil PVC slip-sheet membrane, placed over bed or mortar. Allow suitable movement joint at ends of lintels for expansion and contraction movement at exterior lintels.

### **3.10. LATERAL SUPPORTS**

3.10.1. In addition to requirements of the Contract Documents, Provide horizontal and vertical wall and partition lateral support anchors in accordance with CAN/CSA A370-14.

### **3.11. MOVEMENT (CONTROL) JOINTS**

- 3.11.1. For masonry without openings, space vertical movement joints at no more than 7620 mm (25') on centre.
- 3.11.2. For masonry with multiple openings, Provide symmetrical placement of movement joints and reduced spacing of no more than 6096 mm (20 ft) on center.
- 3.11.3. Place movement joints at changes in wall direction, changes in building heights, at door and window locations where necessary and directed, at major changes in thickness of wall.
- 3.11.4. Extend control (movement) joints to top of masonry, including parapets.
- 3.11.5. Review and coordinate control joint locations with the Consultant prior to installation of masonry.

### **3.12. TEMPORARY BRACING**

3.12.1. Provide adequate temporary bracing to masonry walls until floor and roof decks are installed and can develop adequate diaphragm action to brace walls.

### **3.13. FIELD QUALITY CONTROL**

3.13.1. Conduct quality control in accordance with Section 01 45 00 and perform field control tests in accordance with CSA S304.1-14.

### **3.14. ADJUSTING AND CLEANING**

- 3.14.1. Protect masonry and adjacent work from damage from cleaning work.
- 3.14.2. Clean masonry in accordance with masonry manufacturer's printed instructions. Remove masonry and install new masonry, if masonry is damaged by cleaning work.
- 3.14.3. Use proprietary PH-neutral cleaning solution with water as approved by manufacturer of masonry units in accordance with manufacturer's written directions.
- 3.14.4. Test cleaning agent and procedures by cleaning small, inconspicuous sample location prior to commencement of overall cleaning work. Review cleaning test area with the Consultant and obtain acceptance in writing prior to cleaning remainder of areas requiring cleaning.
- 3.14.5. Soak wall with clean water and flush off loose dirt and mortar.
- 3.14.6. Apply specified cleaning agent in accordance with the manufacturer's direction, working from top to bottom.
- 3.14.7. Rinse areas thoroughly with clean water to remove cleaning solutions, dirt, and mortar residue.
- 3.14.8. Remove mortar from exposed masonry face immediately after pointing and prior to full set to avoid mortar staining of masonry units. Remove efflorescence and mortar deposits from surfaces to receive coatings and surfaces which are exposed to view. Remove masonry and install new masonry, if mortar staining cannot be removed without damaging masonry work.
- 3.14.9. Remove mortar droppings from flashings and other materials immediately to prevent damage and discolouration.

- 3.14.10. Remove efflorescence and mortar deposits from surfaces to receive coatings or surfaces which are exposed to view, occurring within a time period of 1 year after date of Substantial Performance of the Work as required by the Consultant or the Owner.

### **3.15. PROTECTION**

- 3.15.1. Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- 3.15.2. Protect other materials and finishes from contamination by mortar droppings.
- 3.15.3. Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Delivery, Storage, And Handling
- .6 1.6. Field Conditions
- .7 2.1. Materials
- .8 2.2. Material Source
- .9 2.3. Mortar Types
- .10 2.4. Mortar Colour
- .11 2.5. Grout Types
- .12 3.1. Masonry Procedures
- .13 3.2. Measurement And Mixing
- .14 3.3. Grout
- .15 3.4. Field Quality Control
- .16 3.5. Protection

### **1.3. SUMMARY**

- 1.3.1. Mortar and grout for masonry work.
- 1.3.2. Pigmented mortar at following masonry assemblies; locations as indicated:
  - 1.3.2.1. Brick masonry units.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00 and Section 04 05 00.
- 1.4.2. Test and evaluation reports: Submit test results confirming compliance of aggregates with CAN/CSA A179-14.

### **1.5. DELIVERY, STORAGE, AND HANDLING**

- 1.5.1. Protect cementitious materials against moisture.
- 1.5.2. Prevent contamination by foreign materials, and freezing.

### **1.6. FIELD CONDITIONS**

- 1.6.1. Heat materials as follows to produce mortar temperature between 4°C and 50°C:
  - 1.6.1.1. When air temperature is between 4°C and 0°C, heat either sand or water to produce specified mortar temperature.
  - 1.6.1.2. When air temperature is below 0°C, heat both sand and water to produce specified mortar temperature.
  - 1.6.1.3. Do not heat water or sand above 50°C.
  - 1.6.1.4. Produce mortar batches subsequent to the first within plus 6°C of the first.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Mortar and grout: Comply with CAN/CSA A179-14.
- 2.1.2. Portland cement: to CSA A3001-08, Type 10. For exposed mortar, maintain uniformity of cement manufacturer and batch for colour uniformity.
- 2.1.3. Hydrated lime: to ASTM C207-06(2011), Type S.
- 2.1.4. Sand: to CAN/CSA A179-04.

- 2.1.5. Integral water repellent mortar admixture; for block walls using block with water repellent admixture:
  - 2.1.5.1. Integral liquid or dry polymer admixture for mortar added during mixing or at the factory, compatible with integral water repellent admixture used in concrete masonry units.
  - 2.1.5.2. Water permeance of masonry: capable of achieving a Class E Rating when evaluated using ASTM E514/E514M-20 with the test extended to 72 hours, using the rating criteria specified in ASTM E514/E514M-20.
  - 2.1.5.3. Maintain Product uniformity with integral water repellent admixture used in concrete masonry units.
  - 2.1.5.4. Acceptable Products:
    - (1) In accordance with architectural concrete masonry unit manufacturer's written requirements. Refer to Section 04 22 23
- 2.1.6. Mortar pigment:
  - 2.1.6.1. Mortar colours shall contain pure, concentrated mineral pigments especially processed for mixing into mortar and complying with ASTM C979-05.
  - 2.1.6.2. Allow for blended mortar pigment colours to match each type of masonry veneer.
    - (1) Colours: to be selected by *Consultant*.
      - (A) Colours shall be selected from full pricing range.
    - (2) Loading (% of cementing material):
      - (B) 3% (half loading).
      - (C) 6% (full-loading).
  - 2.1.6.3. Acceptable manufacturers:
    - (1) Davis Colors 'True Tone Sweet 16 Cement Colors'.
    - (2) Lanxess Corporation 'Bayferrox Iron Oxide Pigments'.
    - (3) Solomon Colors, Inc. 'Concentrated Mortar Colors'.
    - (4) Or equivalent.

## **2.2. MATERIAL SOURCE**

- 2.2.1. Mortar and grout shall be factory prepared premix including sand and colour. Site mixing of bags and sand will not be accepted. Use mortar and grout as supplied by silo batched systems.
- 2.2.2. Maintain uniformity of mortar material manufacturers, mortar materials and source of aggregate throughout the Work.

## **2.3. MORTAR TYPES**

- 2.3.1. Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type S.
- 2.3.2. Mortar for exterior masonry above grade:
  - 2.3.2.1. Loadbearing: Type S.
  - 2.3.2.2. Non-loadbearing: Type N.
  - 2.3.2.3. Mortar foreterior exposed masonry veneer: Type N, Portland Cement/Lime/Sand mix.
- 2.3.3. Mortar for interior masonry; ready (silo) mixed:
  - 2.3.3.1. Loadbearing: Type S.
  - 2.3.3.2. Non-loadbearing: Type N.

## **2.4. MORTAR COLOUR**

- 2.4.1. Mortar colour; for use as indicated, ready (silo) mixed mortar:
  - 2.4.1.1. Except where pigmented mortar is specified or indicated: Control mortar materials and workmanship to produce uniform grey colour (non-pigmented).

## **2.5. GROUT TYPES**

- 2.5.1. Grout for masonry: Grout to CAN/CSA A179-14.



- 2.5.1.1. Compressive strength in accordance with CAN/CSA A179-14 except where indicated otherwise and except as follows:
  - (1) 20 MPa minimum unless otherwise indicated.
  - (2) Beneath bearing plates: 35 MPa.
- 2.5.1.2. Slump: 200 mm (8") unless otherwise indicated.
- 2.5.2. Grout for hollow metal frames: Fine grout in accordance with CAN/CSA A179-14.
- 2.5.2.1. Compressive strength: 15 MPa minimum.

### **3 EXECUTION**

#### **3.1. MASONRY PROCEDURES**

- 3.1.1. Masonry procedures shall be in accordance with Section 04 05 00 as supplemented herein.
- 3.1.2. Comply with CAN/CSA A179-14, except where indicated otherwise.

#### **3.2. MEASUREMENT AND MIXING**

- 3.2.1. Mix mortars and grout as specified in CAN/CSA A179-14. Use only dry aggregate. Test for bulking to determine accurate proportioning.
- 3.2.2. Adjust water in mortar mix to suit absorption rates of masonry units.
- 3.2.3. Concrete grout: mix as required to achieve specified compressive strength.

#### **3.3. GROUT**

- 3.3.1. Place and grout reinforcing and bearing in accordance with Section 04 05 00, CAN/CSA A371-14, and as indicated.

#### **3.4. FIELD QUALITY CONTROL**

- 3.4.1. Provide mortar for strength testing in accordance with CAN/CSA A179-14 and Section 01 45 00.
- 3.4.2. For pigmented mortars, in order to maintain uniformity of mortar pigment throughout the Work, make visual inspections of cement shade for each cement delivery and compare against future shipments. Cements exhibiting shade differences such that final colour of pigmented mortar will not be uniform throughout the Work or will not match the approved sample, shall be rejected and replaced at no additional cost to the Owner.

#### **3.5. PROTECTION**

- 3.5.1. Provide protection where required at mixing areas to prevent damage attributed to materials of this Section.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 2.1. Materials
- .6 3.1. Movement (Control) Joints
- .7 3.2. Horizontal Reinforcing
- .8 3.3. Masonry Veneer Connectors
- .9 3.4. Reinforced Masonry
- .10 3.5. Bolts and Anchors
- .11 3.6. Lateral Support and Anchorage

### **1.3. SUMMARY**

- 1.3.1. Masonry reinforcing and anchorage.
- 1.3.2. Connectors for anchorage of masonry veneer to the following support assemblies:
  - 1.3.2.1. Concrete unit masonry.
  - 1.3.2.2. Wind bearing metal studs.
- 1.3.3. Horizontal reinforcing for masonry block wall and partition assemblies.

### **1.4. SUBMITTALS**

- .12 Submit required submittals in accordance with Section 01 33 00 and Section 04 05 00.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. General: in accordance with the Ontario Building Code and CAN/CSA A370-14.
- 2.1.2. Corrosion protection; metal materials: in accordance with the Ontario Building Code and CAN/CSA A370-14:
  - 2.1.2.1. Hot dipped after fabrication to ASTM A1064/A1064M-18a, and ASTM A153/A153M-09 Class B2 (457 g/m<sup>2</sup>).
    - (1) Interior to air barrier location: Use mill galvanized.
  - 2.1.2.2. For metal located exterior to the air barrier membrane: Stainless steel Type 304/316.
- 2.1.3. Joint reinforcement: Acceptable manufacturers:
  - 2.1.3.1. Blok-Lok
  - 2.1.3.2. Or equivalent (substitutions in accordance with Section 01 25 00).
    - (1) Exterior wall assemblies: 4.75 mm (3/16") wire, welded rod, ladder design unless otherwise indicated.
    - (2) Interior wall assemblies: 9 gauge mill galvanized wire ladder reinforcement.
- 2.1.4. Exterior masonry veneer connectors for connection to concrete masonry unit back-up:
  - 2.1.4.1. Description: Stainless steel ASTM A666-15 Type 304 or 316 formed plate construction, wire V-TIE or TRI-TIE masonry veneer connector (4.76 mm (3/16") cold drawn stainless steel Type 304 or 316 to ASTM A580/A580M-15), stainless steel or polyethylene insulation securement plates for insulation sheathing:
  - 2.1.4.2. Acceptable Products:
    - (1) Blok-Lok Limited 'BL-507/BL-507S Shear Anchor'.

- (2) Fero 'Slotted Block Tie (Type 1)' /Block Shear Connector'.
    - (3) Or equivalent.
  - 2.1.5. Masonry veneer connectors; stud back-up (installed on top of air barrier membrane and sheathing material):
    - 2.1.5.1. Description: Stainless steel ASTM A666-15 Type 304 or 316 plate construction, wire V-TIE or TRI-TIE masonry veneer connector (4.76 mm (3/16")) cold drawn stainless steel Type 304 or 316 to ASTM A580/A580M-15), stainless steel or polyethylene insulation securement plates for insulation sheathing:
    - 2.1.5.2. Acceptable Products:
      - (1) Blok-Lok 'BL-407'.
      - (2) Fero 'Slotted Rap-Tie'.
      - (3) Or equivalent.
    - 2.1.5.3. Fasteners: minimum of 2 screws per tie, No. 12, Climaseal coated galvanized steel, self-drill type, #10 minimum.

### **3 EXECUTION**

#### **3.1. MOVEMENT (CONTROL) JOINTS**

- 3.1.1. Installation requirements in accordance with Section 04 05 00 and as supplemented herein.
- 3.1.2. Stop reinforcing 25 mm (1") short of each side of control joints unless otherwise indicated.

#### **3.2. HORIZONTAL REINFORCING**

- 3.2.1. Joint reinforcement:
  - 3.2.1.1. Install horizontal joint reinforcement in cavity walls, solid walls, and partitions in accordance with CAN/CSA A371-04 and as indicated in the Contract Documents, the more stringent requirements shall govern.
  - 3.2.1.2. Place reinforcement continuously in horizontal joints at vertical spacing not exceeding 400 mm (16"), beginning with course 400 mm (16") above bearing, unless otherwise indicated.
  - 3.2.1.3. Do not carry reinforcement through intersections where lateral support anchors are installed, at intersections of walls and partitions with solid piers and at block control joints.
  - 3.2.1.4. Reinforcement shall be lapped 300 mm (12"), minimum, with laps staggered 750 mm (30"), minimum, from course to course. Any cross wires in the lap length of the lapped reinforcement shall be removed.

#### **3.3. MASONRY VENEER CONNECTORS**

- 3.3.1. Tie masonry veneer to structural backing in accordance with CAN/CSA A370-14 with masonry veneer connectors at following maximum spacing:
  - 3.3.1.1. Maximum spacing unless otherwise indicated: 600 mm (24") vertically x 820 mm (32") horizontally.
  - 3.3.1.2. Stud back-up assemblies: 600 mm (24") vertically and 400 mm (16") horizontally. Ties are permitted be staggered horizontally on alternating studs provided the stud spacing does not exceed 410 mm (16") o.c. and the resulting horizontal tie spacing does not exceed 820 mm (32") o.c. The stagger shall be arranged so that all studs have ties including the top row of ties.
  - 3.3.1.3. At openings in masonry walls: 600 mm (24") apart around opening, and not more than 300 mm (12") from edge of opening.
  - 3.3.1.4. At tops and bottoms of walls: 300 mm (12") from edge of top of wall, and 400 mm (16") from edge of bottom support.
  - 3.3.1.5. At movement joints: 300 mm (12") from joint.

#### **3.4. REINFORCED MASONRY**

- 3.4.1. Reinforce masonry lintels and bond beams as indicated. Make joints in lintels and bond beams to match adjacent walls.

- 3.4.2. Reinforce masonry walls as indicated on the structural drawings.
- 3.4.3. Place and grout reinforcing in accordance with CSA S304.14. Use concrete of 20 MPa strength in accordance with Section 03 30 00.
- 3.4.4. Provide minimum 150 mm (6") bearing on supports for lintels.
- 3.4.5. Place 100% solid block at each jamb under lintels.

**3.5. BOLTS AND ANCHORS**

- 3.5.1. Embed bolts and anchors solidly in mortar or grout to develop maximum resistance to design forces.

**3.6. LATERAL SUPPORT AND ANCHORAGE**

- 3.6.1. Install lateral support and anchorage in accordance with CAN/CSA A370-14 and as indicated on the structural Drawings.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 2.1. Materials
- .6 3.1. Masonry Installation And Procedures
- .7 3.2. Control Joints
- .8 3.3. Vents
- .9 3.4. Masonry Flashing
- .10 3.5. Insulation Attachments And Sealing
- .11 3.6. Cavity Firestopping
- .12 3.7. Cavity Drainage Material
- .13 3.8. Deflection Space Filler
- .14 3.9. Slip Sheet At Metal Lintels

### **1.3. SUMMARY**

- 1.3.1. Movement (control) joint filler at masonry veneer.
- 1.3.2. Cavity drainage material at exterior masonry cavity walls.
- 1.3.3. Masonry through wall membrane flashing at exterior masonry wall assemblies.
- 1.3.4. Metal flashing at masonry wall assemblies.
- 1.3.5. Cavity firestopping materials at exterior cavity masonry wall assemblies.
- 1.3.6. Deflection space filler at top of non-fire rated masonry partitions.
- 1.3.7. Deflection space filler at top of fire-rated masonry partitions.
- 1.3.8. Preformed movement (control) joint filler at concrete walls/partition assemblies.
- 1.3.9. Slip-sheet membrane for steel lintel bearing over masonry to allow lintel movement (thermal expansion/contraction)

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00 and Section 04 05 00.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Movement (control) joint filler at masonry veneer: sealant and backer rod in accordance with Section 07 92 00.
- 2.1.2. Movement joint filler; concrete block wythes:
  - 2.1.2.1. PVC, designed to fit into sash grooves.
  - 2.1.2.2. Acceptable Product: Blok-Lok 'VS Series'.
    - (1) Hohmann & Barnard Inc '341 Series Round Plastic Weep Holes'.
- 2.1.3. Cavity drainage material: Free-draining mesh made from polymer strands or extruded polypropylene formed cavity units to suit cavity depth, that will not degrade within the wall cavity.
  - 2.1.3.1. Acceptable Products: Subject to compliance with requirements, provide one of the following:
    - (1) Advanced Building Products Inc. 'Mortar Break DT'.
    - (2) Blok-Lok 'Mortar Trap'.
    - (3) Mortar Net Solutions 'MortarNet'.
    - (4) Wire-Bond 'Cavity Net DT'.
- 2.1.4. Masonry through wall flashing:
  - 2.1.4.1. Sheet membrane:

- (1) Single source responsibility: Components required for complete air barrier system and through wall flashing membrane behind the opaque wall assemblies to be obtained from single manufacturer. Coordinate with Section 07 27 00.
  - (2) Primer: as per manufacturer's installation requirements.
  - (3) SBS rubberised asphalt compound integrally laminated to cross laminated polyethylene film.
  - (4) Overall thickness: 1 mm (40 mils).
  - (5) Film thickness: 0.203 mm (8 mils).
  - (6) Service temperature: -40 °C to 70 °C.
  - (7) Acceptable Products:
    - (A) Carlisle Coatings & Waterproofing: CCW-705 TWF.
    - (B) GCP Applied Technologies 'Perm-A-Barrier Wall Flashing'.
    - (C) Henry Company 'Bakor Blueskin TWF'.
    - (D) Soprema 'Sopraseal Stick 130-S'.
    - (E) Tremco 'ExoAir TWF'.
    - (F) W.R. Meadows 'Air-Shield Thru-Wall Flashing'.
- 2.1.5. Metal flashing:
- 2.1.5.1. 0.457 mm (26 gauge SWG) minimum thickness, commercial quality in accordance with ASTM A653/A653M-13 with Z275 designation zinc coating, CSSBI 10000 Series baked enamel finish, standard colour as selected by Consultant, in accordance with Section 07 62 00.
  - 2.1.5.2. Lap sealant: Henry Company 'Air-Bloc 21'.
    - (1) Acceptable Products:
      - (G) Sika "Sikaflex 15 LM".
- 2.1.6. Cavity firestopping materials:
- 2.1.6.1. Mineral type in accordance with Section 07 84 00.
- 2.1.7. Deflection space filler (non-fire rated walls):
- 2.1.7.1. Acceptable Product:
    - (1) Johns Manville 'MinWool Sound Attenuation Fire Batts'.
    - (2) Rockwool 'AFB'.
- 2.1.8. Deflection space filler (fire rated walls):
- 2.1.8.1. Mineral type in accordance with Section 07 84 00.
- 2.1.9. Slip-sheet flashing membrane (for loose lintel bearing locations):
- 2.1.9.1. Minimum 0.5 mm (0.020") thick, PVC membrane, low temperature flexible to 40°C below zero.
  - 2.1.9.2. .2 Acceptable Products:
    - (1) Blok-Lok 'Flex-Flash'.
    - (2) Lexcor F20
- 2.1.10. Weep vents: Full height of masonry unit, designed to keep weep hole open for passage of air and water, UV stabilized polypropylene.
- 2.1.10.1. Size: Height of head joint x depth of masonry unit x thickness of mortar joint.
  - 2.1.10.2. Colour: to later selection by Consultant from manufacturer's full range.
  - 2.1.10.3. Acceptable Product:
    - (1) Advanced Building Products, Inc. 'Mortar Maze Cell-Vents'.
    - (2) Blok-Lok Limited 'Cell-Vent'.
    - (3) Mortar Net Solutions 'CellVent'.
    - (4) Wire-Bond 'Cell-Vent'.

### 3 EXECUTION

#### 3.1. MASONRY INSTALLATION AND PROCEDURES

- 3.1.1. Masonry installation and procedures shall be in accordance with Section 04 05 00, as supplemented herein.

### **3.2. CONTROL JOINTS**

- 3.2.1. Installation requirements in accordance with Section 04 05 00 and as supplemented herein.
- 3.2.2. Keep control joints clear for application of joint sealants.
- 3.2.3. Install control joint filler in accordance with manufacturer's recommendations.

### **3.3. VENTS**

- 3.3.1. Install weep vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at uniform and consistent horizontal spacing not exceeding 610 mm (24"). Do not locate vents within 610 mm (24") adjacent to corners of buildings.

### **3.4. MASONRY FLASHING**

- 3.4.1. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- 3.4.2. Install flashing as follows unless otherwise indicated:
  - 3.4.2.1. Install flashings in masonry in accordance with CAN/CSA A371-14.
  - 3.4.2.2. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal laps and penetrations in flashing watertight in accordance with manufacturer's installation requirements.
  - 3.4.2.3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and project face of sheathing or inner wythe minimum of 150 mm (6"); with upper edge tucked under air/vapour barrier membrane and fully adhered to substrate unless otherwise indicated, lap joints minimum of 100 mm (4").
  - 3.4.2.4. At lintels and shelf angles, extend flashing a minimum of 150 mm (6") into masonry at each end. At heads and sills, extend flashing minimum of 150 mm (6") at ends and turn up 50 mm (2") minimum to form end dams.
  - 3.4.2.5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 12.7 mm (1/2") back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 3.4.2.6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
  - 3.4.2.7. Flashings shall be installed to shed water in masonry cavity to exterior. Make flashings watertight.
  - 3.4.2.8. Install masonry flashing to perform as dampproof course in walls that extend below grade except walls which are not exposed to moisture or protected by moisture retarding materials. Locate more less than 150 mm (6") above finished grade.

### **3.5. INSULATION ATTACHMENTS AND SEALING**

- 3.5.1. Clip insulation tightly to concrete/concrete block substrate with one clip per masonry tie and as required to securely clip each insulation piece.
- 3.5.2. Where insulation clips are not possible, adhere using insulation adhesive as specified in Section 07 21 00.
- 3.5.3. Refer to requirements of Section 07 21 00 with respect to edge buttering of rigid insulation boards and sealing penetrations.

### **3.6. CAVITY FIRESTOPPING**

- 3.6.1. Friction fit cavity firestopping in accordance with manufacturer's installation requirements.
- 3.6.2. Locate and install in continuous rows at maximum horizontal spacing of 20 m (65'7") on centre.

**3.7. CAVITY DRAINAGE MATERIAL**

- 3.7.1. Install cavity drainage units over weep hole vents, flashings, in exterior wythes of masonry cavity and veneer wall construction.
- 3.7.2. Install free-draining mesh units in continuous manner for full cavity length and depth.

**3.8. DEFLECTION SPACE FILLER**

- 3.8.1. Non-fire rated walls: Fill deflection space with deflection space filler. Where deflection space is exposed, tamp filler into deflection space 25 mm (1").
- 3.8.2. Fire-rated walls: Refer to requirements of Section 07 84 00.

**3.9. SLIP SHEET AT METAL LINTELS**

- 3.9.1. Install slip sheet at loose lintel locations between bearing area of lintel and bed. Trim away exposed slip sheet.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Delivery, Storage And Handling
- .5 1.5. Administrative Requirements
- .6 1.6. Submittals
- .7 2.1. Materials
- .8 2.2. Fabrication Tolerances
- .9 3.1. Examination
- .10 3.2. Cutting Masonry Units
- .11 3.3. Wetting Masonry Units
- .12 3.4. Coursing
- .13 3.5. Placing And Bonding
- .14 3.6. Site Tolerances
- .15 3.7. Field Quality Control
- .16 3.8. Adjusting And Cleaning
- .17 3.9. Protection

### **1.3. SUMMARY**

- 1.3.1. Calcium Silicate Brick.

### **1.4. DELIVERY, STORAGE AND HANDLING**

- 1.4.1. Deliver calcium silicate brick in protective film. Prevent damage to units.
- 1.4.2. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.
- 1.4.3. Store units in a manner designed to prevent damage and staining of units.
- 1.4.4. Stack units on timbers or platforms at least 75 mm above grade.
- 1.4.5. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.
- 1.4.6. Cover stored units with protective enclosure if exposed to weather.
- 1.4.7. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

### **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Coordination:
  - 1.5.1.1. Coordinate with other work having a direct bearing on work of this Section.
  - 1.5.1.2. Coordinate the masonry work with anchor requirements at framed openings.
  - 1.5.1.3. Coordinate the masonry work with air barrier installation to achieve continuous monolithic air barrier.

### **1.6. SUBMITTALS**

- 1.6.1. Submit required submittals in accordance with Section 01 33 00 and Section 04 05 00.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Calcium Silicate Brick: To ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; special shapes as indicated; as follows:
  - 2.1.1.1. Modular Size: 60 mm high, 95 mm bed, various lengths up to 600 mm.
  - 2.1.1.2. Texture: smooth exposed face and ends with battered edges.
  - 2.1.1.3. Colour: Midnight Grey

- 2.1.2. Acceptable Manufacture:
  - 2.1.2.1. Arriscraft
- 2.1.3. Acceptable Product:
  - 2.1.3.1. Architectural Linear Series Brick
- 2.1.4. Manufacture total required brick in one continuous batch, for maximum colour and texture uniformity.

## **2.2. FABRICATION TOLERANCES**

- 2.2.1. Fabricate calcium silicate brick to a pressed tolerance of plus or minus 1.5 mm.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Verify site conditions are ready to receive work.
- 3.1.2. Inspect materials for fit and finish prior to installation. Do not set unacceptable units.
- 3.1.3. Beginning of installation means acceptance of existing conditions.

### **3.2. CUTTING MASONRY UNITS**

- 3.2.1. Cut masonry units to length with a masonry splitter.
- 3.2.2. Dress split end to match face when exposed in wall.

### **3.3. WETTING MASONRY UNITS**

- 3.3.1. Where the ambient air temperature exceeds 38°C or exceeds 32°C with a wind velocity greater than 13 km/h, pre-wet masonry units.
- 3.3.2. Lay wetted units when surface dry.

### **3.4. COURSING**

- 3.4.1. Place masonry to lines and levels indicated.
- 3.4.2. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- 3.4.3. Lay masonry units in a random length coursed bond, with a minimum 100 mm overlap of vertical joints.
- 3.4.4. Maintain mortar joint thickness of 10 mm.
- 3.4.5. Tool mortar joints by compacting the surface when thumbprint hard, to a concave finish.

### **3.5. PLACING AND BONDING**

- 3.5.1. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, and deep or excessive furrowing of mortar joints are not permitted.
- 3.5.2. Fully bond intersections, and external corners.
- 3.5.3. Do not adjust masonry units after laying. Where resetting of masonry is required, remove, clean units and reset in new mortar.
- 3.5.4. Install wall ties and anchorages as specified in Section 04 05 19.
- 3.5.5. Install flashings, vents, and masonry accessories as specified in Section 04 05 23
- 3.5.6. Construct movement joints as specified in Section 04 05 00.

### **3.6. SITE TOLERANCES**

- 3.6.1. Conform to standard tolerances for unit masonry of CSA A371.

### **3.7. FIELD QUALITY CONTROL**

- 3.7.1. Perform inspection and testing as required for this section.
- 3.7.2. Consultant Inspection: Consultant will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.
  - 3.7.2.1. Masonry will be inspected to be free of cracks or other blemishes on the finished face or front edges of the masonry units exceeding 10 mm or that can be seen from a distance of 6.0 metres.

- 3.7.2.2. Units shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a 6.0 metre distance.
- 3.7.2.3. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a 6.0 metre distance.
- 3.7.2.4. Efflorescence will not be cause for rejection.
- 3.7.3. Make Good rejected masonry as directed by Consultant.

### **3.8. ADJUSTING AND CLEANING**

- 3.8.1. Clean a 10 square metre area of wall designated by Consultant as directed below and leave for one week. If no harmful effects appear, all objectionable stains removed and after mortar has set and cured, clean masonry as follows:
  - 3.8.1.1. Protect windows, sills, doors, trim and other work from damage.
  - 3.8.1.2. Remove large particles with stiff fibre brushes without damaging surface.
  - 3.8.1.3. Saturate masonry with clean water and flush off loose mortar and dirt.
  - 3.8.1.4. Dilute cleaning agent with clean water in controlled proportions.
  - 3.8.1.5. Apply solution to pre-soaked wall surface using [soft-bristled brush] [low pressure acid-resistant sprayer].
  - 3.8.1.6. Thoroughly rinse cleaning solution and residue from wall surface.
- 3.8.2. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

### **3.9. PROTECTION**

- 3.9.1. Protect units from damage resulting from subsequent construction operations.
- 3.9.2. Use protection materials and methods which will not stain or damage units.
- 3.9.3. Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

**END OF SECTION**

## 1 GENERAL

### 1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### 1.2. SECTION INCLUDE

- .1 1.1. General Instructions
- .2 1.2. Section Include
- .3 1.3. Summary
- .1 1.4 Submittals
- .4 2.1. Materials
- .5 2.2. Source Quality Control
- .6 3.1. Preparation
- .7 3.2. Masonry Procedures
- .8 3.3. Protection

### 1.3. SUMMARY

- 1.3.1. Concrete masonry units:
- 1.3.1.1. Standard weight units (Type A)
  - 1.3.1.2. Lightweight units (Type C)
  - 1.3.1.3. Ultra light weight units (Type D)

### 1.4. SUBMITTALS

- 1.4.1. Submit required submittals in accordance with Section 01 33 00 and Section 04 05 00.

## 2 PRODUCTS

### 2.1. MATERIALS

- 2.1.1. Concrete masonry units:
- 2.1.1.1. Comply with CAN/CSA A165 SERIES-14.
  - 2.1.1.2. Include shapes, such as end, bond, sash groove, ledge and lintel units, required to complete the Work, with uniform appearance.
    - (1) Provide open end blocks where vertical reinforcing occurs in walls.
    - (2) Provide knock-out blocks where horizontal reinforcing bars occur in walls.
    - (3) Solid concrete masonry units may be used where grouted block is indicated, whenever reinforcing is not indicated, in lieu of grouted solid installation method.
    - (4) Size: metric.
  - 2.1.1.3. Standard weight units:
    - (1) Hollow units: H/15/A/O, H/20/A/O, H/25/A/O, and H/30/A/O.
    - (2) Semi-solid units: S/15/A/O, S/20/A/O, H/25/A/O, and S/30/A/O.
    - (3) Full solid units: Sf/15/A/O, Sf/20/A/O, H/25/A/O, and Sf/30/A/O.
    - (4) Colour: grey.
    - (5) Profiles: as indicated.
  - 2.1.1.4. Lightweight units:
    - (1) Hollow units: H/10/C/O, H/15/C/O, H/20/C/O, H/25/C/O, and H/30/C/O.
    - (2) Semi-solid units: H/10/C/O, S/15/C/O, S/20/C/O, H/25/C/O, and S/30/C/O.
    - (3) Full solid units: Sf/15/C/O, Sf/20/C/O, H/25/C/O, and Sf/30/C/O.
    - (4) Colour: grey.
  - 2.1.1.5. Ultra light weight (Type D) units:
    - (1) Hollow units: H/15/D/O.
    - (2) Semi-solid units: SS/15/D/O.
    - (3) Full solid units: Sf/15/D/O.
    - (4) Colour: grey.
    - (5) Profiles: as indicated.
    - (6) Acceptable Products:

- (A) Brampton Brick
- (B) Richvale Block 'Ultra Lite'
- (C) Or equivalent.

## **2.2. SOURCE QUALITY CONTROL**

- 2.2.1. Perform tests on masonry units to determine compressive strength as required by *Authorities Having Jurisdiction* in accordance with CAN/CSA A165 SERIES-04.

## **3 EXECUTION**

### **3.1. PREPARATION**

- 3.1.1. Before commencing masonry work, verify that conditions at the Place of the Work will allow construction of masonry within required limitations for wall heights, wall thicknesses, openings, bond, anchorage, lateral support, and compressive strengths of masonry units and mortars.

### **3.2. MASONRY PROCEDURES**

- 3.2.1. Lay masonry in accordance with Section 04 05 00 – Masonry Procedures and CAN/CSA A371-14, as accepted by the Consultant in mock-up sample wall.

### **3.3. PROTECTION**

- 3.3.1. Protect installed products and components from damage during construction.
- 3.3.2. Repair damage to adjacent materials caused by concrete unit masonry installation.

**END OF SECTION**

**1 GENERAL**

**1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

**1.2**

**1.1 Related Requirements**

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 05 21 00 – Steel Joist Framing.
- .3 Section 05 31 00 – Steel Decking.
- .4 Section 05 50 00 – Metal Fabrications.
- .5 Section 09 91 00 – Painting.

**1.3 References**

- .1 All referenced standards shall be the current edition, or the edition referenced by the Ontario Building Code indicated that formed the basis for the building permit for the project.
- .2 Canadian Standards Association (CSA International):
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-S16, Limit States Design of Steel Structures.
  - .3 CAN/CSA-S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
  - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
  - .5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
  - .6 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .7 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .3 American Society for Testing and Materials (ASTM International):
  - .1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A123 Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
  - .4 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

- .5 ASTM A992, Standard Specifications for Structural Steel Shapes.
- .6 ASTM D6386, Preparation of Zinc (Hot-Dipped Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
- .7 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.
- .8 ASTM F3125M, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- .9
- .4 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-85.10-[99], Protective Coatings for Metals.
- .5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):
  - .1 Handbook of the Canadian Institute of Steel Construction.
  - .2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
  - .3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
  - .4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).
- .6 Master Painters Institute:
  - .1 MPI-INT 5.1, Structural Steel and Metal Fabrications.
  - .2 MPI-EXT 5.1, Structural Steel and Metal Fabrications.
- .7 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:
  - .1 SSPC-SP 1, Solvent Cleaning.
  - .2 NACE No. 3 / SSPC-SP 6, Commercial Blast Cleaning.
  - .3 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.
  - .4 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.
  - .5 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.
  - .6 SSPC Paint Specification No. 20 – Zinc Rich Coating

#### 1.4 **Quality Assurance**

- .1 In accordance with Section 01 43 00 – Quality Assurance.
- .2 Qualifications
  - .1 Structural steel fabricator to have at least five year experience with structural steel for buildings.

- .2 Structural steel fabricator to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components.
- .3 Welders to be CWB approved, working under supervision of a CWB approved firm.
- .4 Engage a Professional Engineer licensed and insured in the Province of Ontario to be responsible for design, detailing and installation of all connections related to structural steelwork.
- .5 The Professional Engineer designing connections to hold a Certificate of Authorization, and to carry the minimum liability insurance (per occurrence) as required by PEO.

#### 1.5 **Quality Control**

- .1 Submit in accordance with Section 01 45 00 – Quality Control.
- .2 Source Quality Control Submittals:
  - .1 Submit mill test reports 4 weeks prior to fabrication of structural steel.
    - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project, and show compliance with the required standards.
    - .2 The reports to be correlated to the materials or products to which they pertain.
- .3 Tolerances
  - .1 Conform to the fabrication and erection tolerances of CAN/CSA S16.
  - .2 If more stringent tolerances are specified elsewhere to suit interfacing materials or AESS members, the latter shall govern.
- .4 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for structural steel connections certifying that the work has been completed in accordance with all contract documents.

#### 1.6 **Action and Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittals & Procedures.
- .2 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Submit 4 hard copies or unlocked PDF documents to the Consultant for review at least 4 weeks prior to fabrication and/or delivery.
- .3 Erection drawings:
  - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including a description of methods; Sequence of



erection; type of equipment used in erection, temporary bracings, beam sizes (in addition to beam marks), and AESS members and their category, and assembly finishing details

- .2 It is recommended that erection diagrams are submitted for review prior to preparing shop details. Copies of the original structural drawings will not be accepted as erection diagrams.

.4 **Fabrication drawings:**

- .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Ontario, Canada. Indicate the following on the drawings:
  - .1 Material specifications.
  - .2 Surface preparation.
  - .3 Shop painting / galvanizing
  - .4 Section splices.
  - .5 Types of shop and field connections.
  - .6 Net weld lengths.
  - .7 Precautions which will be taken to exclude threads from shear planes of bearing type bolted connections (where applicable).
  - .8 Vent holes required for galvanizing process.
- .2 Indicate members which are considered AESS, and their category. Refer to AESS Category Matrix as shown in Table 1 of the CISC Code of Standard Practice, Appendix I.
- .3 For AESS bolted connections, indicate bolt type, finish and which side of the connection bolt heads should be placed.
- .4 For AESS welded connections, show grinding, profile and weld finish.
- .5 Show details by which steel assemblies, which are set in concrete, are to be connected to the formwork.
- .6 Substitution of alternative sections will only be allowed provided the new members have equal or greater capacity and stiffness and their dimensions are approved by the Consultant.

1.7 **Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Products and Workmanship.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

2 **PRODUCTS**

2.1 **Design Requirements**

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, and shears and to allow for

movements indicated. Include loads effects on the members and connections for loads due to fabrication, erection, and handling.

- .2 Shear connections:
  - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
  - .2 Select or design connections to support the reaction resulting from the maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
  - .3 For composite construction select or design minimum end connection to support the reaction resulting from 150% of the maximum uniformly distributed load that can be safely supported by beam in bending as tabulated in the "Handbook of the Canadian Institute of Steel Construction".
- .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non-standard connections when requested.
- .4 Provide seated beam connections with top clip angles.
- .5 Provide all spandrel beams and all floor beams not fully braced by floor construction with top and bottom flange connections for torsional restraint.
- .6 Assume that bolt threads are intercepted by shear plane, unless special measures are indicated on shop drawings to exclude threads from shear plane.
- .7 Connection design to include consideration of all pass-through forces, including tension, compression, moment or shear. Provide local reinforcement at connection or joint as required.
- .8 Where axial forces occur in beams framing to opposite sides of a supporting member, design connections for a pass-through force equal to the smaller axial force. If beam sizes differ, assume the axial force is centred in the smaller beam. Where beams frame into columns, connect each beam for the axial force shown.
- .9 Follow conceptual connection details if shown on structural drawings. Do not change without the Consultant's written approval.
- .10 Pretension all high-strength bolts used in:
  - .1 All elements resisting crane loads.
  - .2 Connections where bolts are subject to tensile loads.
  - .3 Connections using oversized or slotted holes unless finger-tight bolts are required to accommodate movement.
  - .4 Connections required by CSA S16 to be pre-tensioned.

- .11 Install web and flange stiffener plates at moment connections as required by connection design and detail, as well as when indicated on the drawings. If the shear generated in column web exceeds its shear capacity, reinforce the web.
- .12 For beams continuous over support, provide at least one stiffener plate each side of web, unless different stiffeners are shown on drawings.
- .13 Provide moment connections at splices to maintain continuity of cranked beams. Provide header plates or stiffener plates to resist unbalanced flange forces at splices.
- .14 Provide all wall supporting members (shelf angles, hangers, stubs, back braces, etc.) which are attached to floor beams with adjustable connections capable to compensate for the deflection of the floor beams due to self weight of concrete. Anticipate beam deflection to be equivalent to the camber shown, or 20 mm (whichever is more). Alternatively, fabricate based on actual deflected shape of the beams as measured after concrete is poured.
- .15 Provide slotted holes long enough to allow for deflection indicated on drawings plus construction tolerance, assuming bolts are centred in slots. Bolts are to be finger-tight with burred threads to allow for movement during the life of structure without bolts loosening.
- .16 Do not oversize anchor rod holes for site tolerances.
- .17 Connect new steel members to existing concrete using drilled concrete anchors. Activate wedge type anchors by applying pre-determined torque recommended by the manufacturer. Do not field weld at connections with adhesive anchors.
- .18 Fabricate, paint, and erect to the AESS Category 1 (Basic Elements) for the areas designated by the architect as exposed to view including the apparatus bays, corridor, and clerestory roof.

## 2.2 **Materials**

- .1 Structural steel: to CSA-G40.20/G40.21 except:
  - .1 Hollow structural sections: to ASTM A500 or CSA G40.21.
  - .2 Structural pipe: to ASTM A53.
- .2 Anchor rods: to CSA-G40.20/G40.21, Grade 300W.
- .3 Bolts, nuts and washers: to ASTM F3125, grade A325/ASTM A325M type 1.
- .4 Welding materials: to CSA W48 Series, CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint: to CISC/CPMA 1-73a.
- .6 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey. Primer is to be compatible with final paint or coating.

- .7 Hot dip galvanizing: galvanize steel, where indicated, to ASTM 123/A123M, minimum zinc coating of 610 g/m<sup>2</sup>.
- .8 Zinc-rich coating: to SSPC Paint Specification No.20 Type I – Inorganic and Type II - Organic, compatible with top coat (where specified).
- .9 Joint filler for exposed steelwork: Epoxy resin.
- .10 Galvanizing vent hole plug: Grade 6061 Aluminum circular plug.

## 2.3

### **Fabrication**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Continuously seal members by intermittent welds and plastic filler unless continuous welds are indicated on the drawings.
- .3 Position beams having permissible mill camber so that the camber is up.
- .4 Increase specified section thickness at no extra cost if required for fabrication (bending) or galvanizing, Alternatively, fabricate curved sections from plates.
- .5 Reinforce holes through webs of beams and columns in accordance with Typical Detail. Alternatively, design reinforcing in accordance with the procedure set forth in the CISC Handbook of Steel Construction, and provide calculations for the Consultant's review.
- .6 Provide 16mm (5/8") diameter weep holes in base plates of HSS columns which are not made watertight.
- .7 HSS members which require galvanizing to either be per CSA G40.21, grade 350W, Class H, or to be stress relieved prior to galvanizing.
- .8 Provide vent holes in HSS sections where required for galvanizing process. Located so that any water inside HSS will drain away when HSS is in its final position. Maximum size – 16mm (5/8") diameter. Fill holes with vent hole plugs after galvanizing.
- .9 Provide 12 (1/2") dia. holes in HSS columns to be filled with concrete. Locate at opposing column faces 150mm (6") from each end.
- .10 Connect together double beams and double channels in bending at not more than 1200mm (4 ft) centres unless the members are welded toe to toe.
- .11 Connect together axially loaded built-up members (including double angles and other built-up sections noted on the drawings) in accordance with the requirements of CSA S16. Unless otherwise noted on the drawings, connect built up members with the longest side back-to-back with a member spacing of 10mm. In addition, interconnect compression members for trusses and bracing at least at the one-third points.
- .12 Connect cover plates of built-up members to develop the capacity of the built-up member.

- .13 Weld beams to bearing plates unless otherwise noted on drawings. Extend beams for full length of bearing plates. Set bearing plates 10mm (3/8") back from edge of support.
- .14 Anchor roof beams bearing on walls with a minimum of two 16mm (5/8") diameter x 380mm (1'-3") long anchor rods, unless otherwise noted on the Drawings.
- .15 Provide cap plates at tops of columns where required for support of deck, slab, joists, beams or safety anchors.
- .16 Provide connections between tie joists and columns, coordinate with joist supplier.
- .17 Provide closure plates for all exposed and for all exterior tubular members.
- .18 Provide diagonal or cantilevered angles at sides of columns where required to support deck or slab.
- .19 Connect steel lintels to columns where openings are adjacent to columns.
- .20 Unless otherwise noted on drawings, provide 76 x 76 x 9.5 (3" x 3" x 3/8") seat angles attached to sides of columns to support masonry lintels adjacent to columns. Length of seat to equal width of lintel minus 25 mm (1").
- .21 Complete welded shop connections prior to galvanizing.
- .22 Where shop inspection is required, do not ship material to the site before it has been inspected.
- .23 Fabricate in stages complex members for which steel inspection is impossible or difficult once completed, and arrange for the Inspection and Testing Agency to do intermediate shop inspections.
- .24 Fabricate AESS with tolerances and surface quality consistent with AESS category.

#### 2.4 **Shop Painting**

- .1 Clean, prepare surfaces, and shop paint or prime structural steel in accordance with CAN/CSA-S16.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to SSPC-SP-1, Solvent Cleaning, except:
  - .1 Members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.
  - .2 Members receiving intumescent coating: Clean steel to SSPC-SP 6 Commercial Blast Cleaning
  - .3 Members to receive zinc-rich coating: Prepare surface according to SSPC-SP-10, near white blast cleaning.
  - .4 Galvanized members to receive a finish coat of paint: ASTM D6386
- .3 Apply one coat of CISC/CPMA 1-73a shop paint to steel surfaces, except:

- .1 Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required.
  - .2 Surfaces to be encased in concrete or in contact with concrete (such as tops of beams supporting slabs).
  - .3 Members to receive spray fireproofing.
  - .4 Surfaces to receive field installed stud shear connections.
  - .5 Surfaces and edges to be field welded.
  - .6 Faying surfaces of slip-critical connections.
  - .7 Members to be hot-dipped galvanized.
  - .8 Surfaces to receive zinc-rich coating.
  - .9 Surfaces to receive intumescent coating for which a compatible shop primer is required.
- .4 Apply one coat of compatible primer paint (CISC/CPMA 2-75) in the shop to steelwork to receive a finish coat of paint on site. Primer to be compatible with final paint or coating.
- .5 Apply galvanizing in the shop to all structural steel located beyond the vapour barrier, including:
- .1 Shelf angles and hangers in exterior walls.
  - .2 Spandrel angles to which precast panels are attached.
  - .3 Lintels in exterior walls.
  - .4 Exposed exterior steel members.
  - .5 Other steel noted on drawings.
- .6 If a galvanized surface has been damaged or field welded, clean surfaces down to bare metal and apply two coats of zinc-rich touch up paint.
- .7 If galvanized steel is to be painted, use only non passivated galvanizing process (without chromate coating). Prepare galvanized surface in preparation for a coat of paint according to ASTM D6386. Use only paint that is compatible with the galvanizing and preparation process.
- .8 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .9 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .10 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

### **3 EXECUTION**

#### **3.1 Application**

- .1 Fabricator's Instructions: comply with fabricator's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 **General**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

### 3.3 **Connection to Existing Work**

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to the Consultant for direction on before commencing fabrication.

### 3.4 **Marking**

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in an unpainted condition, place the markings at locations not visible from the exterior after erection.
- .2 Match marking: shop mark for fit and match.

### 3.5 **Erection**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 The structural drawings show the final intent of the steel structure. The Contractor is responsible to maintain adequate temporary bracing as necessary to keep the structure stable and in good alignment during construction. Do not overload the structure during construction.
  - .1 Temporary erection bracing is to be designed by a qualified professional engineer licensed in Province of Ontario, Canada retained by the Contractor.
- .3 Field cutting or altering structural members: Obtain approval of the Consultant prior to any modification.
- .4 Environmental considerations:
  - .1 Preheat material adjacent to welding areas when ambient temperature is between +4 degrees C and -17 degrees C.
  - .2 Do not weld in ambient temperatures below -17 degrees C.
- .5 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .6 Continuously seal members by continuous welds where indicated. Grind smooth.
- .7 Set column base plates on leveling screws or on steel shims to the required elevation ready for grouting. Alternatively, use leveling plates set with grout and level to within

- 1.5 mm (1/16") across the plate. Do not erect columns upon plates exceeding this tolerance. Lift base plates for inspection when directed.
- .8 Grout under column base plates and beam bearing plates as soon as steelwork is completed. Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.
  - .9 Do not make permanent connections until structure has been properly aligned.
  - .10 Adjust and finalize connections at wall supporting elements affected by floor beam deflections after concrete is poured.
  - .11 Report ill-fitting connections to the Consultant before taking corrective measures.
  - .12 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.
  - .13 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4°C.
  - .14 Remove slag from all completed welds so that they may be visually inspected.
  - .15 Seal members by continuous welds where indicated.
  - .16 AESS members:
    - .1 Erect using softened slings or other methods to prevent damage.
    - .2 Provide padding as required to protect while rigging and aligning.
    - .3 Weld tabs for temporary bracings and safety cabling only at points concealed from view in the complete structure or where approved by the Consultant.
    - .4 Remove all field connection aids added to allow alignment, fit up and welding.
    - .5 Remove welds at run-out tabs to match adjacent surface.
    - .6 Plug weld holes for erection bolts.

### 3.6 **Field Quality Control**

- .1 Inspection and testing of materials and workmanship, including visual third-party welding inspection, will be carried out by the testing agency as designated requirements in section Section 01 45 00 – Quality Control.
  - .1 Ensure testing agency is certified to CSA W178.1.
  - .2 Ensure individuals performing visual inspection of welds are certified to Level 2 or 3 of CSA W178.2.
  - .3 Do not commence fabrication until details of the inspection program have been coordinated with the Agency.
  - .4 Provide safe access and working areas for testing on site, as required by testing agency.



- .2 Arrange for the testing agency to be present during welding of 10% of moment connections and butt welds in direct tension (minimum 2 of each type).
- .3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.
- .4 Inspection or testing by the Consultant will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.
- .1 Work will be inspected in the shop and when erected. Store fabricated members in the shop so that they are accessible for inspection. Items to be cast into concrete will be inspected on site before being installed.
- .2 Inspection will include:
  - .1 Checking that the mill test certificates or producer's certificates are properly correlated to materials and products supplied for the project or that legible markings were made on the material and products by the producers in accordance with the applicable standards. Where this is not possible, notify the Consultant and if requested carry out sample tests as described below.
  - .2 Confirming that all materials meet specifications.
  - .3 Sampling fabrication and erection procedures for general conformity with the requirements of the Contract.
  - .4 Checking welders' CWB Certification.
  - .5 Checking fabricated members against specified member shapes.
  - .6 Checking fabricated members against allowable mill sweep and camber.
  - .7 Checking fabricated members against specified camber.
  - .8 Visual inspection of all welded connections including spot checking of joint preparation and fit up.
  - .9 Sample checking bolted joints.
  - .10 Sample checking stud anchors.
  - .11 Sample checking drilled concrete and masonry anchors.
  - .12 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
  - .13 Inspection of field cutting.
  - .14 Inspection of surface preparation, shop paint and field touch-up.
  - .15 Inspection of galvanizing and field touch-up.
  - .16 Inspection of grouting under base plates and bearing plates.
- .3 Arrange for the Inspector to be present during welding of 10% of moment connections and 10% of butt welds in direct tension.
- .4 Sample testing: When required, test coupons will be taken and tested in accordance with CSA G40.20 to establish identification. Cut samples from member locations selected by Structural Engineer and provide to the Inspection and Testing Agency. Make good the locations if requested, at no extra cost, by adding new plates and welds acceptable to the Structural Engineer. The Agency will have the samples tested for mechanical properties and for chemical composition and will classify the steel as to specification.

- .5 Arrange for the Inspector to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened and field welding finished.
- .6 The Inspector will check the specified camber of all beams. Do not place steel deck until this has been done and approved in writing by the inspector.
- .7 The Inspector will visually check all bolts in bearing connections. Where erection drawings indicate bolts with threads excluded from the shear plane, he will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.
- .8 The Inspector will visually check all the adjustable connections at wall supporting members to ensure the connections have been finalized after the concrete is poured.

### 3.7 **Field Painting**

- .1 Paint in accordance with Section 09 91 00 - Painting.
  - .1 Touch up damaged surfaces and surfaces without shop coat with primer to match original coating. Apply in accordance: MPI Architectural Painting Specification Manual.
  - .2 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with the SSPC Technology Guide No. 14.

**END OF SECTION**

## **1 GENERAL**

### **1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

### **1.2 Related Requirements**

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 05 12 23 – Structural Steel for Buildings.
- .3 Section 05 31 00 – Steel Decking.
- .4 Section 05 50 00 – Metal Fabrications.
- .5 Section 09 91 00 – Painting.

### **1.3 References**

- .1 All referenced standards shall be the current edition, or the edition referenced by the Ontario Building Code indicated that formed the basis for the building permit for the project.
- .2 Canadian Standards Association (CSA International):
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA S16, Design of Steel Structures.
  - .3 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.
  - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
  - .5 CSA W55.3, Certificate of Companies for Resistance Welding of Steel and Aluminum.
  - .6 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-85.10, Protective Coatings for Metals.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):
  - .1 CISC Handbook of Steel Construction.
  - .2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.
  - .3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.
  - .4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.5 The Master Painters Institute (MPI):

- .1 Architectural Painting Specification Manual.

1.4 **Quality Assurance**

- .1 In accordance with Section 01 45 00 – Quality Control.

.2 Qualifications

- .1 Steel joist fabricator to have at least five years experience with structural steel for buildings.
- .2 Steel joist fabricator to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components.
- .3 Welders to be CWB approved, working under supervision of a CWB approved firm.
- .4 Engage a Professional Engineer licensed and insured in the Province of Ontario to be responsible for design, detailing and installation of all steel joists.
- .5 The Professional Engineer designing steel joists to hold a Certificate of Authorization, and to carry min. \$1,000,000.00 in liability insurance (per occurrence).
- .3 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for steel joists certifying that the work has been completed in accordance with all contract documents.

1.5 **Quality Control**

- .1 Submit in accordance with Section 01 45 00 – Quality Control.

.2 Source Quality Control Submittals:

- .1 Submit mill test reports 4 weeks prior to fabrication of structural steel.
- .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
- .2 The reports to be correlated to the materials or products to which they pertain.

.3 Tolerances

- .1 Conform to the fabrication and erection tolerances of CAN/CSA S16.
- .2 If more stringent tolerances are specified elsewhere to suit interfacing materials or AESS members, the latter shall govern.

1.6 **Action and Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 – Submittals & Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for steel joist framing and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada responsible for the steel joist design.
  - .2 Submit 4 hard copies or unlocked PDF documents to the Consultant for review at least 4 weeks prior to fabrication and/or delivery.
  - .3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
  - .4 Indicate particulars, on shop drawings, relative to joist geometry, spacing, camber, framed openings, splicing details, bearing and anchorage. Include member size, material properties, specified and factored member loads, and stresses under various loadings, deflection and camber, surface preparation and shop painting.
- .4 Delegated Design Submittals:
  - .1 Submit 4 hard copies or unlocked PDF documents of calculations for strength, deflection and vibration control; and joist design drawings to the Consultant for review at least 4 weeks prior to fabrication and/or delivery. Calculations are to show design loads, member forces, and member utilizations.

#### 1.7 **Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Products and Workmanship and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### 2 **PRODUCTS**

#### 2.1 **Design Criteria**

- .1 Design steel joists and bridging to carry loads indicated on the structural drawings to CSA S16 and CSA S136.
- .2 Arrange members to form a statically determinate truss. Chose web and chord members to have an axis of symmetry in the plane of the web.
- .3 Design joists and anchorages for uplift forces as indicated.

- .4 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.
- .5 Limit joist deflection due to specified live load to 1/360 maximum of span and deflection due to specified total load to 1/240 maximum of span unless more stringent requirements are noted on the drawings.
- .6 Limit joist deflection of joists with spans greater than 12m (40 ft.) adjacent to more rigid surfaces (such as adjacent columns and load-bearing walls) to an equivalent deck deflection of L/120 cumulatively between adjacent joists. Increase stiffness of joists incrementally.
- .7 Apply unbalanced live loads and concentrated loads in accordance with CSA S16.
- .8 Design joist shoes for rollover forces where shown on structural drawings.
- .9 Minimum thickness of material: flats and hot rolled sections 2.5mm (0.10"); rods 10mm (0.39") diameter; cold formed sections 2mm (0.079"); members supporting steel deck 3.15mm (0.125").
- .10 Arrange joist web configuration and bridging to accommodate mechanical, electrical and architectural equipment/finishes.
- .11 Line up web members along joist runs sufficiently to permit mechanical services.
- .12 Fabricate, paint, and erect to the AESS Category 1 (Basic Elements) for the areas designated by the architect as exposed to view including the apparatus bays, corridor, and clerestory roof.

## 2.2 **Materials**

- .1 Open web steel joists: to CSA S16 and CSA S136.
- .2 Structural steel: to CSA G40.20/G40.21.
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Shop paint: to CISC/CPMA 1-73a.
- .5 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, red oxide.
- .6 Anchor rods: CSA G40.21, Grade 300W.
- .7 Joint filler for exposed steelwork: Epoxy resin.

## 2.3 **Fabrication**

- .1 Fabricate steel joists and accessories as indicated in accordance with CSA S16, CSA S136 and in accordance with reviewed shop drawings.
- .2 Welding: in accordance with CSA W59.

- .3 Make all joist shoes with solid webs.
- .4 Weld in accordance with CSA W59.
- .5 Provide chord extensions where indicated.
- .6 Provide diagonal bridging, horizontal bridging, and anchorages as indicated on the shop drawings.
- .7 Provide top and bottom chord extensions where required.
- .8 Stagger chord member splices.
- .9 Extend joist shoes for full length of bearing plates.
- .10 Weld joists to bearing plates unless otherwise noted on drawings. Set bearing plates 10mm (.375") back from edge of support.
- .11 Fabricate AESS with tolerances and surface quality consistent with the specified AESS category.
- .12 Do not ship joists to the site before being inspected.

## 2.4

### **Shop Painting**

- .1 Clean, prepare and shop paint or prime surfaces of steel joists in accordance with CAN/CSA-S16.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to SSPC-SP-1, Solvent Cleaning, except:
  - .1 Members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.
  - .2 Apply one coat of shop paint CISC/CPMA 1-73a to joists in the shop with the exception of: Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required.
  - .3 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.
- .3 Apply one coat of primer paint (CISC/CPMA 2-75) in the shop to joists to receive a finish coat of paint on site. Primer to be compatible with final paint or coating.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

### **3 EXECUTION**

#### **3.1 Examination**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for steel joist framing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate prior to delivery and/or installation.
  - .2 Inform the Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 Installation**

- .1 Do structural steel work: to CSA S16.
- .2 Do welding: in accordance with CSA W59.
- .3 Ensure installers are certified to CSA W47.1 for fusion welding or CSA W55.3 for resistance welding as appropriate.
- .4 Submit certification that welded joints are qualified by Canadian Welding Bureau.

#### **3.3 Connection to Existing Work**

- .1 Verify dimensions and condition of existing work; report discrepancies and potential problem areas to the Consultant for direction before commencing fabrication.

#### **3.4 Field Quality Control**

- .1 Inspection and testing of materials and workmanship will be carried out by testing agency designated by the Consultant.
  - .1 Ensure testing agency is certified to CSA W178.1.
  - .2 Ensure individuals performing visual inspection of welds are certified to Level 2 or 3 of CSA W178.2.
- .2 Testing agency will inspect representative joists for integrity, accuracy of fabrication and soundness of welds.
- .3 Ensure test results are promptly distributed to all associated parties including the Owner, Contractor and Consultant.
- .4 Inspection or testing by the Consultant will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

#### **3.5 Erection**

- .1 Erect steel joists and bridging to CSA S16 and in accordance with reviewed erection drawings.



- .2 Complete installation of bridging and anchorages before placing construction loads on joists.
- .3 Field cutting or altering joists or bridging that are not shown on shop drawings: to approval of the Consultant.
- .4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.
- .5 Do not make permanent connections until structure has been properly aligned.
- .6 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4°C.
- .7 Protect installed products from damage during construction.
- .8 AESS joists: erect using softened slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning.
- .9 Tolerances:
  - .1 Conform to the fabrication and erection tolerances of CSA S16.
  - .2 If more stringent tolerances are specified elsewhere to suit interfacing materials or AESS members, the latter shall govern.

### 3.6

#### **Inspection and testing:**

- .1 An Inspection and Testing Agency (certified to CSA W178.1 & 2) will be appointed to carry inspection and testing of all steel joists.
- .2 Do not commence fabrication until details of inspection have been worked out with the Agency.
- .3 The Inspection Agency will submit reports to the Consultant, Structural Engineer, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.
- .4 Work will be inspected in the shop and when erected. Store fabricated members in the shop so that they are accessible for inspection.
- .5 Inspection will include:
  - .1 Checking that the mill test certificates or producer's certificates are properly correlated to materials and products supplied for the project or that legible markings were made on the material and products by the producers in accordance with the applicable standards.
  - .2 Confirming that all materials meet specifications.
  - .3 Sampling fabrication and erection procedures for general conformity with the requirements of the Contract.
  - .4 Checking welders' CWB Certification.
  - .5 Checking fabricated joists against specified member shapes.
  - .6 Checking fabricated joists against allowable sweep and camber.
  - .7 Checking fabricated joists against specified camber.

- .8 Visual inspection of all welded connections including spot checking of joint preparation and fit up.
- .9 Sample checking stud anchors.
- .10 Sample checking that tolerances are not exceeded during erection including fit-up of field welded joints.
- .11 Inspection of surface preparation, shop paint and field touch-up.
- .12 Inspection of galvanizing and field touch-up.
- .13 Inspection of grouting under bearing plates.

### 3.7 **Field Painting**

- .1 Paint: in accordance with Section 09 91 00 - Painting.
  - .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

### 3.8 **Protection**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel joist framing installation.

**END OF SECTION**

**1 GENERAL**

**1.1 General Instructions**

- .1 Read and be governed by conditions of the Contract Documents, including sections of Division 1.

**1.2 Related Requirements**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 30 00 – Cast-In-Place Concrete.
- .3 Section 05 12 23 – Structural Steel for Buildings.
- .4 Section 05 21 00 – Steel Joist Framing.
- .5 Section 05 50 00 – Metal Fabrications.
- .6 Section 09 91 00 – Painting.

**1.3 References**

- .1 All referenced standards shall be the current edition, or the edition referenced by the Ontario Building Code indicated that formed the basis for the building permit for the project.
- .2 Canadian Standards Association (CSA International):
  - .1 CSA C22.2 No.79, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
  - .2 CSA S16, Design of Steel Structures.
  - .3 CSA S136, North American Specification for the Design of Cold Formed Steel Structural Members.
  - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .6 CSA W59, Welded Steel Construction, (Metal Arc Welding).
- .3 Current versions of Canadian Sheet Steel Building Institute (CSSBI):
  - .1 CSSBI 10M, Standard for Steel Roof Deck.
  - .2 CSSBI 12M, Standard for Composite Steel Deck.
- .4 American Society for Testing and Materials (ASTM International):
  - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.5 Canadian General Standards Board (CGSB):

- .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

1.4 **Quality Assurance**

- .1 In accordance with Section 01 45 00 – Quality Control.

.2 Qualifications

- .1 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.  
.2 Welders to be CWB approved for deck welding by Canadian Welding Bureau.  
.3 Engage a Professional Engineer licensed and insured in the Province of Ontario to be responsible for design and installation of all decking.  
.4 The Professional Engineer designing steel decking to hold a Certificate of Authorization, and to carry min. \$1,000,000.00 in liability insurance.

1.5 **Action and Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 – Submittals & Procedures.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for steel decking and include product characteristics, performance criteria, physical size, finish and limitations.  
.2 When requested, provide data to substantiate deck load capacity, including diaphragm shear capacity.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.  
.2 Submit design calculations if requested by the Consultant.  
.3 Submit 4 hard copies or unlocked PDF documents to the Consultant for review at least 4 weeks prior to fabrication and/or delivery.  
.4 Indicate deck layout, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and between sheets, projections, openings, and reinforcement details and accessories.

1.6 **Delivery, Storage and Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Products & Workmanship and with manufacturer's written instructions.  
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.  
.3 Storage and Handling Requirements:

- .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect decking from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **2 PRODUCTS**

### **2.1 Design Criteria**

- .1 Design steel deck to CSA S136, CSSBI 10M and CSSBI 12M.
- .2 Design steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.
- .3 Deflection under specified live load not to exceed 1/240 of span, except that when deflection-sensitive finishes are supported directly from deck, live load deflection not to exceed 1/360 of span.
- .4 Design deck and connections for indicated diaphragm action, including anchorage and side laps, in accordance with CSSBI "Design of Steel Deck Diaphragms" and Hilti Product Technical Guide (for Powder Actuated Fasteners). Increase deck thickness if required by diaphragm design.
- .5
- .6 Make sections continuous over 3 spans or increase thickness of material to give the equivalent stiffness and strength of a 3-span deck.
- .7 If increased wind uplift loads applicable at roof edges and corners are not specifically noted on Structural Drawings, increase the minimum design wind uplift shown (which is applicable in the zones away from roof edges) in accordance with the Users's Guide to NBC – Structural Commentaries (Part 4 of Division B).

### **2.2 Materials**

- .1 Steel Deck: Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather.
- .2 Galvanized deck: Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with Z275, coating, regular spangle surface, chemically treated for unpainted finish for exterior surfaces exposed to weather or interior spaces with high humidity as noted on the structural drawings.
- .3 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .4 Fasteners for galvanized deck and prefinished deck: coated or stainless steel, hex head, self-tapping screws with EPDM bonded washers.
- .5 Powder-actuated fasteners: Hilti Decking Fastening System.
- .6 Closures: as indicated and in accordance with manufacturer's recommendations. Minimum base steel thickness of 0.76 mm. Metallic coating same as deck material

- .7 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm (22 gauge) minimum. Metallic coating same as deck material.
- .8 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

## 2.3 **Types of Decking**

- .1 Steel roof deck:
  - .1 38 mm (1 1/2") maximum deep profile, 152 mm (6") flute spacing, non-cellular, interlocking side laps.

## 2.4 **Fabrication**

- .1 Conform to CSA S136 and CSA W59.
- .2 Fabricate sections from steel sheets by rolling. Form integral ribs which will bear on supports and form interlocking male and female side laps.

# 3 **EXECUTION**

## 3.1 **Examination**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for steel decking installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform the Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

## 3.2 **Installation**

- .1 Structural steel work: in accordance with CSA S136, CSSBI 10M and CSSBI 12M.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.

## 3.3 **Erection**

- .1 Erect steel deck as indicated and in accordance with CSA S136, CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.
- .2 Lap ends: to 50 mm (2") minimum.
- .3 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
- .4 Do not overload structure during erection. Place deck bundles near columns.
- .5 Align deck end to end for accurate fit with corresponding sections. Sections to be parallel, even and straight.

- .6 Locate deck rib directly over perimeter steel beams spanning parallel to deck and at same elevation as underside of deck.
- .7 For exposed deck end laps, do not extend lower deck sheet past the face of the supports.
- .8 Exercise particular care in erection of exposed deck. Sections which are dented, damaged or perforated by welding will be rejected.
- .9 Connections
  - .1 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

### 3.4 **Closures**

- .1 Install closures in accordance with approved details.
  - .1 Reinforce edge of free spanning deck with channel shaped closure fitted to edge and fastened to deck.
  - .2 Provide flashing at columns and points of discontinuity to prevent leakage of mortar when concrete is placed over deck.
  - .3 Provide edge forming for concrete slabs over deck. Fasten to deck.

### 3.5 **Openings and Areas of Concentrated Loads**

- .1 Structural Drawings do not show all openings required. Refer also to Architectural, Mechanical and Electrical drawings. Cut all opening required by other trades.
- .2 No reinforcement required for openings cut in deck which are smaller than 150 mm (6") square.
- .3 Frame deck openings with any one dimension between 150 to 300 mm (6" to 12") as shown on the structural drawings or as recommended by manufacturer , except as otherwise indicated.
- .4 For deck openings with any one dimension greater than 300 mm (12") and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

### 3.6 **Connections**

- .1 Install connections in accordance with CSSBI recommendations as indicated.
- .2 Use connections specified on reviewed shop drawings, to suite uplift, diaphragm shear, requirements of any Fire Rated Assembly Design specified for the Project.
- .3 Connect deck to supporting beams using arc spot welds, mechanical fasteners or power actuated fasteners. Connect male and female side laps using seam or arc puddle welds, mechanical fasteners or by interlocking with a button punch

- .4 Use coated or stainless steel fasteners for all galvanized deck, as well as for decks at steep slopes. Side laps for prefinished or galvanized deck to be mechanically interlocked.

### 3.7 **Field Quality Control**

- .1 Refer to Section 01 45 00 Quality Control.
- .2 Inspection and testing:
  - .1 An Inspection and Testing Agency (certified to CSA W178.1 & 2) will be appointed to carry inspection and testing of steel decks.
  - .2 The Inspection agency will submit reports to the Consultant, Structural Engineer, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.
  - .3 Work will be inspected when erected.
  - .4 Inspection will include:
    - .1 Checking that mill test reports are properly correlated to materials.
    - .2 Confirming that all materials meet specifications.
    - .3 Checking welders' CWB certification.
    - .4 Checking deck types and gauge thicknesses.
    - .5 Checking all welding, fastening and button punching.
    - .6 Checking of all reinforcement required at holes cut in deck.
    - .7 Checking installation of sheet metal strips and edge reinforcing.

### 3.8 **Protection**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel decking installation.

## 4 **END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .1 1.2. Section Includes
- .2 1.3. Summary
- .3 1.4. Administrative Requirements
- .4 1.5. Submittals
- .5 1.6. Quality Assurance
- .6 1.7. Delivery, Storage, and Handling
- .7 2.2. Materials
- .8 2.3. Fabrication
- .9 3.1. Erection
- .10 3.2. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Lateral load-bearing cold-formed metal framing, including but not limited to metal studs, furring at exterior assemblies subject to lateral and loads transferred by exterior cladding materials.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Conduct a pre-installation meeting in accordance with Section 01 31 19.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.5.3. Letters of general conformity:
  - 1.5.3.1. Submit professional letters of general conformity for the work of this section.
- 1.5.4. Shop drawings:
  - 1.5.4.1. Submit engineered shop drawings, including design, connections and restraint of wall assemblies. Field review requirements to be supplemented to include the following:
    - (1) Checking that mill test reports are properly correlated to materials.
    - (2) Sampling fabrication and erection procedures for general conformity to requirements of the Contract Documents.
    - (3) Checking fabricated members against specified member shapes.
    - (4) Sample checking of screwed and bolted joints.
    - (5) Sample checking that tolerances are not exceeded during fit-up or erection.
  - 1.5.4.2. General review of field cutting and alterations required by other sections.
  - 1.5.4.3. Include necessary shop details and erection diagrams. Indicate member sizes, locations thicknesses exclusive of coating, coatings and materials. Include connection details for attaching framing to itself and for attachment to the structure. Show splice details where permitted. Indicate dimensions, openings, requirements of related work and critical installation procedures. Show temporary bracing required for erection purposes.
  - 1.5.4.4. Indicate design loads and design calculations, including horizontal and vertical reactions at connections to building structure for all load cases.

## **1.6. QUALITY ASSURANCE**

### **1.6.1. Qualifications:**

- 1.6.1.1. Execute work only by a Subcontractor who has adequate equipment and skilled workers to perform it expeditiously and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years.
- 1.6.1.2. Aspects of the work of this section related to structural design are required to be prepared by a professional engineer. Refer to Section 01 33 00 for specific details and requirements in this regard.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Products shall be protected from conditions that may cause physical damage or corrosion.

## **2 PRODUCTS**

- 2.1.1. Performance/Design Requirements
- 2.1.2. Design shall be based on limit states design principles using factored loads and resistances.
- 2.1.3. Specified lateral loads shall be in accordance with the building for building classification - 'Post-Disaster Building'.
- 2.1.4. Resistances and resistance factors shall be in accordance with the building code and CAN/CSA S136-07.
- 2.1.5. Conform to the requirements of fire rated assemblies which have been tested in accordance with CAN/ULC S101-07 and provide indicated fire resistance rating.
- 2.1.6. Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to the minor axis. Provide bridging at 1525 mm (60") on centre maximum. Space bridging at equal intervals over the span length of the member.
- 2.1.7. Design anchorage and splice details for bridging.
- 2.1.8. Design for local loading due to anchorage of cladding and interior wall mounted fixtures.
- 2.1.9. Maximum flexural deflections under specified lateral loads shall conform to following:
  - 2.1.9.1.  $L/360$  unless otherwise indicated.
  - 2.1.9.2. Metal framing supporting masonry veneer shall meet the requirements of CSA S304.1-04
- 2.1.10. Design components or assemblies to accommodate specified erection tolerances of the structure.
- 2.1.11. Provide head, sill and jamb members and connections to frame openings larger than 100 mm (3-15/16") in any dimension.
- 2.1.12. Limit free play and movement in connections perpendicular to the plane of the framing to  $\pm 0.5$  mm (0.019") relative to the building structure.
- 2.1.13. Anchor top and bottom track to the structure at a maximum spacing of 813 mm (32") centre to centre. Closer spacing shall be required in accordance with design requirements.
- 2.1.14. Allow for movement of structure. Design end connections to accommodate floor/roof deflections such that framing is not loaded axially.
- 2.1.15. Connections between lightweight steel framing members shall be by bolts or sheet metal screws.
- 2.1.16. Resistances for sheet metal screws shall be based on manufacturer's lowest bound test values multiplied by appropriate resistance factor, given in CAN/CSA S136-07.
- 2.1.17. Lateral load bearing metal framing include:
  - 2.1.17.1. Framing subjected to lateral loads.
  - 2.1.17.2. Steel bridging.
  - 2.1.17.3. Top and bottom track.
  - 2.1.17.4. Head and sill members and jamb framing for openings.
  - 2.1.17.5. Bridging and track connections.

- 2.1.17.6. Top and bottom track connections to main structure including detailing to accommodate floor deflections.

## **2.2. MATERIALS**

- 2.2.1. Steel shall conform to requirements of CAN/CSA S136-07 and shall be identified as to specification, type grade and mechanical properties.
- 2.2.1.1. Minimum base steel thickness exclusive of coating shall be as follows:
- (1) 1.087 mm (0.0428"). Use greater stud thickness if required by the design criteria.
  - (2) Minimum thickness for clip angles shall be 1.367 mm (0.054"). Use greater clip angle thickness if required by the design criteria.
- 2.2.2. Metal framing members forming part of exterior building envelope shall have a minimum coating of Z275 galvanizing in accordance with ASTM A924/A924M-16ae1. Other coatings providing equal or better corrosion protection may be used, subject to acceptance of Consultant.
- 2.2.3. Sheet metal screws shall have a minimum coating thickness of 0.008 mm (0.0003") of zinc. Other coatings providing equal or better corrosion protection may be used, subject to acceptance of Consultant.
- 2.2.4. Zinc rich paint for touching up damaged metallic coatings shall conform to CAN/CGSB 1.181-M99.
- 2.2.5. Isolation strip; at exterior walls: Foam gasket; adhesive backed, closed cell vinyl foam strips, 3.2 mm thick, in width to suit steel stud size.
- 2.2.6. Concrete anchors shall have a minimum coating thickness of 0.008 mm (0.00032") of zinc. Other coatings providing equal or better corrosion protection may be used.
- 2.2.7. Screws:
- 2.2.7.1. Steel screws shall be equal to or exceed minimum diameter indicated on shop drawings.
  - 2.2.7.2. Penetration beyond joined materials shall be not less than 3 exposed threads.
  - 2.2.7.3. Thread types and drilling capability shall conform to manufacturer's recommendations.
  - 2.2.7.4. Screws covered by sheathing materials shall have low profile heads.

## **2.3. FABRICATION**

- 2.3.1. Provide cut-outs centred in webs of members to accommodate mechanical and electrical services. Effect of cut-outs on strength and stiffness of members shall be considered.
- 2.3.2. Steel thickness exclusive of coating shall be marked on each member by embossing, stamping with indelible ink or by colour coding.

## **3 EXECUTION**

### **3.1. ERECTION**

- 3.1.1. Lateral load-bearing metal framing shall be erected true and plumb within specified tolerances. Temporary bracing shall be employed wherever necessary to withstand loads to which the structure may be subject during erection and subsequent construction. Temporary bracing shall be left in place as long as required for safety and integrity of structure. Erector shall ensure that during erection a margin of safety consistent with the requirements of the building code and CAN/CSA S136-07.
- 3.1.2. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- 3.1.3. Erection tolerances:
- 3.1.3.1. For purposes of this section, camber is defined as deviation from straightness of a member or any portion of a member or any portion of a member with respect to its major axis.
  - 3.1.3.2. For framing, out of plumbness shall not exceed 1/500th of member length. Out of straightness (camber and sweep) shall not exceed 1/1000th of the member length.

- 3.1.3.3. Metal framing shall seat into top and bottom tracks. Gap between end of stud and web of track shall not exceed 4 mm (0.158").
- 3.1.3.4. For track, camber shall not exceed 1/1000th of member length.
- 3.1.3.5. Spacing of metal framing shall not be more than 3 mm (1/8") from design spacing. Cumulative error in spacing shall not exceed requirements of finishing materials.
- 3.1.4. Make field measurements necessary to ensure proper fit of members.
- 3.1.5. Cutting of members may be by saw or shear. Torch cutting is not permitted.
- 3.1.6. Holes that are field cut into lightweight steel framing members shall conform to requirements of Paragraph 2.3.1 and 3.1.5.

### **3.2. FIELD QUALITY CONTROL**

- 3.2.1. Conduct quality control in accordance with Section 01 45 00.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, And Handling
- .7 2.1. Performance/Design Requirements
- .8 2.2. Materials
- .9 2.3. Accessories
- .10 2.4. Finishes
- .11 2.5. Fabrication
- .12 3.1. Examination
- .13 3.2. Installation
- .14 3.3. Field Quality Control
- .15 3.4. Adjusting And Cleaning
- .16 3.5. Protection

### **1.3. SUMMARY**

- 1.3.1. Work of this section includes metal fabrications and related metals including, but not limited to, the following:
- 1.3.1.1. Loose steel lintels.
  - 1.3.1.2. Steel angles.
  - 1.3.1.3. Steel columns
  - 1.3.1.4. Steel Brackets
  - 1.3.1.5. Steel Ladders
  - 1.3.1.6. All other items noted on the drawings

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Submit list of fabrications to be provided as part of the work of this Section.
- 1.4.3. Product data sheets:
- 1.4.3.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this Section.
- 1.4.4. Shop drawings:
- 1.4.4.1. Submit engineered shop drawings.
  - 1.4.4.2. Include plans, sections and large scale details, and shall indicate components and methods of assembly, materials and their characteristics, fastenings, metal finishes, welds, and their structural characteristics relative to their purpose, and other fabrication information required.
  - 1.4.4.3. Indicate proposed Site connections and methods.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:
- 1.5.1.1. Installers / applicators / erectors: The work of this Section shall be executed only by a Subcontractor who has adequate plant, equipment, and skilled tradespersons to perform work expeditiously, and is known to have been responsible for satisfactory installations similar to that required in the Work during a period of at least the immediate past 5 years.

- 1.5.1.2. Licensed professionals: retain a Professional Engineer to design the work of this Section; to prepare, seal and sign shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.
- 1.5.2. Requirements of regulatory agencies: the work of this Section that functions to resist forces imposed by dead and live loads shall conform to requirements of Authorities Having Jurisdiction.

## **1.6. DELIVERY, STORAGE, AND HANDLING**

- 1.6.1. Label, tag or otherwise mark metal fabrications supplied for installation by other Sections to indicate its function, location in building and shop drawing designation.
- 1.6.2. Protect work from damage during delivery, storage and handling.
- 1.6.3. Deliver work to location at the Place of the Work designated by Contractor and to meet requirements of the construction schedule.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Design, fabricate, and install work of this Section in accordance with the Ontario Building Code and requirements of all other Authorities Having Jurisdiction.
- 2.1.2. Welding:
  - 2.1.2.1. Weld structural components in steel to conform to requirements of CSA W59-18, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-19 and CSA W55.3-08 (R2018) as applicable.
- 2.1.3. Design assemblies and connections to withstand own dead load, live loads, super-imposed dead loads, and fabrication forces, without permanent distortions or deformation, to maximum allowable deflection of L/360, within the following construction tolerances:
  - 2.1.3.1. Maximum variation from plumb in vertical lines:
    - (1) 3.2 mm (1/8") in 3 m (10 ft)
  - 2.1.3.2. Maximum variation from level:
    - (1) 3.2 mm (1/8") in 9 m (30 ft).
  - 2.1.3.3. Maximum variation from straight:
    - (1) 3.2 mm (1/8") in 3 m (10 ft) under a 3 m (10 ft) straight edge.
  - 2.1.3.4. Maximum variation from angle indicated:
    - (1) 10 seconds.
  - 2.1.3.5. Tolerances shall be non-cumulative.
- 2.1.4. Design of metal fabrications shall be by a Professional Engineer, except work designed on the structural Drawings. Professional Engineer to be experienced in this type of engineering and in accordance with Section 01 33 00.

### **2.2. MATERIALS**

- 2.2.1. General:
  - 2.2.1.1. Unless detailed or specified otherwise, standard Products will be acceptable if construction details and installation meet intent of the Contract Documents.
  - 2.2.1.2. Include materials, Products, accessories, and supplementary parts necessary to complete assembly and installation of work of this Section.
  - 2.2.1.3. Incorporate only metals that are free from defects that are visible, or that impair strength or durability. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharply defined profiles.
  - 2.2.1.4. The Professional Engineer responsible for the production of the shop drawings is responsible for structural design, member sizes, arrangement, connections and anchoring of work of this Section. Coordinate and maintain materials, dimensions, layout and appearance to meet intent of the Contract Documents.
- 2.2.2. Steel:
  - 2.2.2.1. Steel, structural shapes, plate, bars: hot-rolled, CSA G40.21-13, Grade 300W.

- 2.2.2.2. Steel, hollow structural sections: hot-formed, seamless, CSA G40.21-13, Grade 350W, Class H.
- 2.2.2.3. Steel (mild), sheet and strip, hot rolled, ASTM A1011/A1011M-14.
- 2.2.2.4. Steel, sheet: cold rolled, stretcher levelled, fully pickled, ASTM A1008/A1008M-13, Grade CS Type A exposed, matte finish, dry, unless otherwise indicated.
- 2.2.2.5. Steel pipe: ASTM A53 / A53M - 12, Type E or S, Grade A or B, standard weight, Schedule 40 seamless black or AISI MT 1010/1015, or equivalent.

## **2.3. ACCESSORIES**

- 2.3.1. Fasteners:
  - 2.3.1.1. Fasteners: Exposed fasteners to match the material surface on which they occur.
  - 2.3.1.2. Fasteners for stainless steel to be stainless steel 300 Series or stainless steel 400 Series.
  - 2.3.1.3. Fasteners in contact with aluminum to be stainless steel 300 Series, stainless steel 400 Series, cadmium plated or aluminum.
  - 2.3.1.4. Bolts and anchor bolts: to ASTM A307-14.
  - 2.3.1.5. High strength bolts: to ASTM A325-14.
  - 2.3.1.6. Concrete anchors; exterior exposed to weather: embedded epoxy set anchors, unless otherwise noted.
    - (1) Size: in accordance with manufactures written requirements and reviewed shop drawings. Embedment depth shall not be greater than 80% of concrete thickness.
  - 2.3.1.7. Other types of fasteners as appropriate to meet design requirements.
  - 2.3.1.8. Fasteners shall be tamperproof where exposed.
- 2.3.2. Welding materials:
  - 2.3.2.1. Steel: to CSA W59-18.
- 2.3.3. Grout:
  - 2.3.3.1. Epoxy grout; non-shrink, non-expanding:
    - (1) Hilti 'HY-200'.
    - (2) Sika 'Sika AnchorFix 3001'.
    - (3) W.R. Meadows 'REZI-WELD 3/2 EPOXY GROUT/PATCH'.
    - (4) Or equivalent.
  - 2.3.3.2. Cementitious grout: non-shrink, non-expanding to ASTM C1107/C1107M-14a:
    - (1) Sika 'Sika Grout 212' or 'Sika M-Bed Standard'.
    - (2) W.R. Meadows 'Sealtight CG-86 Construction Grout'.
    - (3) Or equivalent.
- 2.3.4. Dielectric separator: Best grade, quick drying non-staining alkali resistant bituminous paint to CAN/CGSB 1.108-M89, or membrane type to acceptance of the Consultant.

## **2.4. FINISHES**

- 2.4.1. Shop primer; steel: CISC/CPMA 2-75 or SSPC-Paint 20, Paint Specification No. 20: Zinc-Rich Primers (Type I "Inorganic" and Type II "Organic").
- 2.4.2. Shop primer; galvanized steel in pool or arena environments: in accordance with Section 09 91 00.
- 2.4.3. Zinc rich paint; steel: Two-component zinc-rich coating, zinc powder to ASTM D520 Type III, SSPC-Paint 20, Type 1 Inorganic or single-component zinc-rich coating to SSPC-Paint, Type 2 Organic, CAN/CGSB 1.181-M99, VOC content <100 g/l to ASTM- D1475.
  - 2.4.3.1. Acceptable Products:
    - (1) Aervoe Industries, Inc. 'Low VOC Cold Galvanize Coating 93% Zinc'.
    - (2) ZRC Worldwide 'ZRC Zero-VOC Galvanizing Compound'.
    - (3) Or equivalent.
- 2.4.4. Hot dip galvanizing: for irregular sections, conforming to CAN/CSA G164-M92, minimum zinc coating of 600 g/m<sup>2</sup>. Use air cooling method (no water or chromate dipping treatment permitted).

## **2.5. FABRICATION**

- 2.5.1. General:
  - 2.5.1.1. Fabricate metal fabrications with machinery and tools specifically designed for the intended manufacturing processes and by skilled tradesmen.
  - 2.5.1.2. Fit and assemble metal fabrications in shop. When this is not possible, make a trial shop assembly.
  - 2.5.1.3. Incorporate anchors at 610 mm (24") on centre or as otherwise required for secure attachment for metal fabrications located in cast-in-place concrete and concrete masonry units.
  - 2.5.1.4. Incorporate means for fastenings of other work secured to work of this section.
  - 2.5.1.5. Do welding work in accordance with CSA W59-18 as applicable, unless specified otherwise.
- 2.5.2. Construction:
  - 2.5.2.1. Fabricate with materials, component sizes, metal gauges, reinforcing, anchors, and fasteners of adequate strength to withstand intended use, and within allowable design factors imposed by jurisdictional authorities. Fabricate items from steel unless otherwise noted.
  - 2.5.2.2. Ensure that metal fabrications will remain free of warping, buckling, opening of joints and seams, distortion, and permanent deformation.
  - 2.5.2.3. Construct items that are part of floor construction, such as gratings and trench covers, to support the same live loads for which surrounding floors are designed unless indicated otherwise.
  - 2.5.2.4. Non-galvanized steel fabrications at exterior locations: Provide drainage holes at exterior exposed tubular fabrications to permit drainage of moisture to exterior of metal fabrications.
- 2.5.3. Assembly:
  - 2.5.3.1. Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.
  - 2.5.3.2. Provide smooth welds with splatter removed where exposed to view.
    - (1) Finish welds shall comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter as shown in NAAMM-AMP 521-01(R2012)
  - 2.5.3.3. Allow for differential movements within assemblies and at junctions of assemblies with surrounding Work.
  - 2.5.3.4. Field welding of hot dipped galvanized members permitted only when other fastening methods are not possible. Locations of field welds to be clearly identified on reviewed shop drawings.
  - 2.5.3.5. Incorporate holes and connections for work installed under other sections.
  - 2.5.3.6. Cleanly and smoothly finish exposed edges of materials including holes.
  - 2.5.3.7. Cap open ends of sections exposed to view, such as pipes, channels, angles, and other similar work.
- 2.5.4. Shop prime painting:
  - 2.5.4.1. Clean loose mill scale, rust, dirt, weld flux and spatter from the work after fabrication.
  - 2.5.4.2. Prepare and prime paint in accordance with manufacturer's installation instructions. Prepare steel by methods specified in CISC/CPMA 2-75 or SSPC SP-18.
- 2.5.5. Galvanizing:
  - 2.5.5.1. Galvanize metal fabrications following fabrication.
  - 2.5.5.2. Paint damage galvanized surfaces with zinc rich paint, immediately following damage to galvanized protection. Prepare substrate to remove oil and grease to SSPC-SP1, rust scale to SSPC-SP3, mill scale to SSPC-SP6.
  - 2.5.5.3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes in exterior fabrications, by plugging with zinc solder and filing off smooth.



### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Take measurements at the Place of the Work to ensure that metal fabrications are fabricated to fit surrounding construction, around obstructions and projections in place, or as indicated, and to suit service locations. The Contractor is responsible for confirming all Site dimensions.

#### **3.2. INSTALLATION**

- 3.2.1. Install metal fabrications plumb, true, square, straight, level, and accurately and tightly fitted together and to surrounding work.
- 3.2.2. Include in work of this Section anchor bolts, high tensile bolts, washers and nuts, expansion bolts, toggles, straps, sleeves, brackets, clips, and other items necessary for secure installation as required by loading and Authorities Having Jurisdiction.
- 3.2.3. Countersink holes at wood screw locations where wood is attached to work of this section.
- 3.2.4. Attach metal fabrications to interior concrete and masonry with corrosion resistant expansion bolts to support load with a safety factor of 3.
- 3.2.5. Attach metal fabrications to exterior concrete and masonry with non-shrink epoxy cement to support load with a safety factor of 3.
- 3.2.6. Insulate between dissimilar metals or between metal, and masonry or concrete with bituminous paint to prevent electrolytic action.
- 3.2.7. Grout metal posts, pickets, balusters, and the like, in metal sleeves cast into concrete, with non-shrink quick setting epoxy anchor cement, unless detailed otherwise. Fabricate sleeves of 75 mm (3") minimum in depth.
- 3.2.8. Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- 3.2.9. Install roof ladders to suit locations indicated complete with safety cages where required. Galvanized finish. Reinforce walls as required to receive roof ladders.
- 3.2.10. Through bolt or cast-in ladder anchorage assemblies unless otherwise approved by authorities having jurisdiction.
- 3.2.11. Field painting: in accordance with Section 09 91 00.

#### **3.3. FIELD QUALITY CONTROL**

- 3.3.1. Conduct quality control in accordance with Section 01 45 00.
- 3.3.2. Work of this section shall be subject to independent inspection and testing.

#### **3.4. ADJUSTING AND CLEANING**

- 3.4.1. After erection, touch up primed surfaces that are burned, scratched or otherwise damaged with prime paint to match shop paint.
- 3.4.2. Clean and repair areas of bare metal and welds on galvanized surfaces with zinc rich paint. Welded area of members to be masked to minimize overpainting of adjacent undamaged surfaces. Prepare substrate to remove oil and grease in accordance with SSPC-SP1-16, rust scale in accordance with SSPC-SP3-18, mill scale in accordance with SSPC-SP6/NACE No. 3-07.
- 3.4.3. Remove damaged, dented, defaced, defectively finished, or tool marked components and replace with new.

#### **3.5. PROTECTION**

- 3.5.1. Maintain protection of work of this section from time of installation until final finishes are applied or to final cleanup.
- 3.5.2. Protect finished surfaces from damage.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. System Description
- .5 1.5. Delivery, Storage & Handling
- .6 2.1. Bollard Sleeves
- .7 2.2. Materials
- .8 3.1. Examination
- .9 3.2. Installation

### **1.3. SUMMARY**

- 1.3.1. Post Guard polyethylene plastic pipe sleeves for steel pipe bollards.

### **1.4. SYSTEM DESCRIPTION**

- 1.4.1. Performance Requirements:
- 1.4.1.1. High molecular weight material. Designed for optimum balance of density, molecular weight and molecular weight distribution demonstrating maximum property advantages for large products that require high impact resistance.
  - 1.4.1.2. Ultraviolet Protection Additive. Five (5) Year UV stabilizer package. Warranty 5 Years.
  - 1.4.1.3. Thickness Nominal wall thickness will be 0.125 inch
  - 1.4.1.4. Abrasion Resistant
  - 1.4.1.5. Environmental Stress Cracks Resistant
  - 1.4.1.6. Reflective Tape: Each Post Guard has two strips of 3M Series Reflective tape recessed on the part 5.875 inches apart
  - 1.4.1.7. Flexural Modulus: 200,000 psi
  - 1.4.1.8. Tensile Strength: 4,000psi

### **1.5. DELIVERY, STORAGE & HANDLING**

- 1.5.1. The Contractor shall place order in a timely fashion to ensure construction schedule is not adversely impacted.
- 1.5.2. Delivery:
- 1.5.2.1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

## **2 PRODUCTS**

### **2.1. BOLLARD SLEEVES**

- 2.1.1. Manufacturer:
- 2.1.1.1. Encore Commercial Products, Inc. - Sure Guard
  - 2.1.1.2. Contact information: 5 Shirley Ave. Kitchener Ontario N2B 2E6.
  - 2.1.1.3. Tel: 519-772-1976, Toll Free: 1-800-756-3537, Fax: 519-570-4333
  - 2.1.1.4. Email: info@sureguard.ca
  - 2.1.1.5. website: www.sureguard.ca;
  - 2.1.1.6. Or equivalent.

### **2.2. MATERIALS**

- 2.2.1. HDPE and LDPE Polyethylene
- 2.2.1.1. Size: as required for all bollard locations noted in the Contract Documents.
  - 2.2.1.2. Colours: to be selected from manufacturer's full range.

2.2.1.3. Tape colors: to be selected from manufacturer's full range.

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Verify the steel pipe cores are set true, correctly aligned and well anchored in below grade concrete encasement.
- 3.1.2. Fill cores with concrete and strike level across the top of pipe.

#### **3.2. INSTALLATION**

- 3.2.1. Centre two foam strips (included) over bollard. Slide the Post Guard over the bollard and foam will expand for a snug fit.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Environmental Requirements
- .7 1.7. Delivery, Storage, And Handling
- .8 2.1. Wood Materials
- .9 2.2. Wood Treatment
- .10 2.3. Panel Materials
- .11 2.4. Sheathing Materials
- .12 2.5. Fastenings And Hardware
- .13 2.6. Source Quality Control
- .14 3.1. General
- .15 3.2. Miscellaneous Woodwork
- .16 3.3. Polymer Lumber Construction
- .17 3.4. Curbs, Supports, And Blocking At Roofing Assemblies
- .18 3.5. Equipment Backboard
- .19 3.6. Miscellaneous Plywood Blocking

### **1.3. SUMMARY**

- 1.3.1. The Supply all labour, materials, equipment, services and perform all operations required to complete all rough carpentry work to the full intent of the drawings and as herein specified.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Shop drawings:
  - 1.4.2.1. Clearly indicate details of construction, profiles, jointing, fastening and other related details.
- 1.4.3. Certificates:
  - 1.4.3.1. Pressure treated lumber and plywood shall be accompanied by supplier's certificate of conformance with this specification.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Lumber identification:
  - 1.5.1.1. Grade stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.
- 1.5.2. Plywood identification:
  - 1.5.2.1. Grade Mark in accordance with the applicable CSA Standards
- 1.5.3. Lumber Quality:
  - 1.5.3.1. Carefully select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing or making proper connections.
- 1.5.4. Moisture Content of wood at time of construction shall be 19% maximum.
- 1.5.5. Each piece of pressure treated lumber and fire retardant treated lumber shall be shop marked with the pressure treatment brand and ULC monogram respectively, in accordance with CAN/CSA O80-M.
- 1.5.6. Dimensions of lumber shall confirm to dressed sizes specified in CAN/CSA-0141 unless actual dimensions are otherwise indicated or specified.

- 1.5.7. Dimensional references to lumber on Drawings and in Specifications are to nominal sizes unless actual dimensions are indicated. Such actual dimensions shall be dry size.
- 1.5.8. Lumber defects: Discard wood with defects which will render a piece unable to serve its intended function. Lumber will be rejected by Consultant for excessive warp, twist, bow, crook, mildew, fungus, or mould, as well as for improper cutting and fitting, whether or not it has been installed.

## **1.6. ENVIRONMENTAL REQUIREMENTS**

- 1.6.1. When it is required that wood maintain dimensional stability and tolerances to ensure accurate installation of later work, store and install it only in dry areas, and where no further installation of moist materials is contemplated.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Co-ordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- 1.7.2. Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- 1.7.3. Store materials in a dry area. Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption and impairment of structural and aesthetic properties. Vent to allow air movement. Tie covering to keep in place.

## **2 PRODUCTS**

### **2.1. WOOD MATERIALS**

- 2.1.1. General requirements:
  - 2.1.1.1. Except as indicated or specified otherwise lumber shall be softwood, S4S, moisture content not greater than 19% at time of installation, in accordance with following standards:
  - 2.1.1.2. CSA O141-05.
  - 2.1.1.3. NLGA-2022 Standard Grading Rules for Canadian Lumber.
- 2.1.2. Furring, blocking, nailing strips, grounds:
  - 2.1.2.1. Use S2S material.
  - 2.1.2.2. Dimension lumber sizes: in compliance with Section 12 of the NLGA-2022.
  - 2.1.2.3. Dimension lumber species and grades:
    - (1) Spruce-Pine-Fir.
    - (2) Light framing to NLGA-2022 Construction grade, S-Dry.
    - (3) Planks to NLGA-2022 No. 2 grade, S-Dry.
    - (4) Boards to NLGA-2022 No. 4 Common grade, S-Dry.
- 2.1.3. Curbs, nailers, plywood for roofing: Spruce species, NLGA construction grade, sound and free of imperfections or deficiencies making unsuitable for use. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
  - 2.1.3.1. Pressure treat with wood preservative.
- 2.1.4. Studs and framing: S-P-F Species Group, S-Dry or kiln dried, Stud Grade or No. 2 Grade unless otherwise indicated.

### **2.2. WOOD TREATMENT**

- 2.2.1. Wood preservative pressure treatment:
  - 2.2.1.1. Wood shall be pressure impregnated with fire-retardant chemicals to CAN/CSA O80 and have flame-spread rating of not more than 25 to CAN/ULC-S102-10 after wood has been subjected to an accelerated weathering test as specified in ASTM D2898-07 for exterior applications.

### **2.3. PANEL MATERIALS**

- 2.3.1. Softwood plywood (CSP): to CSA O151-09.
- 2.3.2. Douglas Fir plywood (DFP): to CSA O121-08.

## **2.4. SHEATHING MATERIALS**

### **2.4.1. Exterior sheathing:**

#### **2.4.1.1. Exterior grade plywood, thicknesses as follows:**

- (1) Walls: 12.7 mm (1/2") minimum, unless otherwise indicated.
- (2) Roofs: 15.9 mm (5/8") minimum, unless otherwise indicated.

## **2.5. FASTENINGS AND HARDWARE**

### **2.5.1. General:**

2.5.1.1. Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 38 mm (1-1/2") into wood substrate.

2.5.1.2. Anchors to concrete and unit masonry: Capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M-22, conducted by a qualified independent testing and inspecting agency.

2.5.1.3. Use surface fastenings of following types, except where specific type is indicated.

- (1) To hollow masonry, plaster and panel surfaces use 9 mm (11/32") expansion bolts or other acceptable anchor.
- (2) To solid masonry and concrete use expansion bolts.
- (3) To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws, or welded stud-bolts.
- (4) To steel deck use bolts through drilled hole or power driven self-drilling screws.

2.5.1.4. Fastener materials:

- (1) Hot-dip galvanized fasteners: ASTM A153/A153M-09 Class A or B1 G185 (CAN/CSA G164-M92 minimum zinc coating of 600 g/m<sup>2</sup>) and connectors meeting ASTM A653/A653M-11 Class G-185 sheet (CAN/CSA G164-M92 minimum zinc coating of 600 g/m<sup>2</sup>) or better.
- (2) For pressure-preservative-treated wood, use stainless-steel Type 304 fasteners.

2.5.1.5. Hardware materials:

- (1) Hot-dipped galvanized to CAN/CSA G164-M92 with minimum zinc coating of 600 g/m<sup>2</sup> or hot-dipped galvanized fasteners complying with ASTM A153/A153M-09, Class A or B1, and connectors complying with ASTM A653/A653M-11, Class G185.

2.5.2. Sheathing fasteners: Bugle head, corrosion resistant steel, power driven type, minimum length of 3 times thickness of sheathing.

2.5.3. Sill plate anchors: 15.9 mm (5/8") diameter bolts, spaced not more than 1.6 m (5'-1/4") o.c. Embed anchor bolts 150 mm (6") minimum into foundation wall so that they may be tightened without withdrawal from concrete. Washers: 2.5 times size of bolt and HEX nuts.

## **2.6. SOURCE QUALITY CONTROL**

2.6.1. Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

## **3 EXECUTION**

### **3.1. GENERAL**

3.1.1. Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.

- 3.1.2. Layout work carefully and to accommodate work of others. Cut and fit accurately. Erect in position indicated. Align, level, square, plumb, and secure work permanently in place.
- 3.1.3. Bore holes true to line and to same size as bolts. Drive bolts into place for snug fit, and use plates or washers for bolt head and nut bearings. Turn up bolts and lag screws tightly when installed, and again just before concealed by other work or at completion of work.
- 3.1.4. Cooperate with work of other sections to ensure that unity of actions will ensure orderly progress to meet construction schedule.
- 3.1.5. Include in work of this section rough hardware such as nails, bolts, nuts, washers, screws, clips, and connectors required for complete and proper installations; and operating hardware required on work of this section for temporary use.
- 3.1.6. Do not attach work by wood plugs or blocking in concrete or masonry.
- 3.1.7. Do not regard nailers, blocking, and such other fastening provision indicated as exact or complete. Install required provisions for fastening, located and secured to suit Place of the Work conditions, and adequate for intended support.
- 3.1.8. Cut work into lengths as long as practical and with square ends. Erect work plumb, in true planes, and fastened rigidly in place.
- 3.1.9. Verify that grounds required for fastening of components and equipment are located correctly and sized for adequate support.
- 3.1.10. Secure wall sheathing horizontally perpendicular to studs, with ends staggered, over firm bearing.

### **3.2. MISCELLANEOUS WOODWORK**

- 3.2.1. Fit and install wood furring, strapping, grounds and blocking. Adequately size, correctly place and conceal members for finishes, fitments and for work under other Sections. Do not assume that Drawings show required work exactly or completely. Anchor wood members securely in place.
- 3.2.2. Install rough bucks, nailing strips and linings to rough openings as required for backing for frames and other work.
- 3.2.3. Except where steel supports are specifically shown, provide wood blocking and supports in metal stud partitions for fastening of item such as casework and other wall mounted accessories. Have respective trades approve the location of such wood blocking.
- 3.2.4. Bolt wood blocking or nailing strips to steel framing.
- 3.2.5. Align and plumb faces of furring and blocking to tolerance of 1:600.
- 3.2.6. Use fire retardant lumber for blocking/framing in ceiling\ spaces, partitions and bulkheads.

### **3.3. POLYMER LUMBER CONSTRUCTION**

- 3.3.1. Construct polymer lumber where indicated on drawings.
- 3.3.2. Cut and pre-drill all wood polymer boards using carbide tipped equipment.
- 3.3.3. Gapping: gap polymer lumber end to end with a 1.6 mm gap for every 20EF of difference between installation temperature and the hottest temperature expected. Gap width to width with a minimum 3 mm gap.
- 3.3.4. Install polymer boards as recommended by manufacturer for summer or winter installations.

### **3.4. CURBS, SUPPORTS, AND BLOCKING AT ROOFING ASSEMBLIES**

- 3.4.1. Install wood curbs, upstands, supports and blocking and securely attach to structure, trimmed and levelled to receive flashings and applied roofing materials.
- 3.4.2. Slope solid wood caps at parapets to Provide positive moisture drainage toward roofing membrane unless otherwise indicated.
- 3.4.3. Provide wood nailers of minimum 38 mm (1-1/2") thick solid wood members for anchorage of fasteners.
- 3.4.4. Securely attach wood members to substrate by anchoring and fastening as indicated, complying with the following:
  - 3.4.4.1. Attach each item in the build-up with fasteners or anchors at spacing not exceeding the following:

- (1) Wood to wood:
  - (A) Screws: 450 mm (18").
  - (B) Nails: 300 mm (12").
- (2) Wood to metal:
  - (C) Screws: 450 mm (18").
  - (D) Bolts/washers: 1220 mm (48").
- (3) Wood to concrete/concrete block:
  - (E) Tapcon type screws: 450 mm (18").
  - (F) Expansion/toggle bolts/washers: 1220 mm (48").
- 3.4.4.2. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces.
- 3.4.4.3. Size fasteners for embedment into substrate in accordance with manufacturer's installation instructions.
- 3.4.5. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood.

### **3.5. EQUIPMENT BACKBOARD**

- 3.5.1. Provide backboards for mounting equipment as required. Use fire rated 19 mm (3/4") Plywood.
- 3.5.2. Refer to Divisions 21, 22, 23, 26, 27 and 28 for requirements for electrical backboards.

### **3.6. MISCELLANEOUS PLYWOOD BLOCKING**

- 3.6.1. Provide minimum 19 mm (3/4") softwood plywood blocking for attachment of miscellaneous fitments as indicated.
- 3.6.2. Wood blocking within gypsum board metal stud assemblies under work of Section 09 22 00.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Warranty
- .10 2.1. Approved Manufactures
- .11 2.2. Performance Requirements
- .12 2.3. Materials
- .13 2.4. Composite Insulating Wall Sheathing
- .14 2.5. Fasteners
- .15 2.6. Sheathing Joint And Penetration Treatment Material
- .16 2.7. Source Quality Control
- .17 3.1. General
- .18 3.2. Sheathing Installation

### **1.3. SUMMARY**

- 1.3.1. Section includes insulating wall sheathing with integral water-resistive barrier and air barrier.

### **1.4. REFERENCES**

- 1.4.1. American Society of Mechanical Engineers (ASME): [www.asme.org](http://www.asme.org)
  - 1.4.1.1. ASME B18.6.1 - Wood Screws (Inch Series)
- 1.4.2. ASTM International (ASTM): [www.astm.org](http://www.astm.org)
  - 1.4.2.1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - 1.4.2.2. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
  - 1.4.2.3. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
  - 1.4.2.4. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
  - 1.4.2.5. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
  - 1.4.2.6. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
  - 1.4.2.7. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
  - 1.4.2.8. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
  - 1.4.2.9. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
  - 1.4.2.10. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- 1.4.3. US Department of Commerce (DOC): <http://gsi.nist.gov/global/index.cfm/L1-5/I2-44/A-355>
  - 1.4.3.1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels
- 1.4.4. International Code Council (ICC): [www.iccsafe.org](http://www.iccsafe.org)

- 1.4.4.1. ICC IBC - International Building Code
- 1.4.4.2. ICC IRC - International Residential Code for One and Two-Family Dwellings
- 1.4.5. ICC Evaluation Service, Inc. (ICC-ES): [www.icc-es.org](http://www.icc-es.org)
  - 1.4.5.1. ICC-ES AC12 - Acceptance Criteria For Foam Plastic Insulation
  - 1.4.5.2. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
  - 1.4.5.3. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
  - 1.4.5.4. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
  - 1.4.5.5. ICC-ES AC201 - Acceptance Criteria for Staples
  - 1.4.5.6. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
  - 1.4.5.7. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
  - 1.4.5.8. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
  - 1.4.5.9. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction
  - 1.4.5.10. Sustainable Forestry Initiative (SFI): [www.sfiprogram.org/](http://www.sfiprogram.org/)
    - (1) SFI 2010 - 2014 Standard

## **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product Data:
  - 1.5.2.1. Submit all product data for each type of sheathing product specified.
- 1.5.3. Evaluation Reports
  - 1.5.3.1. From ICC-ES, for wood sheathing and seam tape.
- 1.5.4. Product Certifications:
  - 1.5.4.1. From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.
- 1.5.5. Certified Wood Certificates:
  - 1.5.5.1. Certificates indicating that manufacturer is currently certified by an FSC-accredited certification body, and chain-of-custody certificates indicating that sheathing products comply with forest certification requirements.

## **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Warranty: Executed copy of manufacturer special warranties.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Manufacturer Qualifications:
  - 1.7.1.1. Provide wood products from manufacturer certified by FSC, or comparable sustainable forestry program acceptable to Architect.
- 1.7.2. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.
- 1.7.3. Provide wall sheathing products meeting requirements of ICC-ES AC269.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Store and handle products according to manufacturer's written recommendations. Support panel bundles off the ground.
- 1.8.2. Cover stored panels with weatherproof protective material; allow sides of protective material to remain loose to ensure adequate air circulation.
- 1.8.3. In high-moisture conditions, cut bundle banding to prevent edge damage to panels. Factory applied packaging is intended only for protection during transit.

## **1.9. WARRANTY**

- 1.9.1. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate

deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.

1.9.2. Warranty Period for Sheathing Products:

1.9.2.1. 30 years following date of Substantial Completion.

1.9.3. Warranty Conditions:

1.9.3.1. Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

## 2 PRODUCTS

### 2.1. APPROVED MANUFACTURES

2.1.1. Basis of Design Product:

2.1.1.1. Huber Engineered Woods LLC

(1) Charlotte NC, USA

(2) Phone: (800) 933-9220

(3) Website: [www.zipsystem.com](http://www.zipsystem.com).

2.1.1.2. Or equivalent

### 2.2. PERFORMANCE REQUIREMENTS

2.2.1. Air-Barrier Assembly Air Leakage:

2.2.1.1. Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.

2.2.2. Water-Vapor Permeance, Facer:

2.2.2.1. Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

2.2.3. Weather Exposure:

2.2.3.1. Manufacturer warranty applies for maximum allowable exposure period of 180 days.

### 2.3. MATERIALS

2.3.1. Certified Wood: Provide sheathing produced from wood obtained from forests certified by an accredited certification body.

2.3.2. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

2.3.3. Rigid Foam Plastic Insulating Board:

2.3.3.1. Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:

(1) Nominal Density: 2.0 pcf (32 kg/cu. m).

(2) Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).

(3) Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.

(4) Edge Configuration: Square finished.

### 2.4. COMPOSITE INSULATING WALL SHEATHING

2.4.1. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch (11.1 mm) thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

2.4.1.1. Basis-of-Design Product:

(1) Huber Engineered Woods LLC; ZIP System R Sheathing.

(2) Or equivalent

2.4.1.2. Span Rating and Performance Category of Sheathing Layer:

(1) Not less than 7/16 Performance Category.

2.4.1.3. Thickness: 63mm (2.5")

2.4.1.4. Thermal Resistivity (R Value): R12.6

2.4.1.5. Edge Profile: Square edge.

2.4.1.6. Exterior Facer:

- (1) Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC308 and AC308.1, with fastener spacing symbols on exterior face for 16-inch (406 mm) and 24-inch (610 mm) on center spacing, with the following characteristics
  - (A) Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
  - (B) Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
  - (C) Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft. (137 Pa).
  - (D) Wind Driven Rain, TAS-100: Pass.
  - (E) Accelerated Weathering, ASTM G154: Pass.

## **2.5. FASTENERS**

- 2.5.1. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.
- 2.5.2. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M
- 2.5.3. Nails, Brads, and Staples: ICC AC116 and ICC AC201.
- 2.5.4. Power-Driven Fasteners: ICC-ES-1539 or NER-272.
- 2.5.5. Wood Screws: ASME B18.6.1.

## **2.6. SHEATHING JOINT AND PENETRATION TREATMENT MATERIAL**

- 2.6.1. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.
- 2.6.2. Basis-of-Design Product:
  - 2.6.2.1. Huber Engineered Woods; ZIP System Stretch Tape.
  - 2.6.2.2. Huber Engineered Woods; ZIP System Flashing Tape.
  - 2.6.2.3. Thickness: 0.012 inch (0.3 mm).

## **2.7. SOURCE QUALITY CONTROL**

- 2.7.1. Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

# **3 EXECUTION**

## **3.1. GENERAL**

- 3.1.1. Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant.
- 3.1.2. Commencement of work of this Section means acceptance of existing conditions.

## **3.2. SHEATHING INSTALLATION**

- 3.2.1. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
- 3.2.2. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.
- 3.2.3. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.
- 3.2.4. Install panels with laminated face to exterior. Stagger end joints of adjacent panel runs.
- 3.2.5. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
  - 3.2.5.1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
  - 3.2.5.2. IBC: Table 2304.9.1 Fastening Schedule.
- 3.2.6. Apply seam tape at all panel seams, penetrations, and face defects or cracks to form continuous weathertight surface.
- 3.2.7. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Field Conditions
- .10 1.10. Warranty
- .11 2.1. Performance/Design Requirements
- .12 2.2. General
- .13 2.3. Wood Materials
- .14 2.4. Panel Materials
- .15 2.5. Plastic And Composite Materials
- .16 2.6. Fasteners And Adhesives
- .17 2.7. Cabinet Hardware
- .18 2.8. Miscellaneous Hardware
- .19 2.9. Fabrication
- .20 2.10. Fabrication - Cabinets
- .21 2.11. Fabrication - Wood Veneer Work
- .22 2.12. Fabrication - Plastic Laminate Faced Work
- .23 2.13. Fabrication - Trim
- .24 2.14. Fabrication - Fire Retardant Treatment
- .25 2.15. Factory Finish
- .26 2.16. Finishes - Interior Architectural Woodwork
- .27 3.1. Preparation
- .28 3.2. Installation
- .29 3.3. Installation – Tolerances
- .30 3.4. Adjusting And Cleaning
- .31 3.5. Protection
- .32 3.6. Field Quality Control
- .33 3.7. Adjustment And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Work of this section *includes* architectural woodwork including, but not limited to, the following:
- 1.3.1.1. Standing and running trim.
  - 1.3.1.2. Cabinetry and hardware.
  - 1.3.1.3. Solid surfacing countertops and fabrications.
  - 1.3.1.4. Wood wall panels.
  - 1.3.1.5. Factory and Site finishing of architectural woodwork.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination:
- 1.4.1.1. Coordinate with other work for satisfactory and expeditious completion of the work of this section. Coordinate with partition accessories, electrical,

- communications, and finish components to ensure that proper provisions are made for the installation of the work of this section and for work by others.
- 1.4.1.2. Where woodwork is to be fitted to other construction, check actual dimension of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delays in the Work.
  - 1.4.1.3. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in the work of this section and set in place. Instruct applicable Subcontractors as to their locations.
  - 1.4.1.4. Provide cut-outs for raceways, sleeves, grommets and other manufactured accessories which are required for the work of this section and for work by others.
- 1.4.2. Conduct a pre-fabrication meeting in accordance with Section 01 31 19.

## **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data for each type of *Product* and process proposed for use in the work of this section and incorporated into items of architectural woodwork.
- 1.5.3. Certificates:
  - 1.5.3.1. Fire retardant pressure treated lumber or panel materials and water resistant panel materials shall be accompanied by supplier's certificate of conformance with this specification.
  - 1.5.3.2. Include manufacturer's written requirements for finishing treated material.
- 1.5.4. Shop drawings:
  - 1.5.4.1. Submit shop drawings for the work of this section complying with the North American Architectural Woodwork Standards 4.0 requirements.
  - 1.5.4.2. Indicate quality standards and grades.
  - 1.5.4.3. Include full scale drawings of all exposed-to-view edge conditions.
  - 1.5.4.4. Include plans, sections and large scale details, and indicate components and methods of assembly, fastenings, and other fabrication information required for the work of this section. Indicate assembly joint lines.
  - 1.5.4.5. Include materials and their characteristics and finishes as applicable including the following:
    - (1) Panel core and material types, thicknesses, compliance with specified standards, special treatments.
    - (2) Adhesive types to be used and locations.
    - (3) Finishing requirements including North American Architectural Woodwork Standards 4.0 finish system number, sheen, and required application steps.
  - 1.5.4.6. Submit coordination drawings indicating locations of concealed grounds, cut-outs, plates, and other required fabrications.
  - 1.5.4.7. Show relation to adjoining construction, details of outside and inside corners and door openings.
  - 1.5.4.8. Provide flame spread ratings of walls and ceiling finishes to meet building code requirements, tested and listed by accredited listing agency.
- 1.5.5. Selection Samples
  - 1.5.5.1. Submit 3 sets of samples for initial selection purposes of actual veneers showing full range of grain variation, colour and matching, natural characteristics reflecting wood cut and species, manufacturing characteristics, and for each wood species specified. Submit samples as many times as required until approved by Consultant. First submission to include one set of samples per Consultant request plus one set lighter in tone and one set darker in tone.

- (1) Solid wood with factory finish, and each type of edge trim: set of 3 pieces, 50 mm x 19 mm x 450 mm (2" x 3/4" x 18"), for each colour and finish and installed condition, finished on one side and one edge.
- 1.5.5.2. Casework hardware, one unit of each type and finish.
- 1.5.6. Verification samples:
  - 1.5.6.1. Submit samples for purpose of verification of compliance with specified requirements.
  - 1.5.6.2. Submit 3 sets of 200 mm x 200 mm (8" x 8") samples, or 200 mm (8") long as applicable, of each specified Product, material and finish, including but not limited to the following:
    - (1) Shop finished materials, showing each type of finish and colour.
    - (2) Samples of each specified Product, in each specified colour and finish.
    - (3) Solid surfacing in each specified colour and finish.
    - (4) Plastic laminates, in each specified colour and finish.

## **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.6.2. Operation and maintenance data:
  - 1.6.2.1. Submit maintenance and cleaning instructions for finishes requiring specific care, noting particularly those procedures or materials which will cause damage to finished surfaces to be included in maintenance manuals.
- 1.6.3. Maintenance materials:
  - 1.6.3.1. Deliver extra sets of hardware items for maintenance as follows:
    - (1) 2 sets of each type actually installed.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Manufacturers:
    - (1) Architectural woodwork shall be manufactured by a firm having a minimum of 5 years' experience on work of similar size and quality.
    - (2) Shall be a member in good standing of the Architectural Woodwork Institute or the Architectural Woodwork Manufacturers Association of Canada or the Woodwork Institute.
    - (3) Fabricator solid surfacing: Fabrication to be performed by a solid surface manufacturer's certified fabricator.
    - (4) Submit certification letter prepared by the solid surfacing manufacturer.
  - 1.7.1.2. Installers / applicators / erectors: engage an installer who has successfully completed 2 architectural woodwork projects similar in scope, materials and design to this project within the last 5 years.
- 1.7.2. Quality standard:
  - 1.7.2.1. *Work* shall be in accordance with the Architectural Woodwork Standards 4.0, Premium Grade, or the highest grade available for performance and appearance characteristics of materials in Sections 3 – 5 used that apply to *Product* fabrication and installation requirements governed by Sections 6 – 12.
- 1.7.3. Mock-ups:
  - 1.7.3.1. All veneer and solid types
  - 1.7.3.2. All edge and joint types.
  - 1.7.3.3. Solid surface countertop; 1 complete countertop mock-up.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Protect architectural woodwork during transit, delivery, storage and handling to prevent damage, spoilage, and deterioration.
- 1.8.2. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate architectural woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only

in areas whose environmental conditions meet requirements specified under paragraph Field Conditions.

- 1.8.3. The Contractor shall be solely responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content. The Contractor shall coordinate the delivery of the woodwork with the architectural woodwork manufacturer.

## **1.9. FIELD CONDITIONS**

- 1.9.1. Environmental conditions:

- 1.9.1.1. During storage and installation:

- (1) Obtain and comply with Architectural Woodwork Standard's for optimum temperature and relative humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained. Woodwork shall be acclimatized for a minimum of 72 hours prior to commencing woodwork installation.

- 1.9.1.2. During finishing:

- (1) Comply with Architectural Woodwork Standard's temperature and humidity requirements before, during, and after application of finishes.

- 1.9.1.3. During service life of woodwork:

- (1) Obtain and comply with woodwork manufacturer's advice for optimum temperature and humidity conditions for woodwork. Note that building humidity control is not in operation 24 hours per Day or 365 Days per year and system is intermittent during winter and summer months. As a result, fabrication of wood components should anticipate major changes in humidity levels.

## **1.10. WARRANTY**

- 1.10.1. Warrant work of this section in accordance with Section 01 78 36.

- 1.10.2. Extended warranty:

- 1.10.2.1. Labour, materials, and workmanship for work of this section.

- 1.10.2.2. Durations:

- (1) Casework and plastic laminate work: 3 years.  
(2) Solid surface fabrications: 10 years

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Casework integrity shall meet the minimum acceptance levels in accordance with SEF 8-1999 as outlined in the North American Architectural Woodwork Standards 4.0 and additional or greater loading capacities as specified throughout the North American Architectural Woodwork Standards 4.0.

- 2.1.2. Maximum allowable adjustable shelf lengths shall comply with shelves assembly rules per the North American Architectural Woodwork Standards 4.0 based on shelf thickness indicated or scheduled.

- 2.1.3. Welding:

- 2.1.3.1. Weld components in steel to conform to requirements of CSA W59-18, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-09(2018) and CSA W55.3-08 (R2018) as applicable.

- 2.1.3.2. Weld components in aluminum to conform to requirements of CSA W59.2-M1991 (R2013), and by a fabricator certified by the Canadian Welding Bureau to conditions of CSA W47.2-12.

- 2.1.3.3. Weld stainless steel components to conform to requirements of CSA W59-15 and ANSI/AWS D1.6/D1.6M as applicable, and by a fabricator fully certified by the Canadian Welding Bureau to conditions of CSA W47.1-09(2018).



## **2.2. GENERAL**

- 2.2.1. Single-source manufacturing and Installation responsibility:
  - 2.2.1.1. Engage a qualified manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.
- 2.2.2. All materials under work of this Section, including but not limited to, adhesives and mastics, are to have low VOC content limits.

## **2.3. WOOD MATERIALS**

- 2.3.1. Lumber:
  - 2.3.1.1. Hardwood for concealed blocking and framing: Custom Grade, any species that, when painted, will not show any defects.
  - 2.3.1.2. Hardwood for exposed blocking: species and grade to match panel veneer.
  - 2.3.1.3. Moisture content: Provide kiln-dried (KD) lumber with moisture content range between 6% to 12% for interior architectural woodwork. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed 5% to 10%.
  - 2.3.1.4. Solid hardwood painted finish.
    - (1) Species: White Birch.
    - (2) Cut: Rift.
- 2.3.2. Wood veneers:
  - 2.3.2.1. Allowable wood veneer face grade characteristics shall comply with Architectural Woodwork Standards, Edition 2, 2014 referenced grade and referenced standards.
    - (1) Species: White Birch.
    - (2) Veneer cut: Rotary.
    - (3) Veneer leaf matching: Random.
  - 2.3.2.2. Edgeband exposed panel edges with 6 mm (1/4") thick solid hardwood trim, unless otherwise indicated.

## **2.4. PANEL MATERIALS**

- 2.4.1. Panel material schedule; except where indicated otherwise:
  - 2.4.1.1. Thickness: 19 mm (3/4") minimum.
  - 2.4.1.2. Core panels:
    - (1) At plastic laminate and melamine work: Particle board.
    - (2) Plywood backing; countertops, backsplashes, and where indicated: Exterior grade plywood with no added urea-formaldehyde used in composition.
    - (3) Plywood backing; solid surface countertops: marine grade plywood.
  - 2.4.1.3. Drawer sides, backs, and bottoms: Baltic Birch, minimum 12.7 mm (1/2").
  - 2.4.1.4. Maximum moisture content at time of installation: 10% to 12%.
- 2.4.2. Plywood:
  - 2.4.2.1. Veneer core plywood non telegraphing grain: Sanded good one side or good two sides (when both sides exposed or to receive applied finish materials) plywood:
    - (1) Hardwood plywood: in accordance with ANSI/HPVA HP-1-2009.
    - (2) Softwood plywood: to US Plywood Standard APA PS-1-09 Structural Plywood (with Typical APA Trademarks).
  - 2.4.2.2. Baltic Birch; exposed and semi-exposed: Birch facers and core veneers, type 2 hot press glue bond (E-1 rating meets European low formaldehyde emission standard), European Face Grade B - Premium grade on exposed faces (patch free clear faces, uniform white in colour), premium edge quality where cut to expose, free of gaps and defects.
  - 2.4.2.3. Marine grade plywood: 19 mm (3/4") nominal thickness, in accordance with CSA O121-08, marine grade DFP, sanded both sides.

- 2.4.2.4. Fire rated plywood shall be pressure impregnated with fire-retardant chemicals in accordance with CAN/CSA O80 and have Flame Spread Value (FSV) of not more than 25 to CAN/ULC-S102-10.
- 2.4.3. Medium density fibreboard (MDF):
  - 2.4.3.1. To ANSI A208.2-2016, 720 kg/m<sup>3</sup> (45 lbs/ft<sup>3</sup>) minimum density and as follows:
    - (1) Grade:
      - (A) Grade 130.
    - (2) Formaldehyde emission: No added urea-formaldehyde used in composition.
  - 2.4.3.2. Fire retardant medium density fibreboard (MDF) shall comply with the following requirements in addition to the above requirements:
    - (1) No Ammonium Polyphosphate used in composition.
    - (2) Maximum values in accordance with CAN/ULC-S102-10:
      - (B) Flame Spread Value (FSV): Maximum 25.
      - (C) Smoke Developed Value (SDV): Maximum 50.
- 2.4.4. Particleboard:
  - 2.4.4.1. In accordance with ANSI A208.1-2009, and as follows:
    - (1) Industrial grade:
      - (D) M-3i Medium density; between 640 - 800 kg/m<sup>3</sup> (40 - 50 lb/ft<sup>3</sup>).
    - (2) Formaldehyde emission: No added urea-formaldehyde used in composition.
  - 2.4.4.2. Fire retardant medium density particle board shall comply with the following requirements in addition to the above requirements:
    - (1) No Ammonium Polyphosphate used in composition.
    - (2) Maximum values in accordance with CAN/ULC-S102-10:
      - (E) Flame Spread Value (FSV): Maximum 25.
      - (F) Smoke Developed Value (SDV): Maximum 50.

## **2.5. PLASTIC AND COMPOSITE MATERIALS**

- 2.5.1. High pressure decorative laminate:
  - 2.5.1.1. General purpose grade: in accordance with ANSI/NEMA LD 3-2005, Horizontal General Purpose Grade (HGS).
  - 2.5.1.2. Colours, finishes, and patterns: as selected by Consultant.
  - 2.5.1.3. acceptable Products: Refer to Materials and Finish Schedule

## **2.6. FASTENERS AND ADHESIVES**

- 2.6.1. Wood screws:
  - 2.6.1.1. FF-S-111D Latest Amendment 1, type, size, material and finish as required for the condition of use.
- 2.6.2. Nails:
  - 2.6.2.1. FED FF-N-105, type, size material and finish as required for the condition of use.
- 2.6.3. Anchors:
  - 2.6.3.1. Type, size material and finish as required for the condition of use.
- 2.6.4. Fastening devices shall be set or countersunk flush with surface of framing member. No exposed fasteners permitted. Where accepted by the Consultant, exposed fasteners shall be flat head hex socket cap screws and matching joint connector sex bolts (also known as Chicago screws or post and screw) by Murakoshi, distributed by Richelieu or equivalent, Spaenaur Joint Connector bolt with decorative head, hex drive series; finish as selected by the Consultant.
- 2.6.5. At butt joints in railing caps and counter surfaces, employ assembling bolts to ensure tight structural joint.
- 2.6.6. Adhesives:
- 2.6.7. Type II water resistant, except use Type I waterproof in wet environments.

## **2.7. CABINET HARDWARE**

- 2.7.1. Casework hardware; to be furnished and installed by the architectural woodwork manufacturer.
  - 2.7.1.1. As far as practical, use one manufacturer's products for all Products specified, indicated, or scheduled.
  - 2.7.1.2. All costs associated with the Products of this Section are not covered by a cash allowance and shall be included in the Contract Price.
  - 2.7.1.3. Cabinet and auxiliary hardware: Where casework hardware is not specified or indicated on the Drawings or scheduled, casework hardware shall comply with ANSI/BHMA Standards, latest edition, minimum grades, loading and other basic rules per the North American Architectural Woodwork Standards, 4.0

## **2.8. MISCELLANEOUS HARDWARE**

- 2.8.1. Stainless steel hat and coat hook: Specified under Section 10 28 00 for installation as part of the work of this section
- 2.8.2. Wall Panel Hanging System: Monarch Hanging System as manufactured by:
  - 2.8.2.1. Monarch Metal Fabrication, 1700 Ocean Ave Suite 2, Ronkonkoma, NY 11779  
Phone: (631) 750-3000  
Fax: (631) 563-8976  
Please note that this system is available through Lee Valley Tools under the product 'Z-Clips'  
<https://www.leevalley.com/en-ca/shop/hardware/fasteners/clips/41869-z-clips>.  
The preferred system depth is 6mm (1/4").
- 2.8.3. Grommets for cable passage through countertops;
  - 2.8.3.1. Moulded-plastic grommets and matching plastic caps with slot for wire passage.
  - 2.8.3.2. Grommets: '12672V' by Richelieu

## **2.9. FABRICATION**

- 2.9.1. Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises pre-cut, where possible, to receive hardware and other items of work.
- 2.9.2. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to maximum extent possible. Trial fit in shop and disassemble components only as necessary for shipment and installation. Where necessary, Provide ample allowance for scribing, trimming, and fitting. Reassemble with concealed fasteners.
- 2.9.3. Provide woodwork, solid tops and other indicated materials with pre-cut openings, where possible, for hardware, appliances, plumbing fixtures, electrical work, telephone cut-outs and similar items. Locate openings accurately and Provide proper size and shape. Smooth edges of cut-outs and, where located in countertops, seal edges of cut-outs with a water-resistant coating.
- 2.9.4. Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.
- 2.9.5. Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Take responsibility for the stability of furniture and fitments.
- 2.9.6. Do fabrication from field measurements with provisions for scribing as required to meet built-in conditions.
- 2.9.7. Provide balancing sheets as required, and specified, complying with the North American Architectural Woodwork Standards 4.0.
- 2.9.8. Provide surface mount blocking & strapping necessary to support the work of this section. Such blocking shall not be exposed upon completion of work.
- 2.9.9. Prefinish work at the factory, except where specified or indicated otherwise.
- 2.9.10. Solid wood edging: No end grain shall be visible; mitre external corners; house internal corners.
- 2.9.11. Fabricate work square and to the required lines. Recess and conceal fasteners and anchor heads. Fill with matching wood plugs.

- 2.9.12. Make each unit rigid and self-supporting, suitable for individual removal.
- 2.9.13. Provide wood members free from bruises, blemishes, mineral marks, knots, shake and other defects and select for colour, grain and texture. Machine and hand sand surfaces exposed in the finished work to an even, smooth surface free from defects detrimental to appearance.
- 2.9.14. Finish exposed edges and curves smooth. Keep contrast in colour and grain in adjoining materials to a minimum.
- 2.9.15. Provide running members in the maximum lengths obtainable. Provide thickness of members in maximum dressed size of standard lumber. Where thickness or width indicated is not available in hardwoods, use glue laminations to obtain sizes required.
- 2.9.16. Spline or key solid boards 150 mm and wider and glue under pressure. Unless otherwise specified or indicated, book-match veneered faces, using selected and approved veneers. Provide unexposed backs of veneers having the same physical characteristics as the face veneer.
- 2.9.17. Design and fabricate work to allow for expansion and contraction of the materials. Unless otherwise specified, work shall be glued, and blind screwed or nailed. Properly frame material with tight, hairline joints and hold rigidly in place. Use glue blocks where necessary.
- 2.9.18. Conceal joints and connections wherever possible. Locate prominent joints where directed. Glue and pin mortise and tenon joints. Intermediate joints between supports will not be permitted. Set and fill surface nails. Prevent opening-up of glue lines in the finished work.
- 2.9.19. Comply with glue manufacturer's recommendations for lumber moisture content, glue shelf life, pot life, working life, mixing, spreading, assembly time, time under pressure and ambient temperature.
- 2.9.20. Provide exposed and grain of solid members and edges of exposed plywood with matching solid edging at least 6 mm thick.
- 2.9.21. Seal finish carpentry wood items before they leave the fabricating shop. For surfaces to receive a natural or stain finish ensure that the sealer is compatible with the final finish. Coordinate with Section 09 91 00 Painting and obtain written approval of proposed sealer.
- 2.9.22. Fit shelf, door, drawer, gable and cabinet edges and other edges with 12 mm hardwood edging prior to application of laminated plastic edging or subsequent finishing.
- 2.9.23. Set nails and screws, apply wood filler to indentations, sand smooth and prepare to receive finish. Clean, ensure surfaces are free of dust.

## **2.10. FABRICATION - CABINETS**

- 2.10.1. Framing: Solid stock framing assembled with machined dovetailed, mortised tennoned or blind dado joints adequately glued and secured with screws.
- 2.10.2. Refer to Architectural Drawings.
- 2.10.3. As identified in specific notes on Architectural Drawing.
  - 2.10.3.1. Unless otherwise indicated, all exposed parts of cabinet modules and drawers (sides of pedestals, supports, including the underside of upper pedestals) as well as exposed shelves will be finished according to the elevations.
  - 2.10.3.2. Unless otherwise specified, fabricate all built-in furniture to the finish assigned in the finish description.
  - 2.10.3.3. All edges of doors and drawers to match the front.
- 2.10.4. Counter tops in laminate will be made of 16mm water resistant plywood finished on all its' surfaces in plastic laminate.
- 2.10.5. Kick-plates: as noted in Architectural Drawings
- 2.10.6. Provide cut-outs for sinks, fitments and services as required.
- 2.10.7. Gables: 19 mm plywood. Attach gables to framing with tongue and groove. Reinforce connections with supplementary metal angles. Route gables to receive shelf standards and fixed shelving.
- 2.10.8. Shelving: 19 mm plywood. All visible edges shall be finished, except that adjustable shelves shall be edged on front and back.

## **2.11. FABRICATION - WOOD VENEER WORK**

- 2.11.1. Check job dimensions and conditions. Do not proceed until unsatisfactory conditions are corrected.

## **2.12. FABRICATION - PLASTIC LAMINATE FACED WORK**

- 2.12.1. Refer to Architectural Drawings for Plastic Laminate locations.
- 2.12.2. Factory apply plastic laminate to interiors of all cabinetwork except drawers, but including drawer fronts and shelves, including underside of cabinets.
- 2.12.3. Edge band doors, drawers, gables and all visible edges of plywood and particle board components with plastic laminate to match faces, strips same width as plywood or particle board.
- 2.12.4. Apply backing sheet to laminated flatwork. Apply uniform coating of sealer on exposed edges. Provide backing sheet of sufficient thickness to compensate stresses caused by the facing sheet.
- 2.12.5. Self-edge straight-line-edging with 1.2 mm standard material and radius corners with post-forming material; apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20 degrees using machine router.
- 2.12.6. Locate joints at 2400 mm to 3000 mm o.c. At L-shaped corners mitre plastic laminate, to the outside corner. Accurately fit members together to provide tight and flush butt joints, in true planes. Provide 6 mm blind spline and approved type draw bolts; one draw bolt for widths up to 150 mm at maximum 450 mm centres for widths exceeding 150 mm. Colour-match adjoining units.
- 2.12.7. Provide cut-outs as required for inserts, fixtures and fittings. Use radiused corners and chamfer edges around cut-outs to avoid chipping laminate.
- 2.12.8. Post-form laminate work to details indicated. Provide same core and laminate profiles to provide continuous support and bond for the entire surface.
- 2.12.9. Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.

## **2.13. FABRICATION - TRIM**

- 2.13.1. Trim members shall be of sizes and profiles indicated. Trim members shall be slow-fed work, free from chatter and other machine marks.
- 2.13.2. Provide trim over 60 mm wide with backs ploughed or kerfed. Mitre all joints. Carefully machine drum-sand exposed flat surfaces. Minimize sanding on the job.

## **2.14. FABRICATION - FIRE RETARDANT TREATMENT**

- 2.14.1. Provide ULC label for treated wood products as received from the pressure treating plant.
- 2.14.2. Do not expose pressure treated material to dampness between the time the material is treated and the time the finish is applied. Carefully sand surfaces which show surface salt deposits to remove such deposits before finish is applied.
- 2.14.3. Provide quality of finished work of equal standard to that of untreated material. Provide identification on materials delivered to Project site showing that these Specifications have been complied with, on each large item, and on bundles of small items. Arrange wood members in pressure treating cylinder to avoid sticker marks on best face of members.
- 2.14.4. Fire retardant varnish: Apply varnish to substrates in strict accordance to manufacturer's instructions. Maintain room temperature and humidity recommended by the varnish manufacturer.

## **2.15. FACTORY FINISH**

- 2.15.1. Factory finish work scheduled to receive stained and clear finish to match approved control sample. Apply finish in accordance with manufacturer's approved methods using approved equipment to cut outs, exposed and semi-exposed surfaces. Unfinished work will be listed as deficiencies.
- 2.15.2. Spray finish work to North American Architectural Woodwork Standards 4.0 (NAAWS) Section 5 Conversion Varnish Premium Grade. Apply wash coat. Let dry and sand lightly. Apply first shade coat, let dry and sand. Apply second shade/toner coat, let dry and sand.

Apply 1 coat of sealer, let dry and sand. Apply top coat with clear alkyd amino conversion varnish, 45 degree sheen.

- 2.15.3. Sand smooth work and clean surfaces free of dust before applying successive coat. Carefully sand with even strokes to provide perfect, scratch-free surface.

## **2.16. FINISHES - INTERIOR ARCHITECTURAL WOODWORK**

- 2.16.1. General:  
2.16.1.1. The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.
- 2.16.2. Preparations for finishing:  
2.16.2.1. Prior to finishing, exposed portions of woodwork shall have handling marks or effects of exposure to moisture removed with a thorough final sanding over surfaces of the exposed portions, using appropriate grit sandpaper, and shall be cleaned prior to applying sealer or finish. Sanding shall be completed just prior to stain or finishing application.
- 2.16.2.2. Concealed surfaces of woodwork that might be exposed to moisture, such as those adjacent to exterior concrete or masonry walls, shall be back-primed.
- 2.16.2.3. Comply with referenced quality standard in Part 1 for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work

## **3 EXECUTION**

### **3.1. PREPARATION**

- 3.1.1. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- 3.1.2. Ensure that environmental conditions have been provided as requested and specified.
- 3.1.3. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.
- 3.1.4. Provide all grounds, nailers and other required fabrications which are to be built into other work when required.
- 3.1.5. Ensure that wall and ceiling variations are not in excess of 6.4 mm (1/4") in 3658 mm (144") and that floors are not in excess of 12.7 mm (1/2") in 3658 mm (144") of being plumb, level, flat, straight, square, of the correct size. Variations shall be corrected prior to installation of work of this section.
- 3.1.6. Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

### **3.2. INSTALLATION**

- 3.2.1. Install woodwork to comply with Architectural Woodwork Standards 4.0 for same grade specified in Part 1 of this section for type of woodwork involved.
- 3.2.2. Install woodwork plumb, level, true, and straight with no distortions.
- 3.2.3. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- 3.2.4. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- 3.2.5. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
- 3.2.6. Provide heavy duty fixture attachments for wall mounted cabinet work.
- 3.2.7. Apply sealant between units and adjacent wall and floor surface, around sills, pipes and escutcheon plates and similar areas to seal and finish installation, in accordance with Section 07 92 00.
- 3.2.8. Make allowances around perimeter where fixed objects pass through or project into carpentry work to permit normal movement without restriction

- 3.2.9. Touch up cut edges and surfaces with sealer.
- 3.2.10. Apply water resistant building paper or bituminous coating over wood framing members in contact with cementitious construction.
- 3.2.11. Mechanically fasten wall panelling to framing by concealed means.
- 3.2.12. After installation, adjust operating hardware for proper fit and function.
- 3.2.13. Protect finished surfaces by approved means. Do not remove until immediately before final inspection.
- 3.2.14. Plastic wood:
  - 3.2.14.1. Install plastic wood in accordance with manufacturer's instructions and recommendations.
  - 3.2.14.2. Install with the following minimum expansion/contraction gaps, wider as recommended by manufacturer:
    - (1) Width-to-width: 9.5 mm (3/8").
    - (2) End-to-end: 3.2 mm (1/8").
    - (3) Perimeter and abutting solid objects: 6.4 mm (1/4").
  - 3.2.14.3. Screw-down installation: Use manufacturer's recommended screws, exterior grade. Install screws at least 25 mm (1") in from board edges.

### **3.3. INSTALLATION – TOLERANCES**

- 3.3.1. Install to a tolerance of 3 mm in 2400 mm (1/8" in 8'-0") for plumb and level (including tops) and with no variations in flushness of adjoining surfaces unless otherwise acceptable in accordance with the North American Architectural Woodwork Standards, 4.0.

### **3.4. ADJUSTING AND CLEANING**

- 3.4.1. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork.
- 3.4.2. Clean, lubricate, and adjust hardware.
- 3.4.3. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

### **3.5. PROTECTION**

- 3.5.1. Protect architectural woodwork during remainder of construction period to ensure that work will be without damage or deterioration at time of acceptance.
- 3.5.2. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that woodwork is without damage or deterioration at time of Substantial Performance of the Work.

### **3.6. FIELD QUALITY CONTROL**

- 3.6.1. 1. Professional engineer responsible for the preparation of engineered submittals shall
- 3.6.2. undertake periodic field review.

### **3.7. ADJUSTMENT AND CLEANING**

- 3.7.1. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork.
- 3.7.2. Clean, lubricate, and adjust hardware.
- 3.7.3. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.
- 3.7.4. On completion, remove manufacturer's identification markings and clean plastic laminate surfaces.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.
- 1.1.2. The Air Tightness Testing Contractor (retained under the cash allowance) will provide the air tightness testing services outlined in 1.6 and 1.7 of this specification section. The remainder of this section outlines the Contractor requirements as they relate to the completion of the air barrier systems, preparation of the building for air tightness tests, accommodating the tests in the project schedule and during daily activities, and addressing any areas of concern relating to air leakage.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. Section Includes
- .3 1.1. Section Includes
- .4 1.3. Summary
- .5 1.4. Related Sections
- .6 1.5. References
- .7 1.6. Proposed Inspection And Reporting
- .8 1.7. Responsibilities
- .9 1.8. Administrative Requirements
- .10 2.1. Adhesives & Sealants
- .11 2.2. Paints & Coatings
- .12 3.1. Onsite Quality Control
- .13 3.2. Whole Building Air Tightness Testing

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Air tightness target for the whole building
  - 1.3.1.2. Air tightness target for compartmentalization
    - .1 Crew Side
    - .2 Apparatus Bay Side
  - 1.3.1.3. Overview of the air tightness tests that will be carried out during construction
  - 1.3.1.4. Sequencing requirements and scheduling milestones relating to the completion of the continuous air barrier system
  - 1.3.1.5. Procedural and coordination requirements to accommodate air tightness testing
  - 1.3.1.6. Remediation requirements

### **1.4. RELATED SECTIONS**

- 1.4.1. Section 01 40 00 – Quality Requirements
- 1.4.2. Section 01 81 21 – Energy Efficiency Requirements

### **1.5. REFERENCES**

- 1.5.1. Abbreviations and Acronyms
  - 1.5.1.1. ATT: Air tightness test
  - 1.5.1.2. ACH: Air changes per hour
  - 1.5.1.3. ATTC: Air Tightness Testing Contractor
- 1.5.2. Air Tightness Testing Methods:
  - 1.5.2.1. Whole building air tightness testing:
    - .1 ASTM WK35913 Standard Test Method for Determining the Air Leakage Rate of Large or Multi-zone Buildings
- 1.5.3. Definitions:
  - 1.5.3.1. Air Barrier System:



- .1 The combination of air barrier assemblies and air barrier components, connected by air barrier accessories to form a continuous barrier to the movement of air through the building enclosure. This includes the top, bottom, and sides of, and all penetrations through, the enclosure.
- 1.5.3.2. Air Tightness Test:
  - .1 A type of test used to measure the air infiltration rate through a volume under an induced pressure. This test is carried out using a blower door and typically involves both a positive and negative pressure test.
- 1.5.3.3. Whole Building Test:
  - .1 This test is performed on the whole building to measure the airtightness of the exterior building enclosure including windows, doors, walls, floors, and roof. In the case of this project this test shall be undertaken on fire compartment.
- 1.5.3.4. Negative Pressure Test:
  - .1 A test wherein air inside the enclosure is drawn to the outdoors. This places the enclosure at a lower (negative) pressure with respect to the outdoors.
- 1.5.3.5. Positive Pressure Test:
  - .1 A test wherein outdoor air is pushed into the enclosure. This air movement places the enclosure at a higher (positive) pressure with respect to the outdoors.
- 1.5.3.6. Blower Door:
  - .1 Commonly used term for an apparatus used to pressurize and depressurize the space within the building enclosure and quantify air leakage through the enclosure. The blower door typically includes a door fan and an air resistant fabric or a series of hard panels that extends to cover and seal the door opening between the fan shroud and door frame. The door fan is a calibrated fan capable of measuring air flow and is usually placed in the opening of an exterior door. With the air barrier otherwise sealed, air produced by the door fan pressurizes or depressurizes the enclosure depending on the orientation of the fan.
- 1.5.3.7. Building Enclosure:
  - .1 The surfaces that separate the inside air from the outside air. This consists of roofs and skylights; above grade walls, windows, curtain walls, and doors; and below grade walls and floors; and connecting flashings, air barrier, and moisture control transition membranes, sealants and expansion joints that separate the interior environment from the outdoors and any adjoining unconditioned spaces.
- 1.5.3.8. Interior Finishes:
  - .1 For the purposes of this specification section, interior finishes include, but are not limited to, the upper level ceiling service cavities (including studs, insulation, and drywall), drywall on exterior walls and ceilings, window and door trim on exterior walls, baseboards and other trim on exterior walls and ceilings, flooring products and finishes for slab-on-grade and/or exposed floor assemblies.

## **1.6. PROPOSED INSPECTION AND REPORTING**

- 1.6.1. Overview of the Whole Building Air Tightness Testing
  - 1.6.1.1. The air tightness target for this project is  $\leq 0.080$  cfm @ 75 Pa per ft<sup>2</sup> of building shell when tested under pressurized and depressurized conditions.
  - 1.6.1.2. The Air Tightness Testing Contractor (ATTC) (retained under the cash allowance) will complete three (3) air tightness tests throughout construction as follows:
    - .1 Whole Building Air Tightness Testing Round # 1 (one test per wing): This test will be carried out upon completion of the air barrier system, but prior

to interior finishes being installed. For the purposes of this test, it is not imperative that all mechanical and electrical penetrations be in place, not final entry doors. Instead, these areas can be sealed off for this test as the goal will be to verify that the building shell meets the air tightness target identified for the project.

- .2 Note: Following the test, areas of excessive air leakage will be identified and documented in a detailed site review report prepared by the ATTC. The Contractor(s) will be expected to remediate any areas of concern before proceeding with Testing Round #2 and the installation of interior finishes.
- .3 Whole Building Air Tightness Testing Round #2 (one test per wing): After all mechanical and electrical penetrations are in place, and after, the Contractor has remediated any areas of concern identified during Testing Round #1, the ATTC will return to site to re-test the building and determine if the remediation efforts were successful. Any areas of concern will be shown to the Contractor.
- .4 Whole Building Air Tightness Testing Round #3: After the building is complete, but prior to occupancy, the ATTC will return to site to determine the final air tightness value of the building in its completed form.

## **1.7. RESPONSIBILITIES**

### **1.7.1. Contractor Responsibilities:**

- 1.7.1.1. Unless otherwise indicated as the responsibility of another identified entity, the Contractor shall provide coordination of the sub-contractors, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof. Provide quality assurance procedures as specified herein. Facilitate inspections, tests, and other quality control services specified herein and elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner.

## **1.8. ADMINISTRATIVE REQUIREMENTS**

### **1.8.1. Air Barrier Meeting:**

- 1.8.1.1. At the beginning of the project, the Contractor shall schedule a meeting with the Architect, ATTC, and all Subcontractors responsible for construction of any component of the air barrier system. The purpose of this meeting will be to review the following items:
  - .1 Air tightness target for whole building air tightness test
  - .2 Air tightness testing scope of work and milestones
  - .3 Exterior air barrier system design including the control layers and related details
  - .4 Air barrier system design including control layers and related details
  - .5 Sequence of construction

### **1.8.2. Sequencing – Whole building Air Tightness Test**

#### **1.8.2.1. Construction Tests:**

- .1 Prior to Testing Round #1, all components that make up the air barrier system must be installed prior to testing, including:
  - (A) Air control layers in the walls, roof and floor
  - (B) Windows and doors (including weather-stripping, sweeps)
  - (C) Air barrier accessories (e.g. flashing tapes) required to connect air control layers together or to other air barrier components
- .2 Prior to Testing Round #2, all planned penetrations through the air barrier system must be in place before it is carried out. This includes all penetrations relating to mechanical, electrical and structural aspects of the project.

- .3 No interior finishes that conceal or prevent access to the air barrier system shall be installed before air tightness tests #1 and #2 have been carried out and approval to proceed has been granted by the Architect.
  - 1.8.2.2. Final Test:
    - .1 Prior to Testing Round #3, the building must be fully complete and vacant.
- 1.8.3. Construction Schedule: The following milestones shall be shown in the construction schedule:
  - 1.8.3.1. Air Barrier System Meeting
  - 1.8.3.2. Completion of the Exterior Air Barrier System
  - 1.8.3.3. Whole Building Air Tightness Testing Round #1 (to take place immediately following completion of the air barrier system, but prior to installation of interior finishes)
  - 1.8.3.4. Whole Building Air Tightness Testing Round #2 (to take place after mechanical and electrical penetrations through air control layers are complete)
  - 1.8.3.5. Whole Building Air Tightness Testing Round #3 (to take place after construction is complete and prior to occupancy)
- 1.8.4. Attendance at Tests:
  - 1.8.4.1. Whole Building Air Tightness Testing Round #1 and Round #2: The Contractor and required sub-trades shall be present at the time that air tightness testing #1 and #2 are carried out by the ATTC.
  - 1.8.4.2. The purpose of attending tests is to witness/identify/review any areas with excess air infiltration and determine a suitable means of remediating the cause.
- 1.8.5. Site Review Report Responses:
  - 1.8.5.1. The ATTC will conduct inspections intermittently throughout construction. Feedback will be provided to the Contractor(s) both onsite and in the form of a Site Review report. Similarly, a Site Review report will be issued after air tightness testing Round #1 and #2. The Contractor(s) shall respond to all high and medium priority issues identified in the report within 5 working days from the time it was issued. The response shall be provided in written format and correspond to the item numbers used in the original report. If required, the Contractor(s) shall provide photos and/or other supporting documentation that has been requested to demonstrate that the identified issues have been addressed.

## **2 PRODUCTS**

### **2.1. ADHESIVES & SEALANTS**

- 2.1.1. All adhesives and sealants used on the interior of the building (i.e., inboard side of the weatherproofing system and applied onsite) shall not exceed the VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule 1168, amended January 7, 2005 as listed in Tables 2 and 4.
- 2.1.2. Aerosol adhesives used on the interior of the building (i.e., inboard side of the weatherproofing system and applied onsite) shall not exceed the VOC content limits of Green Seal Standard GS-36 as listed in Table 3.
- 2.1.3. Adhesives used to fabricate laminated composite wood and agrifibre products, either shop applied or field-applied, shall not contain added urea-formaldehyde.
- 2.1.4. Submit manufacturer documentation (product data sheets, MSDSs or letters) indicating the VOC content in grams per litre less exempt compounds. In the case of adhesives used to fabricate composite wood and agrifibre assemblies, submit manufacturer documentation stating that the product is free of urea-formaldehyde.
- 2.1.5. No adhesive or sealant shall be applied onsite and within the weatherproofing without being reviewed for compliance by the Consultant.

## **2.2. PAINTS & COATINGS**

- 2.2.1. All paints and coatings used on the interior of the building (i.e., inboard side of the weatherproofing system and applied onsite) shall not exceed the VOC content limits of the following references and Table 5:
  - 2.2.1.1. Green Seal Standard GS-11, Paints and Coatings, Third Edition, January 1, 2010 for architectural paints, coatings and primers applied to interior walls and ceilings
  - 2.2.1.2. Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997 for anticorrosive and anti-rust paints applied to interior ferrous metal substrates
  - 2.2.1.3. South Coast Air Quality Management District Rule 1113, Architectural Coatings, July 13, 2007 for clear wood finishes, floor coatings, stains and shellacs applied to interior elements
- 2.2.1.4. Note: The VOC content limits specified in these tables are minimum requirements. They are not intended to contradict or lessen the requirements of individual specification sections where products or materials that have been specified have lower VOC content values.
- 2.2.2. To demonstrate compliance with the above requirements, complete and provide Schedule M1. Submit manufacturer documentation (product data sheets, MSDSs or letters) indicating the VOC content in grams per litre less exempt compounds. Please note that the stated VOC content should exclude water and tinting colour added at the point of sale.
- 2.2.3. No paint or coating shall be applied onsite and within the weatherproofing without being reviewed for compliance by the Consultant.

## **3 EXECUTION**

### **3.1. ONSITE QUALITY CONTROL**

- 3.1.1. Site Inspections:
  - 3.1.1.1. The Contractor and subcontractors shall inspect air control layers and components to ensure that they are continuous and create an airtight system.
- 3.1.2. Conforming Work:
  - 3.1.2.1. Where one or more air control layers or components have been jeopardized, the Contractor shall remediate as required before interior finishes are installed so as not to compromise the effectiveness of the air barrier system and the overall air tightness of the building.
- 3.1.3. Consultant Inspections:
  - 3.1.3.1. The Air Tightness Contractor will complete inspections of the air barrier system intermittently throughout construction and provide feedback on any areas that need to be remediated so as not to compromise the air tightness of the building. Feedback will be provided verbally onsite and in site review reports.

### **3.2. WHOLE BUILDING AIR TIGHTNESS TESTING**

- 3.2.1. Construction of the Air Barrier System:
  - 3.2.1.1. The Contractor shall construct the exterior air barrier system and partitions around to reflect the details provided on the drawings and described in the specifications, and according to any further direction provided by the design team.
  - 3.2.1.2. Penetrations through the air barrier system must be kept to an absolute minimum. Where required, penetrations shall be air sealed and made continuous with the air barrier system using suitable, compatible, and durable gaskets and tapes that will last the anticipated service life of the building. Caulking should be avoided wherever possible, except for small fastener

- penetrations (e.g. screws into wood framing for the purposes of supporting interior components such as conduits).
- 3.2.1.3. Penetrations through the roof assembly air control layer is strictly prohibited except as may be required for plumbing stacks, ducts, conduits, refrigerant lines, etc.
- .1 All permitted penetrations through the roof assembly must be air sealed using a suitable gasket that is taped to the air control layer on all sides. For large opens where gaskets are not possible (e.g. ducts) air sealing can be accomplished using approved air sealing tapes and membranes.
- 3.2.1.4. The air barrier system must be complete prior to any air tightness testing. This includes:
- .1 Air control layers in the walls, roof and floor
- .2 Windows and doors (including weather-stripping, sweeps)
- .3 Air barrier accessories (e.g. flashing tapes) required to connect air control layers together or to other air barrier components
- .4 All planned penetrations through the air barrier system must be in place before test #2 is carried out. This includes all penetrations relating to mechanical, electrical and structural aspects of the project.
- .5 No interior finishes that conceal or prevent access to the air barrier system shall be installed before air tightness testing #1 and #2 are carried out and approval to proceed has been received from the Architect.
- 3.2.2. Preparation for Whole Building Air Tightness Testing Round #1:
- 3.2.2.1. Complete the air barrier system as per section 3.2.1.
- 3.2.2.2. Schedule the air tightness test for a time period when:
- .1 The building can be shut down to normal foot traffic for a 2-hour period (once the testing has started, sub contractors will be unable to enter and leave the building).
- .2 The ventilation and exhaust ducts through the exterior walls can be temporarily sealed.
- .3 No precipitation has occurred 24 hours prior to, or is anticipated to occur, during testing activities in order to prevent water ingress into the enclosure assemblies
- .4 The wind speed is forecasted to be consistent and less than 10 kph during testing activities
- 3.2.2.3. Ensure that a 120 VAC power supply is available inside the building to power the blower door assembly.
- 3.2.2.4. Clean the floor area prior to testing
- .1 During pressurization tests, air will be blown into the building at high enough velocity that it may cause debris, dust and litter to become air borne
- .2 During depressurization tests, air will be blown into the building at high enough velocity that it may cause nearby debris, dust and litter to be drawn to the fan guards or become entangles in the fan blades.
- 3.2.2.5. Prime all plumbing traps located within the envelope (fill with water)
- 3.2.2.6. Turn off all ventilation, exhaust and recirculation fans
- 3.2.2.7. Ensure that the ATTC has unhindered access to all mechanical rooms, air handlers, exhaust fans, and outdoor air and exhaust dampers.
- 3.2.2.8. Ensure that no sub-contractors are working in the area of the blower door equipment.
- 3.2.2.9. Complete any pre-test checklists required by the ATTC.
- 3.2.3. Preparation for Whole Building Air Tightness Testing Round #2:
- 3.2.3.1. Remediate any deficiencies identified by the ATTC during Test #1.
- 3.2.3.2. Schedule the air tightness test for a period of time when all conditions under 3.2.2.2 are met.
- 3.2.3.3. Complete all steps listed under 3.2.2.

- 3.2.4. Preparation for Whole Building Air Tightness Testing Round #3:
  - 3.2.4.1. 1. Schedule the air tightness test for a period of time:
    - .1 When all conditions under 3.2.2.2 are met
    - .2 When construction is 100% complete
    - .3 That is prior to occupancy
  - 3.2.4.2. Complete all steps listed under 3.2.2

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .1 1.2. Section Includes
- .2 1.3. Summary
- .3 1.4. Administrative Requirements
- .4 1.5. Submittals
- .5 1.6. Quality Assurance
- .6 1.7. Field Conditions
- .7 1.8. Delivery, Storage, and Handling
- .8 1.9. Warranty
- .9 2.1. Performance/Design Requirements
- .10 2.2. Materials
- .11 2.3. Expansion Joints
- .12 3.1. General
- .13 3.2. Preparation - Typical
- .14 3.3. Membrane Installation
- .15 3.4. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Sheet waterproof membrane at locations as indicated and as follows:
  - 1.3.1.2. Throughwall membrane flashing: either Type 1 or Type 2 sheet membrane is acceptable.
  - 1.3.1.3. In shower compartments: only Type 1 sheet membrane is acceptable.
  - 1.3.1.4. Damp Proof Course (DPC): only Type 2 sheet membrane is acceptable.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Conduct a pre-installation meeting in accordance with Section 01 31 19.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Submit drawings showing locations of joints, section of entire system, section of each sleeve and penetration condition, flashing conditions and other fabrication information in accordance with Section 01 33 00.
- 1.5.4. Samples:
  - 1.5.4.1. Submit samples complete with manufacturer's labels intact, of materials to be used for the work of this section prior to commencement of work, allowing ample time for review and acceptance by Consultant and independent inspection and testing company. Do not proceed with work of this section until samples are accepted.
- 1.5.5. Manufacturers' instructions:
  - 1.5.5.1. Submit Product manufacturer's standard and project specific installation details required to cover the full spectrum of waterproofing conditions applicable to the work of this section.

## **1.6. QUALITY ASSURANCE**

- 1.6.1. Execute the work of this section only by a Subcontractor who has adequate plant, equipment and skilled workers to perform it expeditiously, is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years, and has been approved in writing by the self-adhered waterproofing system manufacturer for the installation of their Product.
- 1.6.2. Mock-Up:
  - 1.6.2.1. Construct area of typical waterproofing installation for approval. Locate at the Place of the Work as part of final installation.
  - 1.6.2.2. Do not proceed until mock-up has been reviewed and accepted by the Consultant.

## **1.7. FIELD CONDITIONS**

- 1.7.1. Provide forced air circulation during curing period for enclosed applications.
- 1.7.2. Apply only when air and surface temperatures are maintained above 4°C, have been so for 48 hours, and are not likely to fall lower until the work of this Section is completed, unless otherwise approved.
- 1.7.3. The work of this Section may proceed at temperatures below 4°C only with mutual documented agreement of inspection and testing company, manufacturer and applicator that, with materials and methods used, specified installation will be achieved.
- 1.7.4. Ensure application temperature and humidity recommended by material manufacturer are maintained before, during and after installation.
- 1.7.5. Provide forced air circulation or adequate natural ventilation during installation and curing periods for enclosed application.
- 1.7.6. Do not expose materials vulnerable to water or sun damage in quantities greater than can be installed the same Day.
- 1.7.7. Install waterproofing on dry surfaces, free of snow and ice and during weather that will not introduce moisture into waterproofing system.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Package materials and identify on attached labels the manufacturer, contents and material specification number.
- 1.8.2. Store solvent-base liquids and surface conditioner away from excessive heat and open flame. Post "NO SMOKING" signs in areas where solvent-base materials are used and stored.
- 1.8.3. Store surface conditioner at temperature above 5°C.
- 1.8.4. Pallets of waterproofing membrane shall not be double stacked.

## **1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36.

# **2 PART 2 - PRODUCTS**

## **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Waterproofing system shall *Provide* watertight protection to prevent the passage of water under hydrostatic pressure.

## **2.2. MATERIALS**

- 2.2.1. Waterproofing membrane Type 1:
  - 2.2.1.1. Standard ethylene propylene diene monomer (EPDM sheet membrane), to CGSB 37-GP-52M-1984, Type 1, Class A, 1.6 mm (1/16") thick, non-reinforced.
- 2.2.2. Waterproofing membrane Type 2:
  - 2.2.2.1. Self adhering polymeric waterproofing membrane.
  - 2.2.2.2. Thickness: 1.5 mm (1/16").
  - 2.2.2.3. Tensile strength: in accordance with ASTM D412-16.
    - (1) Membrane: 2.24 MPa (325 psi) minimum.
  - 2.2.2.4. Elongation: in accordance with ASTM D412-16.



- (1) Polymeric membrane: 300 percent minimum.
- 2.2.2.5. Water vapour transmission:
  - (1) in accordance with ASTM E96/E96M-13, Method B: 0.05 grains/ft<sup>2</sup>/hour maximum.
- 2.2.2.6. Water absorption: in accordance with ASTM D570-98(2010)e1, 0.1%, 72 hours maximum.
- 2.2.2.7. Resistance to hydrostatic head: equivalent to 70 m (230 ft) of water minimum.
- 2.2.2.8. Puncture resistance: in accordance with ASTM E154/E154M-08a(2019), 222 N (50 pounds) minimum.
- 2.2.2.9. Acceptable Products:
  - (1) Bakor 'WP 200'.
  - (2) Colloid Environmental Technologies Company (CETCO) 'Envirosheet', as distributed by DRE Industries Inc.
  - (3) Tremco 'Permaquik PQ 7100'.
  - (4) GCP Applied Technologies 'Bituthene 3000' and 'Bituthene Low Temperature'.
  - (5) IKO 'AquaBarrier FP'
  - (6) Soprema 'Colphene 3000'.
  - (7) W.R. Meadows 'Mel-Roll'.
  - (8) Or equivalent.
- 2.2.3. Primer/surface conditioner: In accordance with membrane manufacturer's printed installation instructions.
- 2.2.4. Bonding asphalt: Single component bonding asphalt. Use manufacturer's proprietary mastic
- 2.2.5. Adhesives: In accordance with membrane manufacturer's printed installation instructions.
- 2.2.6. Mastic; self-adhered membrane systems: Single component, utility grade, rubber based sealant. Use manufacturer's proprietary mastic.
- 2.2.7. Sealers:
  - 2.2.7.1. For sheet membrane Type 1: use sealant Type 6 in accordance with Section 07 92 00 in accordance with manufacturer's recommendations.
  - 2.2.7.2. For sheet membrane Type 2:
    - (1) With Blueskin WP200, use Polybitume 570-05, as manufactured by Bakor or equivalent.
    - (2) With Per-A-Barrier Wall Membrane, use Bituthene Mastic, as manufactured by Grace Construction Products or equivalent.

### **2.3. EXPANSION JOINTS**

- 2.3.1. Description:
  - 2.3.1.1. Manufactured from a proprietary copolymer with internal polyester reinforcement, monolithic seam vulcanization.
  - 2.3.1.2. Movement and fabrication: Tri-directional movement capability, joint waterproofing system shall be factory fabricated in one piece for the entire contiguous expansion joint or where length of joint exceeds manufacturer's shipping and handling guidelines shall be lapped and vulcanized by manufacturer's mechanics on site, repair of damaged materials shall be performed by manufacturer's mechanics.
  - 2.3.1.3. Compatible with adhesives and membranes associated with expansion joint construction in accordance with manufacturer's installation requirements.
  - 2.3.1.4. Warranted by manufacturer to cover full warranty duration specified in this section.
  - 2.3.1.5. Hydrostatic pressure limit: Working pressure in column of water shall perform under static limit not to exceed 10 m (33ft).
- 2.3.2. Acceptable products; to suit type of roofing assembly and movement design requirements:
  - 2.3.2.1. Situra Inc. 'FlamLINE'.
  - 2.3.2.2. Substitutions: in accordance with Section 01 25 00.

### **3 EXECUTION**

#### **3.1. GENERAL**

- 3.1.1. Comply with manufacturer's Product data, including Product application and installation instructions, as well as manufacturer's shipping and storage recommendations.
- 3.1.2. Examine conditions of substrates and other conditions under which the work of this Section is to be performed and notify the Consultant, in writing, of circumstances detrimental to the proper completion of the Work. Do not proceed with the work of this Section until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's written recommendations.

#### **3.2. PREPARATION - TYPICAL**

- 3.2.1. Protect adjacent work areas and finish surfaces from damage or contamination from waterproofing Products during installation operations.
- 3.2.2. Soil substrates: Grade substrates shall consist of well-levelled soils without voids and debris, and compacted in accordance with Section 31 23 00 for uniform support and containment of waterproofing sheets.
- 3.2.3. Concrete surfaces shall be smooth, clean, dry and free of any foreign matter that would otherwise hinder either adhesion or regularity of waterproofing membrane installation.
- 3.2.4. Remove fins, ridges, and other protrusions levelled and smoothly finished to match monolithic concrete surface. Completely fill honeycomb, aggregate pockets, holes and other voids with non-shrink cementitious grout levelled and smoothly finished to match monolithic concrete surface.
- 3.2.5. Priming:
  - 3.2.5.1. Condition surfaces to receive waterproofing membrane using primer/surface conditioner applied by spray or roller in accordance with manufacturer's mixing and application instructions.
  - 3.2.5.2. Allow primer/surface conditioner to dry adequately before proceeding with waterproofing membrane. Avoid pooling and excess of primer/surface conditioner. Primed surfaces not covered by waterproofing membrane on the same Day must be re-primed.
  - 3.2.5.3. Metal surfaces need not be primed, but should be free of grease, oil, dirt, loose paint, rust or any other contaminants.

#### **3.3. MEMBRANE INSTALLATION**

- 3.3.1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
- 3.3.2. Provide a chalk line or alternate means of establishing a square start location. Align first sheet of membrane with straight edge and after removing first few feet of release paper from roll lay membrane into place. Continue to pull release paper from roll thereby adhering the membrane onto the substrate. Proceed at a rate that allows opportunity to prohibit air from becoming entrapped between membrane and substrate.
- 3.3.3. Continue with subsequent rolls aligning each with previous along lap lines provided on membrane. Maintain a minimum overlap of 64 mm (2-1/2").
- 3.3.4. End laps as encountered at roll ends and splices should overlap the previous membrane a minimum of 150 mm (6"). Stagger end laps. Point exposed edges and terminations with pointing mastic to prevent water from travelling under membrane. Lap to shed water.
- 3.3.5. Lay membrane carefully to ensure a uniform application and to minimize fishmouths (wrinkles extending to membrane's edge).
- 3.3.6. Horizontal to vertical inside corner transition areas are to be pre-treated with manufacturer's proprietary fillet extending 19 mm (3/4") vertically and horizontally from the corner. Apply a minimum 225 mm (9") strip of membrane centred at the joint.
- 3.3.7. Immediately following placement, roll membrane in its entirety to ensure continuous adhesion to the substrate. For verticals, use membrane roller as recommended by manufacturer.

- 3.3.8. On vertical and horizontal applications membrane terminations shall receive an edge dressing of waterproofing mastic to protect against undermining effects of ponded water or vertical drainage.
- 3.3.9. Install DPC across the width of the foundation wall and install throughwall membrane flashing in masonry in accordance with the manufacturer's recommendations and as follows:
  - 3.3.9.1. Install membranes under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install membranes under weep hole courses as indicated.
  - 3.3.9.2. In cavity and veneered walls, carry throughwall membrane flashing from front edge of masonry, under outer wythe, then up backing not less than 250 mm (10") and as follows:
    - (1) For masonry backing, embed membrane a minimum of 25 mm (1") in joint of backing masonry.
    - (2) For frame backing, bond to plywood sheathing using manufacturer's recommended adhesive.
- 3.3.10. Detail work:
  - 3.3.10.1. Over non-working joints or cracks up to a maximum of 5 mm (3/16"), apply a reinforcing strip of waterproofing membrane, not less than 225 mm (9") in width centered over the joint/crack.
  - 3.3.10.2. Non-working joints or cracks greater than 5 mm (3/16") in width, notify the Consultant. Joints shall be filled flush to the level of the surrounding deck surface prior to the placement of a 225 mm (9") reinforcing strip of waterproofing membrane. Waterproofing liquid membrane should be used to fill voids of this nature.
  - 3.3.10.3. Cold pour joints: Grind or chip as required to smooth joint/crack prior to field membrane application. Treat in same manner as non-working joints/cracks less than 5 mm (3/16") wide.
  - 3.3.10.4. Inspect vertical and horizontal inside/outside corner locations to ensure smoothness and regularity. Outside corners should be continuous and free of sharp edges. Inside corners should be free of rough edges resulting from formwork placement. Repair as required.
  - 3.3.10.5. Install a reinforcing ply of waterproofing membrane over outside corners. Use a width of membrane not less than 225 mm (9") centred over the corner and press into full contact with the substrate. Reinforcing strips shall be installed prior to field membrane application.

#### **3.4. FIELD QUALITY CONTROL**

- 3.4.1. Conduct quality control in accordance with Section 01 45 00.
- 3.4.2. Work of this section shall be subject to independent inspection and testing.
- 3.4.3. Manufacturer's field review to be in accordance with Section 01 45 00.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. 1.8 Delivery Storage And Handling
- .7 1.7. Warranty
- .8 2.1. Insulation Materials – Below Grade
- .9 2.2. Insulation Materials – Above Grade
- .10 2.3. Accessory Materials
- .11 3.1. General Installation Requirements
- .12 3.2. Examination
- .13 3.3. Installation – General
- .14 3.4. Installation – Below Grade At Perimeter Foundation And Under Slab
- .15 3.5. Installation – Spray Foam Insulation
- .16 3.6. Field Quality Control
- .17 3.7. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Semi-rigid insulation; cavity walls.
  - 1.3.1.2. Rigid insulation; cavity wall insulation.
  - 1.3.1.3. Rigid insulation; below grade insulation at vertical conditions.
  - 1.3.1.4. Rigid insulation; below grade insulation at horizontal conditions.
  - 1.3.1.5. Foamed-in-place (gap filler) insulation.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
  - 1.4.2.2. Submit data and installation instructions for materials and prefabricated devices, providing descriptions sufficient for identification at the Place of the Work.
  - 1.4.2.3. Submit data from manufacturer's or independent laboratory indicating compatibility and adhesive results of proposed materials.
- 1.4.3. Samples: Submit representative samples of each specified insulation material, insulation clips, adhesives, fasteners, tapes and other material for review.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:
  - 1.5.1.1. Execute work of this section using a *Subcontractor* who has adequate plant, equipment and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years.

### **1.6. 1.8 DELIVERY STORAGE AND HANDLING**

- 1.6.1. Delivery and Acceptance Requirements:

- 1.6.1.1. Deliver material in accordance with Section 01 60 00 - Product Requirements.
- 1.6.1.2. Deliver materials and accessories in insulation manufacture's original packaging with identification
- 1.6.1.3. labels intact and in sizes to suit project.
- 1.6.1.4. Ensure insulation materials are not exposed to moisture during delivery.
- 1.6.1.5. Replace wet or damaged insulation materials.
- 1.6.2. Storage and Handling Requirements:
  - 1.6.2.1. Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
  - 1.6.2.2. Store in original packaging until installed.
- 1.6.3. Packaging Waste Management:
  - 1.6.3.1. Separate and recycle waste packaging materials.
  - 1.6.3.2. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
  - 1.6.3.3. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling.

## **1.7. WARRANTY**

- 1.7.1. Warrant work of this section in accordance with Section 01 78 36.

## **2 PRODUCTS**

### **2.1. INSULATION MATERIALS – BELOW GRADE**

- 2.1.1. INSUL 1; Rigid insulation, below grade insulation at vertical conditions:
  - 2.1.1.1. Extruded polystyrene, closed-cell, smooth skin, to CAN/ULC S701-11, Type 4, 25 psi compressive strength.
  - 2.1.1.2. Acceptable Products:
    - (1) 'Styrofoam SM' as manufactured by Dow Chemical.
    - (2) 'Foamular C-300' as manufactured by Owens Corning.
    - (3) Or equivalent.
- 2.1.2. INSUL 2; Rigid insulation; below grade insulation at horizontal conditions:
  - 2.1.2.1. Extruded polystyrene, closed-cell, smooth skin, to CAN/ULC S701-17, Type 4.
  - 2.1.2.2. Compressive Strength, ASTM D1621-10, 275 kPa (40 psi) minimum (measured at 5% deformation or at yield, whichever occurs first).
  - 2.1.2.3. Acceptable Products:
    - (1) 'Styrofoam Highload 40' as manufactured by Dow Chemical.
    - (2) 'Foamular NGX 400' as manufactured by Owens Corning.
    - (3) Or equivalent.
- 2.1.3. INSUL 3; Rigid insulation; below grade insulation at horizontal conditions, at underside of Apparatus Bay slab only:
  - 2.1.3.1. Extruded polystyrene, closed-cell, smooth skin, to CAN/ULC S701-17, Type 4.
  - 2.1.3.2. Compressive Strength, ASTM D1621-10, 690 kPa (100 psi) minimum (measured at 5% deformation or at yield, whichever occurs first).
  - 2.1.3.3. Acceptable Products:
    - (1) 'Styrofoam Highload 40' as manufactured by Dow Chemical.
    - (2) 'Foamular NGX 1000' as manufactured by Owens Corning.
    - (3) Or equivalent.

### **2.2. INSULATION MATERIALS – ABOVE GRADE**

- 2.2.1. INSUL 4 – Batt Insulation (Exterior Cavity Wall)
  - 2.2.1.1. Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.
  - 2.2.1.2. Thickness: As indicated in the Contract Documents to meet R-Value.
  - 2.2.1.3. Thicknesses 65 mm and above Density:
    - (1) .2 Outer layer: 100 kg/m<sup>3</sup> to ASTM C303.
    - (2) .3 Inner layer: 60 kg/m<sup>3</sup> to ASTM C303

- 2.2.1.4. Acceptable Products:
  - (1) 'Cavity Rock by RockWool
  - (2) Or Equivalent.
- 2.2.2. INSUL 5 – Batt Insulation (Exterior Cavity Stud Wall Framing)
  - 2.2.2.1. Unfaced, semi-rigid, non-combustible, mineral-wool batt insulation, in accordance with CAN/ULC S702, Type 1
  - 2.2.2.2. Thickness: Full depth of stud
  - 2.2.2.3. Acceptable Products:
    - (1) 'Rockwool Comfortbatt' by RockWool
    - (2) Or Equivalent.
- 2.2.3. INSUL 6 - Batt insulation (Non-rated); except where acoustic batt is indicated in the Contract Drawings.:
  - 2.2.3.1. Unfaced, mineral-fibre batts, in accordance with CAN/ULC S702-09, Type 1.
  - 2.2.3.2. Acceptable manufacturers:
    - (1) Fibrex.
    - (2) 2 Johns Manville.
    - (3) Owens Corning Canada.
    - (4) 'ComfortBatt' by RockWool
    - (5) Or Equivalent.
- 2.2.4. INSUL 7 - Batt insulation (Rated/Acoustic);
  - 2.2.4.1. Unfaced, semi-rigid, non-combustible, mineral-wool batt insulation, in accordance with CAN/ULC S702, Type 1, providing fire resistance to ASTM E136 and sound control to ASTM E90 and ASTM E423.
  - 2.2.4.2. Acceptable Products:
    - (1) 'SAFB Thermafiber' by Owens Corning Canada.
    - (2) 'Rockwool AFB evo' by RockWool
    - (3) Or Equivalent.
- 2.2.5. INSUL 8 - Foamed-in-place (gap filler) insulation:
  - 2.2.5.1. One-component CFC-free polyurethane foam in accordance with CAN/ULC S710.1-05.
  - 2.2.5.2. Two-component CFC-free polyurethane foam in accordance with CAN/ULC S711.1-05.

## **2.3. ACCESSORY MATERIALS**

- 2.3.1. Adhesive:
  - 2.3.1.1. Solvent based polymer modified liquid applied membrane, compatible with insulation to be applied, type as manufactured for the attachment of insulation.
  - 2.3.1.2. Acceptable Product:
    - (1) Bakor Airbloc 21 or 230-21 or equivalent.
- 2.3.2. Insulation fasteners:
  - 2.3.2.1. Impaling clip of galvanized steel with washer retainer, to be adhered to surface to receive board insulation with adhesive, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- 2.3.3. Batt insulation restraint:
  - 2.3.3.1. Zinc coated woven wire and mechanical fasteners.

## **3 EXECUTION**

### **3.1. GENERAL INSTALLATION REQUIREMENTS**

- 3.1.1. Comply with requirements of Section 01 45 00.
- 3.1.2. Install materials in accordance with manufacturer's installation instructions.

### **3.2. EXAMINATION**

- 3.2.1. Take measurements at the Place of the Work to ensure that work is fabricated to fit structure; surrounding construction; around obstructions and projections in place, or as indicated; and to suit locations of services.

- 3.2.2. Verify that backup construction is aligned for proper installation of work before commencing erection.
- 3.2.3. Verify that all surfaces to receive spray-in-place insulation are clean and free of all frost, oil, rust, or deleterious materials.
- 3.2.4. Verify that all environmental conditions required for successful application of materials, can be met.
- 3.2.5. Report in writing, any defects in surfaces or conditions which may adversely affect the installation or performance of the products provided under this section.
- 3.2.6. Start of insulation installation indicates installer's acceptance of substrate installation conditions.

### **3.3. INSTALLATION – GENERAL**

- 3.3.1. Surfaces to receive insulation shall be dry and free of dew, frost, voids, loose material, oil, grease, asphalt curing compounds and other matter detrimental to bond of adhesive. Adhesive shall be compatible with waterproofing on walls.
- 3.3.2. Apply adhesives, and install insulation in accordance with manufacturer's printed recommendations. Apply at rate as required to prevent displacement of insulation boards during construction operations.
- 3.3.3. Butt joints tightly and offset vertical joints to form an unbroken thermal envelope. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- 3.3.4. Apply insulation to ensure total and complete coverage of surfaces indicated to be insulated, and in direct contact with such surfaces. Unless otherwise specified, apply insulation in single layer of thickness indicated.
- 3.3.5. Ensure integrity and continuity of insulation at juncture with different types of materials and seal in an acceptable manner.
- 3.3.6. Do not enclose insulation until it has been reviewed and accepted by the Consultant.

### **3.4. INSTALLATION – BELOW GRADE AT PERIMETER FOUNDATION AND UNDER SLAB**

- 3.4.1. Below grade vertical insulation:
  - 3.4.1.1. Adhere rigid insulation to face of below grade perimeter walls with adhesive.
  - 3.4.1.2. Perimeter below grade application: extend boards to top of footing from finish floor slab, installed on face of perimeter foundation walls.
- 3.4.2. Below grade insulation; underslab:
  - 3.4.2.1. Install in accordance with insulation manufacturer's written specifications and in accordance with requirements of 3.3 – General Installations of this section.

### **3.5. INSTALLATION – SPRAY FOAM INSULATION**

- 3.5.1. Preparation
  - 3.5.1.1. Mask all adjacent surfaces not to receive spray-in-place insulation which may be damaged or stained by insulation installation.
  - 3.5.1.2. Apply primers where recommended by insulation manufacturer.
- 3.5.2. Application
  - 3.5.2.1. Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
  - 3.5.2.2. Apply insulation in consecutive passes not less than 13mm and not more than 50mm thick, for a total thickness scheduled herein.
  - 3.5.2.3. Finished surface of foam insulation shall be free of voids and imbedded foreign objects.
  - 3.5.2.4. Avoid overspray of adjacent areas and surfaces.
  - 3.5.2.5. Finished installation shall be inspected and approved by Consultant prior to concealment

### **3.6. FIELD QUALITY CONTROL**

- 3.6.1. Conduct quality control in accordance with Section 01 45 00.

**3.7. PROTECTION**

- 3.7.1. Protect installed products and accessories from damage during construction.
- 3.7.2. Protect polystyrene insulation from extended exposure to sunlight.
- 3.7.3. Repair damage to adjacent materials caused by insulation installation.

**END OF SECTION**



## 1 GENERAL

### 1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### 1.2. SECTION INCLUDES

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 2.1. Sheet Vapour Barrier
- .7 2.2. Accessories
- .8 3.1. Installation
- .9 3.2. Attachment
- .10 3.3. Exterior Surface Openings
- .11 3.4. Perimeter Seals
- .12 3.5. Lap Joint Seals
- .13 3.6. Electrical Boxes
- .14 3.7. Field Quality Control

### 1.3. SUMMARY

- 1.3.1. Section includes:  
1.3.1.1. Above-grade vapour barrier.

### 1.4. SUBMITTALS

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:  
1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.4.3. Samples:  
1.4.3.1. Submit sample of proposed Products for review by the *Consultant*.

### 1.5. QUALITY ASSURANCE

- 1.5.1. Qualifications: *Provide* work of this Section, executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
- 1.5.2. Mock-up:  
1.5.2.1. Construct 10 m<sup>2</sup> (100 ft<sup>2</sup>) area of typical installation for each type of *Product*.  
(1) Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
- 1.5.2.2. Locate at the *Place of the Work* as part of final installation. Space installation to include exterior wall panel incorporating window and insulation.
- 1.5.2.3. Do not proceed until mock-up has been reviewed by the Consultant.
- 1.5.2.4. When accepted, mock-up will demonstrate minimum standard of quality required for this work.

## 2 PRODUCTS

### 2.1. SHEET VAPOUR BARRIER

- 2.1.1. Polyethylene film: CAN/CGSB 51.34-M86, Type 1, 0.15 mm (6 mil) thick, with a water vapour permeance of not greater than 45 ng/(P•s•m<sup>2</sup>), flame spread rating of less than 150 to CAN/ULC-S102-10.

## **2.2. ACCESSORIES**

- 2.2.1. Joint sealing tape: air resistant pressure sensitive adhesive tape
- 2.2.2. Acceptable products:
  - 2.2.2.1. Tuck Tape 'Tuck Blue Sheathing Tape for PE Vapour Barrier', 75 mm (3") wide.
- 2.2.3. Lap sealant;
  - 2.2.3.1. Gunnable sealant, adheres to polyethylene film, non-acrylic based.
    - (1) In accordance with ASTM C920-14 Type N or S, Grade NS, Use NT or ASTM C919-22.
    - (2) Acceptable Products:
      - (A) DOWSIL '758 Silicone Weather Barrier Sealant'.
      - (B) Substitutions: in accordance with Section 01 25 00
  - 2.2.3.2. Gunnable sealant, adheres to polyethylene film, non-hardening synthetic rubber
    - (1) Acceptable products:
      - (A) Pecora 'BA98'.
      - (B) Tremco 'Acoustical Sealant'.
      - (C) QuietSeal 'Acoustic Sealant QS-350'.
      - (D) Or equivalent.
- 2.2.4. Staples and fasteners: minimum 6.4 mm (1/4") leg.
- 2.2.5. Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Ensure services are installed and inspected prior to installation of sheet vapour barrier.
- 3.1.2. Install sheet vapour barrier on interior side of insulation at exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous application.
- 3.1.3. Use sheets of largest practical size to minimize joints.
- 3.1.4. Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.

### **3.2. ATTACHMENT**

- 3.2.1. Seal vertical joints in sheet vapour barrier over framing by lapping no fewer than two studs.
- 3.2.2. Fasten sheet vapour barrier to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 400 mm (16") o.c.

### **3.3. EXTERIOR SURFACE OPENINGS**

- 3.3.1. Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

### **3.4. PERIMETER SEALS**

- 3.4.1. Seal perimeter of sheet vapour barrier as follows:
  - 3.4.1.1. Apply continuous bead of sealant to substrate at perimeter of sheets.
  - 3.4.1.2. Lap sheet over sealant and press into sealant bead.
  - 3.4.1.3. Install staples through lapped sheets at sealant bead into wood substrate.
  - 3.4.1.4. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### **3.5. LAP JOINT SEALS**

- 3.5.1. Seal lap joints of sheet vapour barrier as follows:
  - 3.5.1.1. Attach first sheet to substrate.
  - 3.5.1.2. Apply continuous bead of sealant over solid backing at joint.
  - 3.5.1.3. Lap adjoining sheet minimum 150 mm (6") and press into sealant bead.
  - 3.5.1.4. Install fasteners through lapped sheets at sealant bead into wood substrate.
  - 3.5.1.5. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

**3.6. ELECTRICAL BOXES**

- 3.6.1. Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  - 3.6.1.1. Install moulded box vapour barrier or double wrap boxes with film sheet providing minimum 305 mm (12") perimeter lap flange.
  - 3.6.1.2. Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

**3.7. FIELD QUALITY CONTROL**

- 3.7.1. Conduct quality control in accordance with Section 01 45 00.
- 3.7.2. Work of this section shall be subject to independent inspection and testing.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 2.1. Materials
- .7 3.1. Installation
- .8 3.2. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:  
1.3.1.1. Below-grade vapour barrier; located beneath concrete slabs.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:  
1.4.2.1. Submit manufacturer's Product data sheets for Products to be for used in the work of this section.
- 1.4.3. Samples:  
1.4.3.1. Submit sample of proposed Products for review by Consultant.
- 1.4.4. Manufacturer's instructions:  
1.4.4.1. Submit manufacturer's Product installation instruction for Products to be used in the work of this section.
- 1.4.5. Vapour barrier test results and certification:  
1.4.5.1. Provide certification prepared by accredited testing company for test procedures listed in Table 1 of ASTM E1745-17 and paragraphs 7.1.2, 7.1.3, 7.1.4, and 7.1.5 of ASTM E1745-17. Provide the date of the most recent test and the test results for each test.  
(1) Accompany certification tests specified above with letter signed by Product manufacturer attesting that material to be provided is of the same formulation and manufacture as the Product tested.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:  
1.5.1.1. *Provide* work of this Section, executed by competent installers with minimum 5 years' experience in application of Products.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Vapour barrier membrane:  
2.1.1.1. Performance criteria:  
(1) Permeance, as tested after conditioning: not greater than 0.5700 ng/(Pa\*s \*m<sup>2</sup>)(0.010 perms (gm/ft<sup>2</sup>/in-Hg)) to ASTM E1745-17 paragraphs 7.1.2 through 7.1.5.  
(2) Strength: Class A to ASTM E1745-17.  
(3) Thickness of plastic:  
(A) 0.38 mm (15 mils) minimum.
- 2.1.1.2. Acceptable Products:  
(1) Stego Industries 'Stego Wrap Vapor Barrier', thickness specified above.

- (2) W.R. Meadows 'PERMINATOR', thickness specified above.
  - (3) Substitutions: in accordance with Section 01 25 00.
- 2.1.2. Vapour barrier membrane joint tape:
  - 2.1.2.1. Description:
    - (1) High density polyethylene tape, pressure sensitive, 100 mm (4") wide, product as per vapour barrier membrane manufacturer's installation instructions.
- 2.1.3. Penetration flashing:
  - 2.1.3.1. Vapour barrier membrane material and vapour barrier joint tape in accordance with manufacturer's instructions.

### **3 EXECUTION**

#### **3.1. INSTALLATION**

- 3.1.1. Install vapour barrier membrane in accordance with manufacturer's instructions and ASTM E1643-18a.
- 3.1.2. Extend vapour barrier to the perimeter of the slab and seal to perimeter and penetration conditions. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter.
- 3.1.3. Install vapour barrier membrane using largest practicable sheet size to minimize joints over compacted fill.
- 3.1.4. Inspect vapour barrier membrane sheets for continuity. Repair punctures and tears in vapour barrier membrane with sealing tape before work is concealed.
- 3.1.5. Vapour barrier membrane installation shall be continuous and vapour tight.
- 3.1.6. Overlaps vapour barrier membrane joints 150 mm (6") minimum and tape seal with vapour barrier joint tape.
- 3.1.7. Unroll vapour barrier membrane with longest dimension parallel with direction of concrete placement.
- 3.1.8. Lap vapour barrier membrane up foundation walls a minimum of 100 mm (4") and tape seal with vapour barrier joint tape.
- 3.1.9. Centre vapour barrier joint tape over vapour barrier membrane laps and joints. Keep area of tape adhesion free of dust, dirt, and moisture.
- 3.1.10. Cut slit around pipes, ductwork, rebar, and wire penetrations to place the initial layer of vapour barrier membrane.
  - 3.1.10.1. Cut a piece of vapour barrier membrane minimum width of 300 mm (12"). The length should be 1 1/2 times the pipe circumference. With a roofer's knife or scissors, cut "fingers" half the width of the film.
  - 3.1.10.2. Wrap vapour barrier membrane around and tape the collar onto the pipe and completely tape fingers to the bottom layer of vapour barrier membrane with vapour barrier joint tape.
- 3.1.11. In the event that vapour barrier membrane is damaged during or after installation, repairs shall be made. Cut a piece of vapour barrier membrane large enough to cover damage by minimum overlap of 150 mm (6"). Clean adhesion areas of dust, dirt, and moisture. Tape down edges using vapour barrier joint tape.

#### **3.2. FIELD QUALITY CONTROL**

- 3.2.1. Conduct quality control in accordance with Section 01 45 00.
- 3.2.2. Work of this section shall be subject to independent inspection and testing.
- 3.2.3. Manufacturer's field review to be in accordance with Section 01 45 00

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, and Handling
- .8 1.8. Field Conditions
- .9 1.9. Extended Warranty
- .10 2.1. Performance/Design Requirements
- .11 2.2. Materials – General
- .12 2.3. Sheet-Applied, Vapour Impermeable Self-Adhesive Air / Vapour Barrier Membrane System
- .13 2.4. Sheet-Applied, Vapour Permeable Sheathing Membrane Air Barrier System
- .14 3.1. Installation – General
- .15 3.2. Installation – Sheet Applied, Vapour Impermeable, Self-Adhesive Membrane
- .16 3.3. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Sheet-Applied Self-Adhesive Air / Vapour Barrier Membrane.

### **1.4. REFERENCES**

- 1.4.1. Definitions:
  - 1.4.1.1. Air barrier material: A building material that is designed and constructed to *Provide* primary resistance to airflow through air barrier system.
  - 1.4.1.2. Air barrier system: The collection of air barrier materials and auxiliary materials applied to substrate, including joints and junctions to abutting construction, to control air movement through the building envelope.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.5.3. Compatibility statement:
  - 1.5.3.1. Submit manufacturer's compatibility statement validating compatibility of air barrier system materials with substrates and adjacent materials.

### **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. *Provide* the work of this Section, executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
- 1.6.2. Mock-up:
  - 1.6.2.1. Construct minimum 10 m2 (100 ft2) area of each typical wall assembly installation for each type of Product.
  - 1.6.2.2. Locate at the Place of the Work as part of final installation.
  - 1.6.2.3. Do not proceed until mock-up has been reviewed by the *Consultant*.

### **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Package materials and identify on attached labels the manufacturer, contents and material specification number.
- 1.7.2. Store flammable solvent-base liquids away from excessive heat and open flame. Primer contains solvent. Do not use near open flame.
- 1.7.3. Store surface conditioner at temperature above 5°C to facilitate handling.
- 1.7.4. Store roll materials on end.

### **1.8. FIELD CONDITIONS**

- 1.8.1. Provide forced air circulation during curing period for enclosed applications.
- 1.8.2. Low temperature application:
  - 1.8.2.1. Perform adhesion test for membrane when ambient temperature is below -5°C.
  - 1.8.2.2. Proceed with work when temperature is (or predicted) to fall below -5°C ambient temperature only with the mutual documented agreement of inspection and testing company, manufacturer and applicator.
- 1.8.3. Do not perform installation during rainy or inclement weather or on wet or frost covered surfaces.
- 1.8.4. Provide temporary protection of the applied membrane to prevent mechanical damage or damage from spillage of oil or solvents.

### **1.9. EXTENDED WARRANTY**

- 1.9.1. The work of this Section shall meet the specified building envelope performance requirements during the warranty period.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Air barrier system shall perform as continuous air barrier and as liquid-water drainage plane flashed to discharge to exterior of building envelope incidental condensation or water penetration.
- 2.1.2. At wall and roof cladding transitions, air barrier system shall perform as continuous air barrier and as liquid-water drainage plane flashed to discharge to exterior of building envelope incidental condensation or water penetration by creation of unobstructed drainage plane that extends across the cladding transition or by flashing to discharge to exterior of building envelope incidental condensation or water penetration.
- 2.1.3. Air barrier system shall accommodate substrate movement, construction material changes, and transitions at perimeter conditions without deterioration which permits air and water leakage exceeding the following specified limits and requirements, or interruption of the drainage plane:
  - 2.1.3.1. Air permeance of air barrier material: Maximum 0.02 L/s.m<sup>2</sup> at 75 Pa (0.004 cfm/ft<sup>2</sup> at 1.57 psf) to ASTM E2178-13.
  - 2.1.3.2. Rate of air leakage of air barrier system: Maximum 0.15 L/s.m<sup>2</sup> at 75 Pa (0.030 cfm/ft<sup>2</sup> at 1.57 psf) to ASTM E283-04.
  - 2.1.3.3. Water vapour transmission for air / vapour barriers: Maximum 5.7 ng/Pa.m<sup>2</sup>.s. (0.1 perms).
  - 2.1.3.4. Water vapour transmission for vapour permeable air vapour barriers: Minimum 570 ng/Pa.m<sup>2</sup> s. (10 perms).
  - 2.1.3.5. Air barrier membrane system structural performance while maintaining air barrier performance for air leakage: Air barrier system shall transfer wind loads to structure and shall resist 100% of design wind load in accordance with the Ontario Building Code.
  - 2.1.3.6. Low temperature performance: Minimum -30°C (-22°F).
  - 2.1.3.7. Compatibility: Air barrier system materials shall be compatible with substrate and adjacent materials with material manufacturers and show no performance deterioration during service conditions.
  - 2.1.3.8. Self-sealability: ASTM D1970/D1970M-21

- 2.1.4. Air barrier system shall be joined in an airtight and flexible manner to air barrier material of adjacent building envelope air barrier systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between the following unless otherwise applicable:
  - 2.1.4.1. Foundation and walls.
  - 2.1.4.2. Walls and openings (windows, doors, louvres, and other wall penetrations).
  - 2.1.4.3. Wall and roof systems.
  - 2.1.4.4. Wall and roof over unconditioned space.
  - 2.1.4.5. Walls, floor and roof across construction, control, and movement joints.
  - 2.1.4.6. Walls, floors and roof to utility, pipe and duct penetrations.

## **2.2. MATERIALS – GENERAL**

- 2.2.1. Single source responsibility: Materials shall be sourced from one manufacturer including sheet membranes, air barrier sealants, primers, mastics and adhesives.

## **2.3. SHEET-APPLIED, VAPOUR IMPERMEABLE SELF-ADHESIVE AIR / VAPOUR BARRIER MEMBRANE SYSTEM**

- 2.3.1. Description: Composite preformed modified bituminous membrane system consisting of SBS modified asphalt for low temperature flexibility and polyethylene scrim reinforcing, with physical properties as follows:
  - 2.3.1.1. Single source responsibility: Components required for complete air barrier system and through wall flashing membrane behind the opaque wall assemblies to be obtained from single manufacturer. Coordinate with Section 07 27 00.
  - 2.3.1.2. Thickness: 1.0 mm (40 mils)
  - 2.3.1.3. Application temperature: in accordance with product installation instructions.
  - 2.3.1.4. Primer: in accordance with product installation instructions.
  - 2.3.1.5. Termination and penetration sealing mastic: in accordance with product installation instructions.
  - 2.3.1.6. Acceptable product systems:
    - (1) Henry Company 'Bakor Blueskin SA' and 'Blueskin SA LT'.
    - (2) Carlisle Coatings & Waterproofing 'CCW 705'.
    - (3) Grace Construction Products 'Perm-A-Barrier Wall Membrane'.
    - (4) IKO 'AquaBarrier AVB' and AquaBarrier AVB Low Temp'.
    - (5) Soprema 'Sopraseal Stick 1100 Summer Grade' and Sopraseal Stick 1100 Winter Grade'.
    - (6) Tremco 'ExoAir 110 and 110LT'.
    - (7) W.R. Meadows 'Air Shield' and 'Low Temperature Air Shield'.
    - (8) Or equivalent.

## **2.4. SHEET-APPLIED, VAPOUR PERMEABLE SHEATHING MEMBRANE AIR BARRIER SYSTEM**

- 2.4.1. Description: Flexible sheet material with high vapour permeability to CAN/CGSB 51.32-M77, for breather type sheathing membranes.
- 2.4.2. Air barrier tape: as per manufacturer's printed installation instructions.
- 2.4.3. Fasteners:
  - 2.4.3.1. For steel frame construction: as per manufacturer's printed installation instructions, rust resistant screws with 50 mm (2") diameter plastic cap.
  - 2.4.3.2. For wood frame construction: as per manufacturer's printed installation instructions, nails with large heads or plastic washers. Wide staples with a 25 mm (1") minimum crown may be used if applied on wood sheathing.
- 2.4.4. Acceptable Products:
  - 2.4.4.1. Dupont 'Tyvek CommercialWrap'.
  - 2.4.4.2. Fabrene Inc. 'Air-Gard XL'.
  - 2.4.4.3. Dow 'Styrofoam WeatherMate Plus'.
  - 2.4.4.4. Fiberweb 'Tyvar Metrowrap'.
  - 2.4.4.5. Or equivalent.



### **3 EXECUTION**

#### **3.1. INSTALLATION – GENERAL**

- 3.1.1. Surfaces to receive air barrier systems shall be smooth, dry and free from conditions that will adversely affect execution, permanence, or quality of the work of this Section.
- 3.1.2. Air barrier system shall be continuous in the building envelope. Lap and seal air barrier systems in accordance with product manufacturer's installation instructions to construction, control, and expansion joints, across junctions between different building assemblies, and around penetrations through the building assembly.
- 3.1.3. Wrap into jamb, head and sill of building envelope window openings, door openings, and other openings with air barrier system membrane by returning membrane to inside face of opening unless otherwise indicated.
  - 3.1.3.1. Coordinate air / vapour barrier terminations of work of this section with air / vapour barrier membrane in Section 08 41 00.

#### **3.2. INSTALLATION – SHEET APPLIED, VAPOUR IMPERMEABLE, SELF-ADHESIVE MEMBRANE**

- 3.2.1. Apply self-adhering membrane continuous to prepared and primed substrate in an overlapping shingle fashion to shed moisture towards exterior and in accordance with manufacturer's recommendations and written instructions. Stagger vertical joints 200 mm (8").
- 3.2.2. Align and position self-adhering membrane, remove protective film and press firmly into place. Ensure minimum 50 mm (2") overlap at end and side laps. Promptly roll laps and membrane with a counter top roller to affect the seal.
- 3.2.3. At the end of each Day's work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel apply a feathered edge to seal termination and shed water.
- 3.2.4. Seal projections with application of liquid air seal mastic.
- 3.2.5. Apply self-adhering membrane continuous across junctions between different building assemblies, and around penetrations through the building assembly. Provide 100 mm (4") overlap unless otherwise indicated, or required by manufacturer's installation instructions.
- 3.2.6. Inspect membrane for punctures, misaligned seams and fishmouths, apply additional layer of membrane over affected area, extending minimum of 150 mm (6") beyond damaged area in all directions.

#### **3.3. FIELD QUALITY CONTROL**

- 3.3.1. Conduct quality control in accordance with Section 01 45 00.
  - 3.3.1.1. Perform pull adhesion tests for project substrates in accordance with ASTM D4541-09e1.
- 3.3.2. Work of this section shall be subject to independent inspection and testing.
- 3.3.3. Manufacturer's field review to be in accordance with Section 01 45 00.

**END OF SECTION**

## **1 GENERAL**

### **1.1. SUMMARY**

- 1.1.1. Provide labour, materials, products, equipment, and services to complete the PV cladding panels work specified herein. This includes, but is not necessarily limited, to:
  - 1.1.1.1. Building-integrated PV cladding assemblies
  - 1.1.1.2. Auxiliary materials required for a complete installation.

### **1.2. RELATED REQUIREMENTS**

- 1.2.1. Specifications throughout all Divisions of the Project shall be read as a whole and may be directly applicable to this Section.
- 1.2.2. Related requirements provided below are for convenience purposes only.
  - 1.2.2.1. Section 05 41 00, Structural Metal Stud Framing: for secondary support framing supporting metal wall panels.
  - 1.2.2.2. Section 07 21 00, Insulation: for provision of thermal insulation.
  - 1.2.2.3. Section 07 27 00, Air Barriers: for provision of air barrier assemblies.
  - 1.2.2.4. Section 07 62 00, Sheet Metal Flashing and Trim: for miscellaneous copings, flashings and other sheet metal work not part of work of this Section.
  - 1.2.2.5. Section 07 92 00, Joint Sealants: for field-applied sealants not otherwise specified in this Section.
  - 1.2.2.6. Division 26 – Electrical: For the facility's electrical infrastructure.
  - 1.2.2.7. Section 26 31 00 – Photovoltaic Collectors.

### **1.3. SECTION INCLUDES**

- .1 1.1. Summary
- .2 1.2. Related Requirements
- .3 1.3. Section Includes
- .4 1.4. References
- .5 1.5. Definitions
- .6 1.6. Administrative Requirements
- .7 1.7. Submittals
- .8 1.8. Closeout Submittals
- .9 1.9. Quality Assurance
- .10 1.10. Delivery, Storage And Handling
- .11 1.11. Project Conditions
- .12 1.12. Coordination
- .13 1.13. Warranty
- .14 2.1. Manufacturers
- .15 2.2. Regulatory Requirements
- .16 2.3. Design And Performance Requirements
- .17 2.4. Panel Assembly
- .18 2.5. Core Material
- .19 2.6. Subframing
- .20 2.7. Panel Accessories
- .21 2.8. Fabrication
- .22 2.9. Finishes
- .23 3.1. Manufacturer's Instructions
- .24 3.2. Examination
- .25 3.3. Preparation
- .26 3.4. Faced PV Cladding Panel Installation
- .27 3.5. Field Quality Control
- .28 3.6. Adjusting, Cleaning, And Protection

#### **1.4. REFERENCES**

- 1.4.1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- 1.4.2. All reference amendments adopted prior to the Bid Closing date of this Project shall be applicable to this Project.
- 1.4.3. All materials, installation and workmanship shall comply with all applicable requirements and standards.
- 1.4.4. ASTM International
  - 1.4.4.1. ASTM B117-16: Standard Practice for Operating Salt Spray (Fog) Apparatus
  - 1.4.4.2. ASTM C271/C271M-16: Standard Test Method for Density of Sandwich Core Materials
  - 1.4.4.3. ASTM C273/C273M-18: Standard Test Method for Shear Properties of Sandwich Core Materials
  - 1.4.4.4. ASTM C297/C297M-16: Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
  - 1.4.4.5. ASTM C364/C364M-16: Standard Test Method for Edgewise Compressive Strength of Sandwich Constructions
  - 1.4.4.6. ASTM C365: Standard Test Method for Flatwise Compressive Properties of Sandwich Cores
  - 1.4.4.7. ASTM C393/C393M-16: Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure
  - 1.4.4.8. ASTM C480/C480M-16: Standard Test Method for Flexure Creep of Sandwich Constructions
  - 1.4.4.9. ASTM C481-99 (Reapproved 2016): Standard Test Method for Laboratory Aging of Sandwich Constructions
  - 1.4.4.10. ASTM C666/C666M-15: Standard Test Method for Resistance to Rapid Freezing and Thawing
  - 1.4.4.11. ASTM C880/C880M-15: Standard Test Method for Flexural Strength
  - 1.4.4.12. ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood
  - 1.4.4.13. ASTM D7766/D7766M-16: Standard Practice for Damage Resistance Testing of Sandwich Constructions
  - 1.4.4.14. ASTM E84: Tunnel Test
  - 1.4.4.15. ASTM E283/E283M-04 (2012): Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - 1.4.4.16. ASTM E330/E330M-02: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - 1.4.4.17. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
  - 1.4.4.18. ASTM E1886-13a: Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
  - 1.4.4.19. ASTM E1996: Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
  - 1.4.4.20. ASTM G154: Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
- 1.4.5. CSA International
  - 1.4.5.1. CSA C22.1: Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
- 1.4.6. Institute of Electrical and Electronics Engineers (IEEE)
  - 1.4.6.1. IEEE 100 CD: Standards Dictionary: Glossary of Terms And Definitions

- 1.4.7. International Organization for Standardization (ISO)
  - 1.4.7.1. ISO 10545-8: Part 8 Determination of linear thermal expansion
- 1.4.8. Underwriters Laboratories (UL)
  - 1.4.8.1. UL 61730: Standard for Flat-Plate Photovoltaic Modules and Panels
- 1.4.9. Underwriters Laboratories of Canada (ULC)
  - 1.4.9.1. CAN/ULC S102: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - 1.4.9.2. CAN/ULC-S114: Standard method of test for determination of non-combustibility in building materials – Component material testing
  - 1.4.9.3. CAN/ULC-134: Standard Method of Fire Test of Exterior Wall Assemblies

## **1.5. DEFINITIONS**

- 1.5.1. Electrical and Electronics Terminology:
  - 1.5.1.1. Unless otherwise specified or indicated, electrical and electronics terminology used shall herein be as defined by IEEE 100 CD.
- 1.5.2. Solar Energy Conversion and Solar Photovoltaic Energy System Terminology:
  - 1.5.2.1. Unless otherwise specified or indicated, solar energy conversion and solar photovoltaic energy system terminology used herein shall be as defined by ASTM E772.
- 1.5.3. Abbreviations and Acronyms
  - 1.5.3.1. EVA: Ethylene-Vinyl Acetate
  - 1.5.3.2. MSVD: Magnetic Sputter Vacuum Deposition
  - 1.5.3.3. PV: Photovoltaic

## **1.6. ADMINISTRATIVE REQUIREMENTS**

- 1.6.1. Preinstallation Meeting: Conduct Meeting at Project site.
  - 1.6.1.1. Meet with Owner, Consultant, Subcontractor, manufacturer's representative, structural-support Subcontractor, and Subcontractors whose work interfaces with or affects faced PV cladding panels, including installers of doors, windows, and louvers. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 1.6.1.2. Review flashings, special panels details, wall penetrations, openings, and condition of other construction that affect faced PV cladding panels.
  - 1.6.1.3. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 1.6.1.4. Review temporary protection requirements for faced PV cladding panels during and after installation.
  - 1.6.1.5. Review procedures for repair of panels damaged after installation.
  - 1.6.1.6. Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.
  - 1.6.1.7. Agenda: review progress of other construction activities and preparations for the particular activity under consideration.
  - 1.6.1.8. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
    - (1) Scheduling: Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    - (2) Sequencing: Sequence work to permit installation of materials in conjunction with related materials and seals.

## **1.7. SUBMITTALS**

- 1.7.1. Product Data: Submit in accordance with Division 01 for the following:

- 1.7.1.1. Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.7.1.2. Submit WHMIS Safety Data Sheets (SDS) in accordance with requirements of Division 01.
- 1.7.1.3. Submit material manufacturer's Product Data, instructions for temperature and other limitations of installation conditions, technical data supplied by the manufacturer.
- 1.7.2. Shop Drawings:
  - 1.7.2.1. Submit in accordance with Division 01 for faced PV cladding panel assemblies' work. Include plans, elevations, sections, full-size details, anchorage, locations of accessory items and attachments to other work.
  - 1.7.2.2. Include fabrication and installation layouts of faced PV cladding panel assemblies; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
  - 1.7.2.3. Accessories: Include details of the flashing, trim and anchorage.
  - 1.7.2.4. Indicate field measurements on Shop Drawings.
  - 1.7.2.5. Include diagrams for power, and wiring.
- 1.7.3. Professional Engineer's Stamped Shop Drawings and Submittals: Submit engineered and stamped shop drawings for faced PV cladding panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation in accordance with Division 01.
- 1.7.4. Initial Selection Samples: Submit in accordance with Division 01 for each type of faced PV cladding panel component requiring finish selection.
  - 1.7.4.1. Include representative Samples of available finishes and graphics.
- 1.7.5. Verification Samples: Upon initial selection of samples, submit verification samples in accordance with Division 01 for each type of faced PV cladding panel showing each component and with the required finishes as follows:
  - 1.7.5.1. Submit 300 mm (12 inches) square sample of each type of PV cladding panels illustrating typical exterior panel assembly, including typical junction box and associated wiring.
- 1.7.6. Warranties: Submit sample of extended warranties specified in this Section for Consultant's review.
- 1.7.7. Quality Assurance Submittals: submit the following in accordance with Division 01.
  - 1.7.7.1. Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

## **1.8. CLOSEOUT SUBMITTALS**

- 1.8.1. Maintenance Data: Submit operation and maintenance data for each type of faced PV cladding panel assembly to include in maintenance manuals.

## **1.9. QUALITY ASSURANCE**

- 1.9.1. Subcontractor Qualifications:
  - 1.9.1.1. Installation must be performed by an installer who has been trained or otherwise authorized by manufacturer.
- 1.9.2. Manufacturer Qualifications:
  - 1.9.2.1. Provide Products from a manufacturer with minimum 10 years of experience and capable of providing PV cladding panel assemblies that meet or exceed performance requirements indicated.
- 1.9.3. Mock-ups: Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1.9.3.1. Build mockup of typical faced PV cladding panel assembly including corner, supports, attachments, and accessories.

- 1.9.3.2. Subject to compliance with requirements, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.
- 1.9.4. Source Limitations for panels:
  - 1.9.4.1. Obtain primary components of faced PV cladding panel assemblies, from single manufacturer. Obtain secondary components and accessories from sources acceptable to manufacturer of primary materials.

#### **1.10. DELIVERY, STORAGE AND HANDLING**

- 1.10.1. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Inspect components for damage upon delivery.
- 1.10.2. Storage: Store products in a secure enclosed area protected from the elements, in manufacturer's packaging until ready for installation.
- 1.10.3. Handling: Handle materials with care and avoid dents, scratches, or damage to products. Remove labels, stickers or protection after installation.

#### **1.11. PROJECT CONDITIONS**

- 1.11.1. Field Measurements:
  - 1.11.1.1. Verify actual panel locations by field measurements performed by the installer prior to commencement of fabrication. Ensure recorded measurements provided by the installer are indicated on Shop Drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- 1.11.2. Weather Limitations:
  - 1.11.2.1. Proceed with installation only when existing and forecasted weather conditions permit assembly of faced PV cladding panels to be performed according to manufacturers' written instructions and warranty requirements.

#### **1.12. COORDINATION**

- 1.12.1. Coordinate faced PV cladding panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### **1.13. WARRANTY**

- 1.13.1. Extended Warranty: Provide manufacturer's standard warranty which covers Products specified in this Section that fail in materials or workmanship within specified warranty period.
  - 1.13.1.1. Warranty Period - Materials:
    - (1) Panel performance: 25 years from date of Substantial Performance of the Work.
    - (2) Solar photovoltaic cells: 25 years from date of Substantial Performance of the Work.
    - (3) Power output: 25 years manufacturer's power output warranty, at 80% minimum rated power output of the initial nominal power by year 25.
    - (4) Delamination: lifetime of Products.

### **2 PRODUCTS**

#### **2.1. MANUFACTURERS**

- 2.1.1. Acceptable Manufacture;
  - 2.1.1.1. Materials specified in this Section are based on Products as supplied by: Mitrex Inc.; 41 Racine Road, Toronto, ON M9W 2Z4;  
T: 416-497-7120;  
E: info@mitrex.com;  
web: www.mitrex.com

- 2.1.2. Substitution: Conforming to requirements of Section 01 25 00, Substitution Procedures and as follows:
- 2.1.2.1. Consultant will consider requests for substitution if received 15 days before Bid Closing Deadline. Requests received after that time will be rejected. Consultant will consider requests for substitution when following conditions are satisfied:
- (1) Requests for substitution include a list of at least five similar projects of equivalent size where products have been installed for a minimum of five years.
  - (2) Requested substitution does not require extensive revisions to the Contract Documents.
  - (3) Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - (4) Requested substitution will not adversely affect construction schedule.
  - (5) Requested substitution provides specified warranty.

## **2.2. REGULATORY REQUIREMENTS**

- 2.2.1. Comply with applicable provisions in the Ontario Building Code, and requirements of authorities having jurisdiction.

## **2.3. DESIGN AND PERFORMANCE REQUIREMENTS**

- 2.3.1. Professional Engineer's Design and Certification: Employ the services of a Professional Engineer licensed to practice in the Province of Ontario carrying professional liability insurance, and who is experienced in providing engineering services of similar kind, scope and complexity; to design and certify building-integrated PV cladding panels.
- 2.3.2. Provide panels with following physical characteristics:
- 2.3.2.1. Salt Spray Resistance: No deleterious effects after 1000 Hours of exposure in accordance with ASTM B117
- 2.3.2.2. Density of Sandwich Core: Not less than 327 kg/m<sup>3</sup> (20.42 lb/ft<sup>3</sup>) for 305 mm x 305 mm x 15 mm (12 inch x 12 inch x 0.6 inch) when tested in accordance with ASTM C271/C271M.
- 2.3.2.3. Laboratory Aging of Sandwich Construction:
- (1) Based on Procedure A per ASTM C481 for six repetitions of following load cycle:
    - (A) Immerse in water at 50 deg C (122 deg F) for 1 hour
    - (B) Spray with steam at 95 deg C (203 deg F) for 3 hours
    - (C) Store at -12 deg C (10 deg F) for 20 hours
    - (D) Heat at 100 deg C (212 deg F) for 3 hours
    - (E) Spray with steam at 95 deg C (203 deg F) for 3 hours
    - (F) Heat in dry air at 100 deg C (212 deg F) for 18 hours
  - (2) Results: ASTM C273; ASTM C297; ASTM C364; ASTM C393 tests were reconducted after aging; variation as follows: +1.36 %, -5.90%; +2.55%; -7.95% (Positive variation indicates no decrease in strength after aging)
- 2.3.2.4. Linear Thermal Expansion:  $11.28 \times 10^{-6}$  per deg C when tested from room temperature to 100 deg C in accordance with ISO 10545-8.
- 2.3.2.5. Fluorescent Ultraviolet Radiation Exposure: No visible change to facing or adhesive after 2000 hours of UV exposure when tested in accordance with ASTM G154.
- 2.3.2.6. Rapid Freeze-Thaw Cycling Resistance: No visible change to facing or adhesive after 200 cycles of rapid freeze and thaw ranging from 4 deg C (39 deg F) to -18 deg C (-0.4 deg F) when tested in accordance with ASTM C666/C666M
- 2.3.2.7. Uniform Static Pressure/Deflection under loading: Provide faced PV cladding panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:

- 
- (1) Maximum permanent deflection of 0.10 mm at 5.76 kPa (positive) and - 5.006 kPa (negative) based on static pressure and uniform static deflection testing.
  - (2) Deflection Limits: Maximum deflection as follows under 3.84 kPa (80.2 psf) positive and negative loadings:
    - (G) Positive pressure: 4.14 mm (0.163 inch)
    - (H) Negative pressure: 4.93 mm (0.194 inch)
  - (3) Ensure stress on panel skin does not exceed manufacturer's recommended maximum value to avoid permanent deformation.
- 2.3.2.8. Shear Stress and Shear Modulus: Ultimate Core strength of not less than 1.01 MPa (147 psi) and core shear modulus of not less than 10.9 MPa (1,583 psi) based on testing per ASTM C273/C273M (Compressive force applied until rupture)
- 2.3.2.9. Flatwise Tensile Bond Strength: Not less than 1.52 MPa (220 psi) when tested in accordance with ASTM C297/C297M based on load applied to the top and bottom layers of the panel.
- 2.3.2.10. Edgewise Compressive Strength: Not less than 37.85 MPa (5490 psi) when tested in accordance with ASTM C364/C364M based on compressive load applied at a rate 0.508 mm / min (0.02 in/min)
- 2.3.2.11. Flatwise Tensile Bond Strength: Not less than 1.52 MPa (220 psi) when tested in accordance with ASTM C365 based on compressive load applied at to and bottom layer of panel
- 2.3.2.12. Shear Strength by Beam Flexure: Not less than the following based on testing in accordance with ASTM C393/C393M (loaded in flexure with facing side in tension at a cross head speed of 0.635 mm / min (0.025 in/min.):
- (1) Maximum Core Shear Strength of not less than 0.94 MPa (137 psi)
  - (2) Facing Bending Stress of not less than 8.14 MPa (1180 psi)
- 2.3.2.13. Flexure Creep: Net creep of 0.74 mm per day (0.029 inch per day) based on testing in accordance with ASTM C480/C480M (based on midspan loading with stone-facing side in tension at a cross head speed of 0.635 mm / min (0.025 in/min.)
- 2.3.2.14. Flexural Strength (composite panel): not less than 22.83 MPa (3311psi) based on testing per ASTM C880/C880M.
- 2.3.2.15. Tensile Properties of adhesive bond: No Failure of adhesive bond based on testing per ASTM C897
- 2.3.2.16. Rivet withdrawal test: Not less than 2.124 kN (477.5 lbs-f) when tested at a rate of 2.5 mm/min (0.098 in / min) in accordance with ASTM D1761
- 2.3.2.17. Damage resistance testing of sandwich constructions: No panel deformation in accordance with ASTM D7766/D7766M based on loading applied at midpoint of panel using 13 mm (1/2 inch) diameter hemispherical steel indenter at a rate of 0.254 mm / min (0.01 in/min) until a drop-in load was observed.
- 2.3.2.18. Cyclic Pressure Loading: Pass per ASTM E1886. Not less than 3,500 positive and negative pressure cycles applied at a pressure of  $\pm 2880$  Pa (60 psf)
- 2.3.2.19. Air Infiltration: Air leakage (infiltration and exfiltration) of not more than 0.01 L/s per sq. m (0.002 cfm/sq. ft.) when tested according to ASTM E283 at test-pressure difference of 75 Pa (1.57 lbs/sq.ft)
- 2.3.2.20. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at 720 Pa (15 lbf/sq. ft)
- 2.3.2.21. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 in accordance with the following:
- 2.3.2.22. Large-Missile Test: Pass; a weighted 2x4 projectile fired at the panel at 15.24 m/s (50 ft/s).



- 2.3.2.23. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 2.3.3. Fire Performance:
  - 2.3.3.1. System Fire Propagation Characteristics: pass per CAN/ULC-S134;
  - 2.3.3.2. Non-combustibility: pass per CAN/ULC S114;
  - 2.3.3.3. Panel Fire Performance:
    - (1) Flame spread less than 25 and smoke developed less than 40, in accordance with CAN/ULC S102.
- 2.3.4. Rain Screen Principle:
  - 2.3.4.1. Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.
  - 2.3.4.2. Design for compartments at corners to achieve appropriate pressure equalization in exterior cladding system.
  - 2.3.4.3. Provide gaskets, baffles, overlaps, seals where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain integrity of continuous air/vapour barrier system with adjacent surrounding air/vapour barrier.
  - 2.3.4.4. Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.
- 2.3.5. Electrical Characteristics:
  - 2.3.5.1. Provide materials to fabricate functioning photovoltaic systems in accordance with CSA, ASTM, IEEE, NEMA, and cUL requirements, as specified in this section, and as shown on Drawings.
  - 2.3.5.2. System operating temperature shall be from -40 deg C to +85 deg C.
  - 2.3.5.3. Minimum Performance Parameters of PV system: to UL 1703.

## **2.4. PANEL ASSEMBLY**

- 2.4.1. Provide PV cladding system manufactured from panels fabricated from laminated glass consisting of the following:
  - 2.4.1.1. Minimum 3.2 mm thick tempered glass conforming to ASTM C1048, Kind FT (fully tempered) or CAN/CGSB-12.1 with manufacturer's proprietary UV-resistant and fade-resistant decorative finish.
    - (1) Finish: As selected from manufacturer's standard range
  - 2.4.1.2. Encapsulation: 0.76 mm thick encapsulation consisting of EVA interlayer, photovoltaic cells and EVA interlayer.
    - (1) Photovoltaic Cells: Monocrystalline silicon solar cells, listed to UL 1703 with performance characteristics ( $\pm 10\%$ ) of typical PV Module at Standard Test Conditions (STC = 25°C cell temperature, 1000 W/m<sup>2</sup> irradiance at Air Mass of 1.5 spectrum) as follows:
      - (l) 2032 mm x 990 mm (80 inches x 39 inches)
        - (a) Nominal Maximum Power (P<sub>max</sub>): 390W
        - (b) Maximum Power Voltage (V<sub>mp</sub>) = 41.9V
        - (c) Maximum Power Current (I<sub>mp</sub>) = 9.31A
        - (d) Open Circuit Voltage (V<sub>oc</sub>) = 47.2V
        - (e) Short Circuit Current (I<sub>sc</sub>) = 9.77A
        - (f) Module efficiency = 19.2%
        - (g) Power tolerance = +/- 5%
        - (h) Maximum series fuse rating = 20A]

- (J) 1220 mm x 610 mm (48 inches x 24 inches)
  - (a) Nominal Maximum Power (Pmax): 95W
  - (b) Maximum Power Voltage (Vmp) = 10.4V
  - (c) Maximum Power Current (Imp) = 9.13A
  - (d) Open Circuit Voltage (Voc) = 11.8V
  - (e) Short Circuit Current (Isc) = 9.77A
  - (f) Module efficiency = 12.8%
  - (g) Power tolerance = +/- 5%
  - (h) Maximum series fuse rating = 20A]
- (K) 2032 mm x 1092 mm (80 inches x 43 inches)
  - (a) Nominal Maximum Power (Pmax): 390W
  - (b) Maximum Power Voltage (Vmp) = 41.9V
  - (c) Maximum Power Current (Imp) = 9.31A
  - (d) Open Circuit Voltage (Voc) = 47.2V
  - (e) Short Circuit Current (Isc) = 9.77A
  - (f) Module efficiency = 17.6%
  - (g) Power tolerance = +/- 5%
  - (h) Maximum series fuse rating = 20A]

2.4.1.3. Honeycomb core with non-combustible/non-conductive backsheet.

## **2.5. CORE MATERIAL**

- 2.5.1. Honeycomb core: Not less than 12 mm (1/2 inch), aerospace-grade lightweight aluminum honeycomb core with 6000 series aluminum with following characteristics:
  - 2.5.1.1. Typical Cell Size: 5 mm (0.20 inch)
  - 2.5.1.2. Density: Manufacturer's standard as required for application.
  - 2.5.1.3. Foil: 0.05 mm (0.002 inch)
  - 2.5.1.4. Core Type: Type B - Non-combustible welded core.
- 2.5.2. Top and bottom sheet: Not less than 0.5 mm (0.02 inch) thick.
- 2.5.3. Adhesive system: Manufacturer's recommended epoxy resin adhesive system with following performance characteristics specified in this Section.

## **2.6. SUBFRAMING**

- 2.6.1. Provide manufacturer's standard interlocking sections manufactured from ASTM B221, extruded aluminum alloy 6063 T3 and as required for support and alignment of faced PV cladding panel system.
  - 2.6.1.1. Minimum wall thickness of sections: 2.4 mm (0.094 inch)
  - 2.6.1.2. Air space: Not less than 25 mm (1 inch)
  - 2.6.1.3. Basis-of-Design: "CL Interlocking Channel/CL Anchor plate system" by Mitrex.
- 2.6.2. Thermally-Broken Sub-framing: Provide low-conductivity thermally-broken, intermittent structural attachment insulation clips designed maintain insulation effectiveness, with adjustable depth and suitable for vertical and horizontal sub-girts.

## **2.7. PANEL ACCESSORIES**

- 2.7.1. Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
- 2.7.2. Panel Fasteners: Manufacturer's recommended fasteners and rivets designed to withstand design loads. Where exposed fasteners are unavoidable, provide with heads matching colour of panels.
- 2.7.3. Sealants: ASTM C920; elastomeric silicone sealant of type, grade, class, and use classifications required to seal joints, and as recommended in writing by panel manufacturer.
- 2.7.4. Electrical Components

- 2.7.4.1. Junction Box: IP67, 3 by-pass diodes.
- 2.7.4.2. Connector: TE or MC4; suitable for solar panels.
- 2.7.4.3. Coordinate with Division 26 for provision of connections and coordination for electrical characteristics.

## **2.8. FABRICATION**

- 2.8.1. Provide factory-formed and -assembled, honeycomb wall panels fabricated from lightweight (aircraft quality) aluminum honeycomb bonded having epoxy impregnated aluminum panel skins. Provide panels formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
- 2.8.2. Fabricate and finish faced PV cladding panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- 2.8.3. Fabrication Tolerances:
  - 2.8.3.1. Nominal Thickness:
    - (1) More than 13 mm (1/2 inch) up to and including 50 mm (2 inches):  $\pm 3$  mm (1/8 inch)
    - (2) More than 50 mm (2 inches) up to and including 125 mm (5 inches):  $\pm 6$  mm (1/4 inch)
    - (3) More than 125 mm (5 inches):  $\pm 13$  mm (1/2 inch)
  - 2.8.3.2. Flatness: deviation from flatness of surface must not exceed 0.2" % of panel length, but never more than 6 mm (1/4 inch).
  - 2.8.3.3. Length and Width for sawn edges 50 mm (2 inches) or less:
    - (1) Less than 610 mm (24 inches):  $\pm 1.5$  mm (1/16 inch)
    - (2) More than or equal to 610 mm (24 inches):  $\pm 3$  mm (1/8 inch)
    - (3) Maximum angle tolerance:  $\pm 0.2\%$

## **2.9. FINISHES**

- 2.9.1. Carry out surface finishing uniformly to edges of the cladding panel. Where surface finishing of panels involves use of patching, fillers or similar products, faults or cracks, it shall be considered as part of normal finish process.
- 2.9.2. Surfaces must have a regular appearance as function of finishing process and worked to meet specified finish on exposed surfaces.

## **3 EXECUTION**

### **3.1. MANUFACTURER'S INSTRUCTIONS**

- 3.1.1. Compliance:
  - 3.1.1.1. Comply with manufacturer's latest written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2. EXAMINATION**

- 3.2.1. Examine substrates, areas, and conditions, with Subcontractor present, for compliance with requirements required for installation tolerances, supports, and other conditions affecting performance of the Work.
  - 3.2.1.1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by faced PV cladding panel manufacturer.
  - 3.2.1.2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by faced PV cladding panel manufacturer.

- 3.2.1.3. Verify that air-barriers/vapour-retarders have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- 3.2.2. Examine roughing-in for components and assemblies penetrating faced PV cladding panels to verify actual locations of penetrations relative to seam locations of faced PV cladding panels before installation.
- 3.2.3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.3. PREPARATION**

- 3.3.1. Miscellaneous Supports:
  - 3.3.1.1. Install subframing, furring, thermally-broken subframing and other miscellaneous panel support members and anchorages according to ASTM C754 and faced PV cladding panel manufacturer's written recommendations.

### **3.4. FACED PV CLADDING PANEL INSTALLATION**

- 3.4.1. Install faced PV cladding panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor faced PV cladding panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- 3.4.2. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by stone-faced honeycomb material panel manufacturer.
- 3.4.3. Install attachment assembly required to support faced PV cladding panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels. Do not apply sealants to panel joints unless otherwise indicated.
  - 3.4.3.1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
  - 3.4.3.2. Install support assembly at locations, spacings, and with fasteners recommended by fabricator. Use Fabricator's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, and draining to the exterior.
- 3.4.4. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
- 3.4.5. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
- 3.4.6. Wiring Installation: to CSA C22.1/CE Code.
  - 3.4.6.1. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections.
  - 3.4.6.2. Locate wires out of way of windows, doors, openings, and other hazards.
  - 3.4.6.3. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Manufacturer's Field Services:
  - 3.5.1.1. Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- 3.5.2. Tests:
  - 3.5.2.1. Perform tests in accordance with the manufacturer's written recommendations.

### **3.6. ADJUSTING, CLEANING, AND PROTECTION**

- 3.6.1. Remove temporary protective coverings and strippable films, if any, as faced PV cladding panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of faced PV cladding panel installation, clean finished surfaces as recommended by faced PV cladding panel manufacturer. Maintain in a clean condition during construction.
- 3.6.2. After faced PV cladding panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- 3.6.3. Replace faced PV cladding panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- 3.6.4. Protect finished work in accordance with Product Requirements specified in Division 01.
- 3.6.5. Do not permit adjacent work to damage work of this Section.
- 3.6.6. Upon completion of acceptance checks, settings, and tests, demonstrate that in-service PV electrical power generation system is in good operating condition and properly performing the intended function. Coordinate with Division 26.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Related Requirements
- .5 1.5. References
- .6 1.6. Administrative Requirements
- .7 1.7. Submittals
- .8 1.8. Closeout Submittals
- .9 1.9. Quality Assurance
- .10 1.10. Delivery, Storage And Handling
- .11 1.11. Project Conditions
- .12 1.12. Coordination
- .13 1.13. Warranty
- .14 2.1. Manufacturers
- .15 2.2. Regulatory Requirements
- .16 2.3. Design And Performance Requirements
- .17 2.4. Materials
- .18 2.5. Composite Panel
- .19 2.6. Subframing
- .20 2.7. Panel Accessories
- .21 2.8. Fabrication
- .22 2.9. Finishes
- .23 3.1. Manufacturer's Instructions
- .24 3.2. Examination
- .25 3.3. Preparation
- .26 3.4. Air Barrier Membrane Application
- .27 3.5. Insulation
- .28 3.6. Panel Installation
- .29 3.7. Installation Tolerances
- .30 3.8. Field Quality Control
- .31 3.9. Adjusting And Cleaning
- .32 3.10. Protection

### **1.3. SUMMARY**

- 1.3.1. Provide labour, materials, products, equipment and services to complete the faced honeycomb composite panels work specified herein. This includes, but is not necessarily limited, to:
- 1.3.1.1. Faced honeycomb composite, metal panel assemblies
  - 1.3.1.2. Auxiliary materials required for a complete installation.

### **1.4. RELATED REQUIREMENTS**

- 1.4.1. Specifications throughout all Divisions of the Project shall be read as a whole, and may be directly applicable to this Section.
- 1.4.2. Related requirements provided below are for convenience purposes only.
- 1.4.2.1. Section 04 22 00, Concrete Unit Masonry
  - 1.4.2.2. Section 05 41 13, Wind Load-Bearing Cold-Formed Metal Framing: for secondary support framing supporting metal wall panels.
  - 1.4.2.3. Section 07 21 00, Thermal Insulation: for provision of thermal insulation.
  - 1.4.2.4. Section 07 27 00, Air Barriers: for provision of air barrier assemblies.
  - 1.4.2.5. Section 07 62 00, Sheet Metal Flashing and Trim: for miscellaneous copings, flashings and other sheet metal work not part of work of this Section.

- 1.4.2.6. Section 07 92 00, Joint Sealants: for field-applied sealants not otherwise specified in this Section.

## **1.5. REFERENCES**

- 1.5.1. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- 1.5.2. All reference amendments adopted prior to the Bid Closing date of this Project shall be applicable to this Project.
- 1.5.3. All materials, installation and workmanship shall comply with all applicable requirements and standards.
- 1.5.4. ASTM International
  - 1.5.4.1. ASTM B117-16: Standard Practice for Operating Salt Spray (Fog) Apparatus
  - 1.5.4.2. ASTM B221M: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
  - 1.5.4.3. ASTM C97 / C97M-15: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
  - 1.5.4.4. ASTM C170 / C170M-17: Standard Test Method for Compressive Strength of Dimension Stone
  - 1.5.4.5. ASTM C271/C271M-16: Standard Test Method for Density of Sandwich Core Materials
  - 1.5.4.6. ASTM C273/C273M-18: Standard Test Method for Shear Properties of Sandwich Core Materials
  - 1.5.4.7. ASTM C297/C297M-16: Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
  - 1.5.4.8. ASTM C364/C364M-16: Standard Test Method for Edgewise Compressive Strength of Sandwich Constructions
  - 1.5.4.9. ASTM C365: Standard Test Method for Flatwise Compressive Properties of Sandwich Cores
  - 1.5.4.10. ASTM C393/C393M-16: Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure
  - 1.5.4.11. ASTM C480/C480M-16: Standard Test Method for Flexure Creep of Sandwich Constructions
  - 1.5.4.12. ASTM C481-99 (Reapproved 2016): Standard Test Method for Laboratory Aging of Sandwich Constructions
  - 1.5.4.13. ASTM C666/C666M-15: Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
  - 1.5.4.14. ASTM C754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - 1.5.4.15. ASTM C920: Standard Specification for Elastomeric Joint Sealants
  - 1.5.4.16. ASTM D7766/D7766M-16: Standard Practice for Damage Resistance Testing of Sandwich Constructions
  - 1.5.4.17. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
  - 1.5.4.18. ASTM E283/E283M-04 (2012): Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
  - 1.5.4.19. ASTM E330/E330M-02: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - 1.5.4.20. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
  - 1.5.4.21. ASTM E1886-13a: Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
  - 1.5.4.22. ASTM E1996: Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

- 1.5.4.23. ASTM G154: Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
- 1.5.5. Underwriters Laboratories of Canada
  - 1.5.5.1. CAN/ULC S102: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
  - 1.5.5.2. CAN/ULC-S114: Standard method of test for determination of non-combustibility in building materials
  - 1.5.5.3. CAN/ULC-134: Standard Method of Fire Test of Exterior Wall Assemblies
- 1.5.6. International Organization for Standardization (ISO)
  - 1.5.6.1. ISO 10545-8: Ceramic tiles — Part 8: Determination of linear thermal expansion

## **1.6. ADMINISTRATIVE REQUIREMENTS**

- 1.6.1. Preinstallation Meeting: Conduct Meeting at Project site.
  - 1.6.1.1. Meet with Owner, Consultant, Subcontractor, manufacturer's representative, structural-support Subcontractor, and Subcontractors whose work interfaces with or affects faced honeycomb composite panels, including installers of doors, windows, and louvers. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 1.6.1.2. Review flashings, special panels details, wall penetrations, openings, and condition of other construction that affect faced honeycomb composite panels.
  - 1.6.1.3. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 1.6.1.4. Review temporary protection requirements for faced honeycomb composite panels during and after installation.
  - 1.6.1.5. Review procedures for repair of panels damaged after installation.
  - 1.6.1.6. Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.
  - 1.6.1.7. Agenda: review progress of other construction activities and preparations for the particular activity under consideration.
  - 1.6.1.8. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
- 1.6.2. Scheduling:
  - 1.6.2.1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 1.6.3. Sequencing:
  - 1.6.3.1. Sequence work to permit installation of materials in conjunction with related materials and seals.
- 1.6.4. Coordination:
  - 1.6.4.1. Coordinate with installers of wall mounted items, equipment, and mechanical and electrical work so that installation will not subvert the integrity of the cladding system.
  - 1.6.4.2. Coordinate interface, transition, lapping, flashings and compatibility of membranes with work of Section 07 27 00.

## **1.7. SUBMITTALS**

- 1.7.1. Product Data: Submit in accordance with Division 01 for the following:
  - 1.7.1.1. Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - 1.7.1.2. Submit WHMIS Safety Data Sheets (SDS) in accordance with requirements of Division 01.
  - 1.7.1.3. Submit material manufacturer's Product Data, instructions for temperature and other limitations of installation conditions, technical data supplied by the manufacturer.
- 1.7.2. Shop Drawings:



- 1.7.2.1. Submit in accordance with Division 01 for faced honeycomb composite panel assemblies' work. Include plans, elevations, sections, full-size details, anchorage, locations of accessory items and attachments to other work. Include fabrication and installation layouts of faced honeycomb composite panel assemblies; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
- 1.7.2.2. Accessories:
  - (1) Include details of the flashing, trim and anchorage. Indicate field measurements on Shop Drawings.
- 1.7.2.3. Indicate methods to achieve watertight assembly, including sealants, penetration seals, drainage path of moisture from within assembly to exterior of envelope.
- 1.7.3. Initial Selection Samples:
  - 1.7.3.1. Submit in accordance with Division 01 for each type of faced metal cladding panel component requiring finish selection.
  - 1.7.3.2. Include representative Samples of available finishes.
- 1.7.4. Verification Samples:
  - 1.7.4.1. Upon initial selection of samples, submit verification samples in accordance with Division 01 for each type of faced cladding panel showing each component and with the required finishes as follows:
  - 1.7.4.2. Submit 300 mm (12 inches) square sample of each type of faced metal cladding panels illustrating typical exterior panel assembly.
- 1.7.5. Professional Engineer's Stamped Shop Drawings and Submittals:
  - 1.7.5.1. Submit engineered and stamped shop drawings for faced honeycomb composite panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation in accordance with Division 01.
- 1.7.6. Warranties:
  - 1.7.6.1. Submit sample of extended warranties specified in this Section for Consultant's review.
- 1.7.7. Quality Assurance Submittals:
  - 1.7.7.1. Submit the following in accordance with Division 01:
    - (1) Manufacturer's Instructions:
      - (A) Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- 1.7.8. Certificates:
  - 1.7.8.1. Submit certification from composite aluminum cladding system manufacturer that the manufacturing process and field installation procedure have been both carried out under an independent quality assurance program designed to confirm that the product and its application are consistent with the system as tested and listed in accordance with CAN/ULC S134-92.

## **1.8. CLOSEOUT SUBMITTALS**

- 1.8.1. Maintenance Data:
  - 1.8.1.1. Submit operation and maintenance data for each type of faced honeycomb composite panel assembly to include in maintenance manuals.

## **1.9. QUALITY ASSURANCE**

- 1.9.1. Qualifications:
  - 1.9.1.1. Installers / applicators / erectors:
    - (1) Installation must be performed by an installer who has been trained or otherwise authorized by manufacturer.
- 1.9.2. Manufacturer Qualifications:
  - 1.9.2.1. Provide Products from a manufacturer with minimum 10 years of experience and capable of providing glazed faced honeycomb composite panel assemblies that meet or exceed performance requirements indicated.
- 1.9.3. Mock-ups:

- 1.9.3.1. Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
- 1.9.3.2. Build mockup of typical faced honeycomb composite panel assembly including corner, supports, attachments, and accessories.
- 1.9.3.3. Subject to compliance with requirements, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.
- 1.9.4. Source Limitations for panels:
  - 1.9.4.1. Obtain primary components of faced honeycomb composite panel assemblies, from single manufacturer. Obtain secondary components and accessories from sources acceptable to manufacturer of primary materials.

#### **1.10. DELIVERY, STORAGE AND HANDLING**

- 1.10.1. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Inspect components for damage upon delivery.
- 1.10.2. Storage:
  - 1.10.2.1. Store products in a secure enclosed area protected from the elements, in manufacturer's packaging until ready for installation.
- 1.10.3. Handling:
  - 1.10.3.1. Handle materials with care and avoid dents, scratches or damage to products. Remove labels, stickers or protection after installation.

#### **1.11. PROJECT CONDITIONS**

- 1.11.1. Field Measurements:
  - 1.11.1.1. Verify actual panel locations by field measurements performed by the installer prior to commencement of fabrication. Ensure recorded measurements provided by the installer are indicated on Shop Drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- 1.11.2. Weather Limitations:
  - 1.11.2.1. Proceed with installation only when existing and forecasted weather conditions permit assembly of faced honeycomb composite panels to be performed according to manufacturers' written instructions and warranty requirements.

#### **1.12. COORDINATION**

- 1.12.1. Coordinate faced honeycomb composite panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### **1.13. WARRANTY**

- 1.13.1. Warrant work of this section in accordance with the Articles of Agreement.
- 1.13.2. Extended Warranty:
  - 1.13.2.1. Provide manufacturer's standard warranty which covers Products specified in this Section that fail in materials or workmanship within specified warranty period.
- 1.13.3. Warranty Period - Materials:
  - 1.13.3.1. Panel performance:
    - (1) 25 years from date of Substantial Performance of the Work.
  - 1.13.3.2. Delamination:
    - (1) lifetime of Products.

### **2 PRODUCTS**

#### **2.1. MANUFACTURERS**

- 2.1.1. Approved Manufacture:
  - 2.1.1.1. "Cladify Cladding Systems" as supplied by Cladify Inc.; 41 Racine Road, Toronto, ON M9W 2Z4; T: (416) 874-7473 ; E: [info@cladify.com](mailto:info@cladify.com); web: [www.cladify.com](http://www.cladify.com)
  - 2.1.1.2. Or Equivalent

## **2.2. REGULATORY REQUIREMENTS**

- 2.2.1. Comply with applicable provisions in the Ontario Building Code, and requirements of authorities having jurisdiction.

## **2.3. DESIGN AND PERFORMANCE REQUIREMENTS**

- 2.3.1. Professional Engineer's Design and Certification: Employ the services of a Professional Engineer licensed to practice in the Province of [Ontario] carrying professional liability insurance, and who is experienced in providing engineering services of similar kind, scope and complexity; to design and certify aluminum composite material wall panel assemblies.
- 2.3.2. Provide panels with following physical characteristics:
- 2.3.2.1. Salt Spray Resistance:
- (1) No deleterious effects after 1000 Hours of exposure in accordance with ASTM B117
- 2.3.2.2. Specific Gravity:
- (1) 0.992 at 23 deg C (73 deg F) when tested in accordance with ASTM C97/C97M (based on limestone testing)
- 2.3.2.3. Water Absorption:
- (1) Not more than 0.4% when tested in accordance with ASTM C97/C97M (based on limestone testing)
- 2.3.2.4. Density of Sandwich Core:
- (1) Not less than 327 kg/m<sup>3</sup> (20.42 lb/ft<sup>3</sup>) for 305 mm x 305 mm x 15 mm (12 inch x 12 inch x 0.6 inch) when tested in accordance with ASTM C271/C271M.
- 2.3.2.5. Laboratory Aging of Sandwich Construction:
- (1) Based on Procedure A per ASTM C481 for six repetitions of following load cycle:
    - (A) Immerse in water at 50 deg C (122 deg F) for 1 hour
    - (B) Spray with steam at 95 deg C (203 deg F) for 3 hours
    - (C) Store at -12 deg C (10 deg F) for 20 hours
    - (D) Heat at 100 deg C (212 deg F) for 3 hours
    - (E) Spray with steam at 95 deg C (203 deg F) for 3 hours
    - (F) Heat in dry air at 100 deg C (212 deg F) for 18 hours
  - (2) Results: ASTM C273; ASTM C297; ASTM C364; ASTM C393 tests were reconducted after aging; variation as follows: +1.1 %, -5.60%; +2.05%; -7.05% (Positive variation indicates no decrease in strength after aging)
- 2.3.2.6. Linear Thermal Expansion:
- (1)  $12.53 \times 10^{-6}$  per deg C when tested from room temperature to 100 deg C in accordance with ISO 10545-8.
- 2.3.2.7. Fluorescent Ultraviolet Radiation Exposure:
- (1) No visible change to facing or adhesive after 2000 hours of UV exposure when tested in accordance with ASTM G154.
- 2.3.2.8. Rapid Freeze-Thaw Cycling Resistance:
- (1) No visible change to facing or adhesive after 200 cycles of rapid freeze and thaw ranging from 4 deg C (39 deg F) to -18 deg C (-0.4 deg F) when tested in accordance with ASTM C666/C666M
- 2.3.2.9. Uniform Static Pressure/Deflection under loading:
- (1) Provide faced honeycomb composite panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
    - (A) Maximum permanent deflection of 0.10 mm at 5.76 kPa (positive) and -5.006 kPa (negative) based on static pressure and uniform static deflection testing.
    - (B) Deflection Limits: Limit deflection under design wind loads to no greater than L/180 of the span.
    - (C) Ensure stress on panel skin does not exceed manufacturer's recommended maximum value to avoid permanent deformation.
- 2.3.2.10. Compressive Strength:

- (1) Not less than 1.57 MPa (228 psi) when tested in accordance with ASTM C170/C170M (based on limestone testing)
- 2.3.2.11. Shear Stress and Shear Modulus:
  - (1) Ultimate Core strength of not less than 1.01 MPa (147 psi) and core shear modulus of not less than 10.9 MPa (1,583 psi) based on testing per ASTM C273/C273M (Compressive force applied until rupture)
- 2.3.2.12. Flatwise Tensile Bond Strength:
  - (1) Not less than 1.52 MPa (220 psi) when tested in accordance with ASTM C297/C297M based on load applied to the top and bottom layers of the panel.
- 2.3.2.13. Edgewise Compressive Strength:
  - (1) Not less than 37.85 MPa (5490 psi) when tested in accordance with ASTM C364/C364M based on compressive load applied at a rate 0.508 mm / min (0.02 in/min)
- 2.3.2.14. Flatwise Tensile Bond Strength:
  - (1) Not less than 1.92 MPa (278 psi) when tested in accordance with ASTM C365 based on compressive load applied at a rate 2 mm / min (0.079 in/min)
- 2.3.2.15. Shear Strength by Beam Flexure:
  - (1) Not less than the following based on testing in accordance with ASTM C393/C393M (loaded in flexure with stone facing side in tension at a cross head speed of 0.635 mm / min (0.025 in/min.):
    - (A) Maximum Core Shear Strength of not less than 0.94 MPa (137 psi)
    - (B) Facing Bending Stress of not less than 8.14 MPa (1180 psi)
- 2.3.2.16. Flexure Creep:
  - (1) Net creep of 0.74 mm per day (0.029 inch per day) based on testing in accordance with ASTM C480/C480M (based on midspan loading with stone-facing side in tension at a cross head speed of 0.635 mm / min (0.025 in/min.))
- 2.3.2.17. Flexural Strength (composite panel):
  - (1) not less than 18.13 MPa (2630 psi) based on testing per ASTM C880/C880M.
- 2.3.2.18. Tensile Properties of adhesive bond:
  - (1) No Failure of adhesive bond based on testing per ASTM C897
- 2.3.2.19. Screw withdrawal test:
  - (1) Not less than 2.124 kN (477.5 lbs-f) when tested at a rate of 2.5 mm/min (0.098 in / min) in accordance with ASTM D1761
- 2.3.2.20. Damage resistance testing of sandwich constructions:
  - (1) No panel deformation in accordance with ASTM D7766/D7766M based on loading applied at midpoint of panel using 13 mm (1/2 inch) diameter hemispherical steel indenter at a rate of 0.254 mm / min (0.01 in/min) until a drop-in load was observed.
- 2.3.2.21. Cyclic Pressure Loading:
  - (1) Pass per ASTM E1886. Not less than 3,500 positive and negative pressure cycles applied at a pressure of  $\pm 2880$  Pa (60 psf)
- 2.3.2.22. Air Infiltration:
  - (1) Air leakage (infiltration and exfiltration) of not more than 0.01 L/s per sq. m (0.002 cfm/sq. ft.) when tested according to ASTM E283 at test-pressure difference of 75 Pa (1.57 lbs/sq.ft)
- 2.3.2.23. Water Penetration under Static Pressure:
  - (1) No water penetration when tested according to ASTM E331 at 720 Pa (15 lbf/sq. ft)
- 2.3.2.24. Windborne-Debris Impact Resistance:
  - (1) Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 in accordance with the following:
    - (A) Large-Missile Test:
      - (a) Pass; a weighted 2x4 projectile fired at the panel at 15.24 m/s (50 ft/s).

- 2.3.2.25. Thermal Movements:
  - (1) Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 2.3.3. Fire Performance:
  - 2.3.3.1. System Fire Propagation Characteristics: pass per CAN/ULC-S134;
  - 2.3.3.2. Non-combustibility: pass per CAN/ULC S114;
  - 2.3.3.3. Panel Fire Performance:
    - (1) Flame spread less than 25 and smoke developed less than 40, in accordance with CAN/ULC S102.
- 2.3.4. Rain Screen Principle:
  - 2.3.4.1. Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.
  - 2.3.4.2. Design for compartments at corners to achieve appropriate pressure equalization in exterior cladding system.
  - 2.3.4.3. Provide gaskets, baffles, overlaps, seals where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain integrity of continuous air/vapour barrier system with adjacent surrounding air/vapour barrier.
  - 2.3.4.4. Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

## **2.4. MATERIALS**

- 2.4.1. Aluminum alloy and temper for type and use, and with strength and durability properties for each application, and in accordance with following standards:
  - 2.4.1.1. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
  - 2.4.1.2. Extruded Bars and Shapes: ASTM B 221, alloy 6063-T6.

## **2.5. COMPOSITE PANEL**

- 2.5.1. Provide minimum 13 mm (1/2 inch) thick honeycomb-backed composite panel consisting of honeycomb core and aluminum facing as follows:
  - 2.5.1.1. Honeycomb core: Not less than 12 mm (1/2 inch), aerospace-grade lightweight aluminum honeycomb core with 6000 series aluminum with following characteristics:
    - (1) Typical Cell Size: 10 mm (3/8 inch)
    - (2) Density: Manufacturer's standard as required for application.
    - (3) Foil: 0.6 mm (0.024 inch)
    - (4) Core Type: Type B - Non-combustible welded core
    - (5) Top and bottom sheet: Not less than 0.8 mm thick.
    - (6) Adhesive system: Manufacturer's recommended epoxy resin adhesive system with following performance characteristics specified in this Section.
  - 2.5.1.2. Aluminum Facing Thickness: Not less than 1 mm (3/64 inch)
  - 2.5.1.3. Finish:
    - (1) High-Performance Organic fluoropolymer thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - (2) System:
      - (A) Three coat.
    - (3) Color and Gloss:
      - (A) As selected from manufacturer's full range.

## **2.6. SUBFRAMING**

- 2.6.1. Provide manufacturer's standard interlocking sections manufactured from ASTM B221, extruded aluminum alloy 6063 T3 and as required for support and alignment of faced honeycomb composite panel system.
  - 2.6.1.1. Minimum wall thickness of sections: 2.4 mm (0.094 inch)
  - 2.6.1.2. Air space: Not less than 25 mm (1 inch)
  - 2.6.1.3. Basis-of-Design: "CL Interlocking Channel/CL Anchor plate system" by Cladify.
- 2.6.2. Thermally-Broken Sub-framing:
  - 2.6.2.1. Provide low-conductivity thermally-broken, intermittent structural attachment insulation clips designed maintain insulation effectiveness, with adjustable depth and suitable for vertical and horizontal sub-girts.

## **2.7. PANEL ACCESSORIES**

- 2.7.1. Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.
- 2.7.2. Panel Fasteners:
  - 2.7.2.1. Manufacturer's recommended fasteners and screws designed to withstand design loads. Where exposed fasteners are unavoidable, Provide with heads matching colour of panels.
- 2.7.3. Sealants:
  - 2.7.3.1. ASTM C920; elastomeric silicone sealant of type, grade, class, and use classifications required to seal joints, and as recommended in writing by panel manufacturer.

## **2.8. FABRICATION**

- 2.8.1. Provide factory-formed and -assembled, honeycomb wall panels fabricated from lightweight (aircraft quality) aluminum honeycomb bonded having epoxy impregnated aluminum panel skins. Provide panels formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
- 2.8.2. Fabricate and finish faced honeycomb composite panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- 2.8.3. Join intersecting parts together to achieve tight, accurately fitted joints with adjoining surfaces in true planes.
- 2.8.4. Fabricate system to conform to requirements of reference standards specified.
- 2.8.5. Co-operate with applicable sections to ensure all co-ordination required for proper installation of work of this section in conjunction with and incorporated with other work.
- 2.8.6. Lay out panels to obtain uniform metal and paint grain finish. Mark direction of metal grain and paint application on back of panels.
- 2.8.7. Fabrication Tolerances:
  - 2.8.7.1. Plumb:
    - (1) 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
  - 2.8.7.2. Level:
    - (1) 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
  - 2.8.7.3. Alignment:
    - (1) Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").
    - (2) Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2 to 1") wide, limit offset from true alignment to 3.2 mm (1/8").
    - (3) Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").
  - 2.8.7.4. Variation from plane:

- (1) 3.2 mm in 3.6 m (1/8" in 12'-0"); 12.7 mm (1/2") over total length.
- 2.8.7.5. Panels:
  - (1) Bow: 0.2% of panel dimensions up to 3.2 mm (1/8") maximum.
  - (2) Indicated size:
    - (G) Up to 1220 mm (4'-0"): plus/minus 0.76 mm (0.030").
    - (H) 1220 mm to 3050 mm (4'-0" to 10'-0"): plus/minus 1.52 mm (0.060").
- 2.8.7.6. Square or rectangular:
  - (1) Maximum 3.2 mm (1/8") difference between diagonal measurements.
- 2.8.7.7. Variation from indicated position: plus/minus 3 mm (1/8").
- 2.8.8. Tolerances shall not be cumulative.

## **2.9. FINISHES**

- 2.9.1. Carry out surface finishing uniformly to edges of the cladding panel. Where surface finishing of panels involves use of patching, fillers or similar products for natural holes, faults or cracks, it shall be considered as part of normal finish process.
- 2.9.2. Surfaces must have a regular appearance as function of finishing process and worked to meet specified finish on exposed surfaces.

## **3 EXECUTION**

### **3.1. MANUFACTURER'S INSTRUCTIONS**

- 3.1.1. Compliance:
  - 3.1.1.1. comply with manufacturer's latest written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2. EXAMINATION**

- 3.2.1. Take *Site* measurements to ensure that work of this Section is fabricated to fit structure; surrounding construction; around obstructions and projections in place, or as shown on the Drawings; and to suit locations of services.
- 3.2.2. Examine substrates, areas, and conditions, with Subcontractor present, for compliance with requirements required for installation tolerances, supports, and other conditions affecting performance of the Work.
  - 3.2.2.1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by faced honeycomb composite panel manufacturer.
  - 3.2.2.2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by faced honeycomb composite panel manufacturer.
  - 3.2.2.3. Verify that air-barriers/vapour-retarders have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- 3.2.3. Examine roughing-in for components and assemblies penetrating faced honeycomb composite panels to verify actual locations of penetrations relative to seam locations of faced honeycomb composite panels before installation.
- 3.2.4. Notify the Consultant in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

### **3.3. PREPARATION**

- 3.3.1. Miscellaneous Supports:
  - 3.3.1.1. Install subframing, furring, thermally-broken subframing and other miscellaneous panel support members and anchorages according to ASTM C754 and faced honeycomb composite panel manufacturer's written recommendations.

### **3.4. AIR BARRIER MEMBRANE APPLICATION**

- 3.4.1. Install in accordance with manufacturer's installation instructions.
- 3.4.2. Surfaces must be smooth, clean dry and free from loose contaminants. Brushing and/or scraping of block and concrete surfaces may be required to adequately prepare surface.
- 3.4.3. Apply primer for membrane work.

- 3.4.4. Wrap openings with membrane returning to inside face of openings.
- 3.4.5. Ensure air barrier seals into adjacent systems for complete air barrier to building envelope.

### **3.5. INSULATION**

- 3.5.1. Carefully cut and fit insulation in pieces to fit surfaces of members to which insulation bears contact.
- 3.5.2. Cut backs of pieces as required to fit over projecting anchors, fastenings or similar protrusions. Fit boards neatly with tight joints around pipes, ducts, obstructions, openings, corners, and structural members.
- 3.5.3. Apply insulation to ensure total and complete coverage of surfaces indicated to be insulated, and in direct contact with such surfaces.
- 3.5.4. Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

### **3.6. PANEL INSTALLATION**

- 3.6.1. Install faced honeycomb composite panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor faced honeycomb composite panels and other components of the Work securely in place, with provisions for thermal and structural movement.
- 3.6.2. Erect systems complete with flashings forming part of the system, clips, fasteners, closures and caulking to meet same design criteria as specified for fabrication.
- 3.6.3. Erect panels in straight lines that are true, level, square, and plumb.
- 3.6.4. Attachment system: Allow for free and noiseless vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -28.9°C to 82.2 °C (-20 °F to 180 °F). Buckling of panels, opening of joints, undue stress on fasteners, failure to sealants or any other detrimental effects due to thermal movement is not permitted. Allow for ambient temperature at time of fabrication, assembly and erection procedures.
- 3.6.5. Anchor cladding securely as per recommendations of Professional Engineer and in accordance with reviewed shop drawings to allow for necessary thermal movement, wind loading and structural support.
- 3.6.6. Seal between work of this section and work of other sections to meet specified requirements of Section 07 92 00 and to achieve a watertight installation.
- 3.6.7. Cut, flash, and apply sealant to system penetrations. Seal around materials penetrating metal cladding watertight.
- 3.6.8. Install various components within cladding assembly to Provide positive controlled drainage of moisture to exterior of building envelope or drainage outlet.
- 3.6.9. Conceal fasteners.
- 3.6.10. Do not install component parts that are observed to be defective, including warped, bowed, dented, and broken members.
- 3.6.11. Obtain panel symmetry whenever possible relative to openings in both vertical and horizontal plane.
- 3.6.12. Brake form metal flashings to profile required, in maximum lengths.
- 3.6.13. Install head and sill flashings, edge trim, cap pieces and other formed profiles as applicable and/or detailed.
- 3.6.14. Do not cut, trim, weld or braze component parts during erection in manner that would damage finish, decrease strength or result in a visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- 3.6.15. Separate dissimilar metals and use gasketed fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.
- 3.6.16. Protect surface of metals in contact with concrete, mortar, plaster or other cementitious surface with isolation coating.
- 3.6.17. Metal Protection:



- 3.6.17.1. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal-faced honeycomb material panel manufacturer.
- 3.6.18. Install attachment assembly required to support faced honeycomb composite panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels. Do not apply sealants to panel joints unless otherwise indicated.
  - 3.6.18.1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
  - 3.6.18.2. Install support assembly at locations, spacings, and with fasteners recommended by fabricator. Use Fabricator's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, and draining to the exterior.
- 3.6.19. Accessory Installation:
  - 3.6.19.1. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- 3.6.20. Expansion Provisions:
  - 3.6.20.1. Provide for thermal expansion of exposed flashing and trim.

### **3.7. INSTALLATION TOLERANCES**

- 3.7.1. Comply with the following maximum tolerances:
  - 3.7.1.1. Plumb:
    - (1) 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
  - 3.7.1.2. Level:
    - (1) 3.2 mm in 3 m (1/8" in 10'-0"); 6.4 mm in 12.2 m (1/4" in 40'-0").
  - 3.7.1.3. Alignment:
    - (1) Where surfaces abut in line or are separated by reveal or protruding element up to 12.7 mm (1/2") wide, limit offset from true alignment to 1.6 mm (1/16").
    - (2) Where surfaces are separated by reveal or protruding element from 12.7 to 25.4 mm (1/2 to 1") wide, limit offset from true alignment to 3.2 mm (1/8").
    - (3) Where surfaces are separated by reveal or protruding element of 25.4 mm (1") wide or more, limit offset from true alignment to 6.4 mm (1/4").
  - 3.7.1.4. Variation from plane:
    - (1) 3.2 mm in 3.6 m (1/8" in 12'-0"); 12.7 mm (1/2") over total length.
  - 3.7.1.5. Panels:
    - (1) Bow: 0.2% of panel dimensions up to 3.2 mm (1/8") maximum.
    - (2) Indicated size:
      - (I) Up to 1220 mm (4'-0"): plus/minus 0.76 mm (0.030").
      - (J) 1220 mm to 3050 mm (4'-0" to 10'-0"): plus/minus 1.52 mm (0.060").
  - 3.7.1.6. Square or rectangular:
    - (1) Maximum 3.2 mm (1/8") difference between diagonal measurements.
  - 3.7.1.7. Variation from indicated position: plus/minus 3 mm (1/8").
    - (1) Tolerances shall not be cumulative.

### **3.8. FIELD QUALITY CONTROL**

- 3.8.1. Conduct quality control in accordance with Section 01 45 00.
- 3.8.2. Inspection and testing company shall perform inspection for completed *Work*.

### **3.9. ADJUSTING AND CLEANING**

- 3.9.1. Remove temporary protective coverings and strippable films, if any, as faced honeycomb composite panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of faced honeycomb composite panel installation, clean finished surfaces as recommended by faced honeycomb composite panel manufacturer. Maintain in a clean condition during construction.
- 3.9.2. After faced honeycomb composite panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

- 3.9.3. Replace faced honeycomb composite panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**3.10. PROTECTION**

- 3.10.1. Protect finished work in accordance with Product Requirements specified in Division 01.
- 3.10.2. Do not permit adjacent work to damage work of this Section.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL CONDITIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.
- 1.1.2. All conditions of Contract and Divisions 0 and 1 apply to this section and to requirements of Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.
- 1.1.3. Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect work including all amendments up to project date.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Conditions
- .2 1.2. Section Includes
- .3 1.3. Section Summary
- .4 1.4. Administrative & Co-Ordination Requirements
- .5 1.5. Standards
- .6 1.6. Submittals
- .7 1.7. Closeout Submittals
- .8 1.8. System Description
- .9 1.9. Qualifications
- .10 1.10. Quality Control
- .11 1.11. Pre-Start Meeting
- .12 1.12. Delivery, Storage & Handling
- .13 1.13. Field Conditions
- .14 1.14. Warranty
- .15 2.1. Roofing System Manufacturer
- .16 2.2. Performance/Design Requirements – General
- .17 2.3. Performance/Design Requirements – Fire Protection
- .18 2.4. Roofing Materials
- .19 2.5. Accessories
- .20 2.6. Expansion Joints
- .21 3.1. Examination
- .22 3.2. Preparation
- .23 3.3. Method Of Installation
- .24 3.4. Gypsum Boards
- .25 3.5. Vapour Retarder
- .26 3.6. Insulation (Bottom Layers)
- .27 3.7. Tapered Insulation
- .28 3.8. Insulation (Top Layer)
- .29 3.9. Membrane Application – Base Sheet
- .30 3.10. Membrane Application – Cap Sheet
- .31 3.11. Asphalt Application
- .32 3.12. Night Seal
- .33 3.13. Membrane Flashings
- .34 3.14. Scuppers/Mechanical Condensate Pipe/Roof Access
- .35 3.15. Field Quality Control
- .36 3.16. Adjusting And Cleaning
- .37 3.17. Finish

### **1.3. SECTION SUMMARY**

- 1.3.1. Section Includes

- 1.3.1.1. Two-ply styrene-butadiene-styrene (SBS) modified bituminous membrane roofing; as follows:
  - .1 Exposed membrane roofing system.
- 1.3.1.2. Roofing insulation.
- 1.3.1.3. Air and vapour barrier.
- 1.3.1.4. Associated roofing accessories and products.

#### **1.4. ADMINISTRATIVE & CO-ORDINATION REQUIREMENTS**

- 1.4.1. Co-ordinate work of this Section with work of:
  - 1.4.1.1. Section 07 05 13 Common Work Results for Roofing.
  - 1.4.1.2. Section 06 10 00 Rough Carpentry.
  - 1.4.1.3. Section 07 62 00 Sheet Metal Flashing and Trim.
  - 1.4.1.4. Section 07 92 00 Joint Sealants.
  - 1.4.1.5. Section 26 31 00 Solar Photovoltaics.
- 1.4.2. Coordinate with installation of air barrier at walls to ensure complete continuity of air barrier system for building. Roofing air barrier membrane to lap by 75 mm (3") minimum and terminate with wall system air barrier membrane.
- 1.4.3. The manufacturer shall meet with the necessary parties at the *Site* to review and discuss project conditions as it relates to the integrity of the roofing assembly.

#### **1.5. STANDARDS**

- 1.5.1. CAN/CSA O80 SERIES-08 – Wood Preservation.
- 1.5.2. CAN/CGSB 19.13-M87: Single Compound, One-Component, Elastomeric, Chemical Curing.
- 1.5.3. CSA A123.23: Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- 1.5.4. CGSB 37-GP-9MA: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- 1.5.5. CGSB 37-GP-64M: Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-up Roofing.
- 1.5.6. ASTM C165-12: Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
- 1.5.7. ASTM D6164/D6164M-11: Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- 1.5.8. ASTM A653/A653M-10: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- 1.5.9. ASTM E84-12: Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.5.10. UL 790: Standard Test Methods for Fire Tests of Roof Coverings
- 1.5.11. UL 1256: Fire Test of Roof Deck Constructions.

#### **1.6. SUBMITTALS**

- 1.6.1. Submit required submittals in accordance with Section 01 33 00.
- 1.6.2. Product data sheets:
  - 1.6.2.1. Submit manufacturer's *Product* data sheets for each type of product indicated.
- 1.6.3. Shop drawings; general details:
  - 1.6.3.1. Include plans, elevations, sections, details, and attachments to other work for the following:
    - .1 Base flashings, cants, and membrane terminations.
    - .2 Tapered insulation, including slopes.
    - .3 Crickets, saddles, and tapered edge strips, including slopes.
    - .4 Insulation fastening patterns.
- 1.6.4. Certificates:

- 1.6.4.1. Installer certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- 1.6.4.2. Manufacturer certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in Subsection 2.2 "Performance Requirements" below.
  - .1 Submit evidence of compliance with performance requirements.
- 1.6.5. Roofing manufacturer's warranty and design criteria:
  - 1.6.5.1. Submit copy of completed roofing manufacturer's pre-installation notification form at least 10 Working Days prior to commencement of roofing installation.
  - 1.6.5.2. Submit copy of roofing manufacturer's warranty specimen and warranty design criteria for roofing system prior to commencement of roofing installation.
- 1.6.6. Samples:
  - 1.6.6.1. Submit samples complete with manufacturer's labels intact, of materials to be used for work of this Section prior to commencement of work. Allowing ample time for review and acceptance by the *Consultant* and roofing inspection company. Do not proceed with work until samples are accepted.

#### **1.7. CLOSEOUT SUBMITTALS**

- 1.7.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.7.2. Operation and maintenance data:
  - 1.7.2.1. Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

#### **1.8. SYSTEM DESCRIPTION**

- 1.8.1. 2-Ply Modified Bituminous Roof Areas
  - 1.8.1.1. Modified Bituminous Conventional Roofing System: 1-ply granulated modified bitumen membrane (white cap sheet) torched in place, 1-ply modified bitumen membrane (base sheet) torched in place over stone wool insulation in adhesive, over min. 2% tapered insulation in adhesive, over polyisocyanurate insulation in adhesive over self-adhering vapour retarder adhered over gypsum boards mechanically fastened in place over the metal deck. Membrane flashing to be 2-ply modified bitumen membranes, 1-ply modified bitumen membrane (base sheet) self-adhered in place and 1-ply granulated modified bitumen membrane (white cap sheet) torched in place.

#### **1.9. QUALIFICATIONS**

- 1.9.1. Qualifications:
  - 1.9.1.1. Manufacturers: Company specializing in manufacturing the Products specified in this section, with a minimum of 10 years' experience.
  - 1.9.1.2. Installers / applicators / erectors: Provide work of this section, executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers.
    - .1 Work of this Section shall be installed by a *Subcontractor* that is a member in good standing of the Canadian Roofing Contractors Association (CRCA) and Ontario Industrial Roofing Contractors Association (OIRCA), who has been a member for at least 5 years.
    - .2 Roofing *Subcontractor* must be approved by the membrane manufacturer for the warranty program specified. Submit *Subcontractor's* certification letter prepared by the membrane manufacturer.
- 1.9.2. Execute work of this Section only under full time supervision of qualified *Subcontractor's* site supervisor.
- 1.9.3. Mock-up:

- 1.9.3.1. Prepare a 10 m<sup>2</sup> (100 ft<sup>2</sup>) mock-up of the work of this Section. Incorporate materials and methods of fabrication and installation identical with project requirements.
- 1.9.3.2. Install mock-up at roof area location directed by the Consultant. Retain accepted mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and workmanship.

#### **1.10. QUALITY CONTROL**

- 1.10.1. Quality controls are listed in the GENERAL CONDITIONS under section 01 45 00 QUALITY CONTROL – GOOD ROOFING PRACTICES

#### **1.11. PRE-START MEETING**

- 1.11.1. A pre-start meeting is to be scheduled one week prior to any work commencing. The roofing contractor, the consultant, the on-site contact and/or owner's representative should be present. The following items will be discussed at the pre-start meeting:
  - 1.11.1.1. Methods and procedures relating to the roof assembly installation
  - 1.11.1.2. On-site procedures
  - 1.11.1.3. On-site material storage
  - 1.11.1.4. The construction schedules

#### **1.12. DELIVERY, STORAGE & HANDLING**

- 1.12.1. Deliver roofing materials to the *Site* in original containers with seals unbroken and labelled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- 1.12.2. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- 1.12.3. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- 1.12.4. Handle materials carefully to preclude damage. Follow manufacturer's written recommendations.
- 1.12.5. Package materials and identify on attached labels the manufacturer, brand, contents, weight as applicable, and Product and specification numbers.
- 1.12.6. Protect edges of roll goods from damage during handling, and store rolls on end to prevent flattening.
- 1.12.7. Do not store roofing materials on roof. Store them in a dry area protected from inclement weather while roofing installation is not in progress. Store above materials under opaque, breathable and waterproof tarpaulins or in sheds.
- 1.12.8. Prevent compression of insulation panels at any point and breakage of edges and corners. Discard wet, cupped, bowed, or otherwise damaged insulation from *Place of the Work*.
- 1.12.9. Protect edges and corners of precast concrete paving slabs to prevent damage.

#### **1.13. FIELD CONDITIONS**

- 1.13.1. Weather limitations:
  - 1.13.1.1. Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

#### **1.14. WARRANTY**

- 1.14.1. *Provide* Ontario Industrial Roofing Contractors Association (OIRCA) 2 year warranty for labour, materials, and workmanship.
- 1.14.2. Warranty work of this section in accordance with Section 01 78 36 for a period of 2 years.

- 1.14.3. In addition, roofing manufacturer shall *Provide* total system warranty including the following:
  - 1.14.3.1. Roofing membrane manufacturer will issue a written document in the *Owner's* name, valid for duration listed below, for the repair of leaks in the roofing membrane to restore the roofing system to dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. Include copy of required warranty with close out documentation.
  - 1.14.3.2. Warranty shall cover entire cost of the repair(s) required to maintain dry and watertight roofing system during the full warranty duration.
  - 1.14.3.3. Warranty shall include for labour, materials, and workmanship.
  - 1.14.3.4. Warranty shall be non-prorated with no dollar limit (NDL) for duration of warranty.
  - 1.14.3.5. 10-year warranty duration

## **2 PRODUCTS**

### **2.1. ROOFING SYSTEM MANUFACTURER**

- 2.1.1. General:
  - 2.1.1.1. Single source responsibility: each roofing component to be by one manufacturer.
- 2.1.2. Acceptable roof system manufacturers: Subject to compliance with requirements, *Provide* products by one of the following:
  - 2.1.2.1. Firestone Building Products.
  - 2.1.2.2. GAF Materials Corporation.
  - 2.1.2.3. IKO Industries.
  - 2.1.2.4. Siplast.
  - 2.1.2.5. Soprema.
  - 2.1.2.6. Or equivalent.

### **2.2. PERFORMANCE/DESIGN REQUIREMENTS – GENERAL**

- 2.2.1. Roofing system: The roofing system shall include roofing system materials required to achieve roofing membrane manufacturer's warranty.
- 2.2.2. Roofing materials, components, and assemblies shall resist environmental and wind (uplift) loads, and effects of those loads in accordance with the Ontario Building Code.
- 2.2.3. General performance: Installed roofing system and base flashings shall withstand wind uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and base flashings shall remain watertight.
- 2.2.4. Material compatibility: *Provide* roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- 2.2.5. Roofing system: Prevent water from entering building and roofing assembly through roofing membrane.
- 2.2.6. Roofing system design:
  - 2.2.6.1. Roofing system assemblies shall have been successfully tested by a qualified testing agency to resist project roofing uplift pressures in accordance with the Ontario Building Code.
  - 2.2.6.2. Roofing system shall meet roofing system manufacturer's 145 kph (90 mph) wind speed requirements or equivalent FM Class 60 Windstorm Classification for wind uplift pressures, and to cladding design wind loads indicated in wind study report, as applicable.
- 2.2.7. Roof covering classification: Roof assembly shall have a Class C classification as determined in conformance with CAN/ULC S107-10 "Standard Methods of Fire Tests of Roof Coverings".

- 2.2.8. Air barrier system shall accommodate substrate movement, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding the following specified limits and requirements:
  - 2.2.8.1. Air permeance of air barrier material: Maximum 0.02 L/s m<sup>2</sup> at 75 Pa (0.004 cfm/ft<sup>2</sup> at 1.57 psf) to ASTM E2178-13.
  - 2.2.8.2. Rate of air leakage of air barrier system: Maximum 0.15 L/s m<sup>2</sup> at 75 Pa (0.030 cfm/ft<sup>2</sup> at 1.57 psf) to ASTM E283-04 (2012).
  - 2.2.8.3. Water vapour transmission for air / vapour barriers: Maximum 5.7 ng/Pa.m<sup>2</sup>.s. (0.1 perms).
  - 2.2.8.4. Pull-off strength of liquid or sheet applied membrane and laps: Cohesive or substrate failure permitted when tested to specified wind load. Air barrier system shall transfer wind load to structure and shall resist 100% of design wind load or minimum of 2.15 kPa (45 psf), whichever is greater.
  - 2.2.8.5. Low temperature flexibility: to -30°C (-22°F) to CGSB 37-GP-56M-1985.
- 2.2.9. Air barrier system shall be joined in an airtight and flexible manner to air barrier material of adjacent building envelope air barrier systems, allowing for relative movement of systems due to thermal and moisture variations and creep. Connection shall be made between the following unless otherwise applicable:
  - 2.2.9.1. Walls and openings.
  - 2.2.9.2. Across construction, control, and expansion joints.
  - 2.2.9.3. Penetrations.
- 2.2.10. Solar Reflectance: roof Cap Sheet shall have a minimum SRI of 90.

## **2.3. PERFORMANCE/DESIGN REQUIREMENTS – FIRE PROTECTION**

- 2.3.1. At the end of each *Working Day*, use a heat detector gun or equipment as recommended by membrane manufacturer to spot smouldering or concealed fire. Schedule the Work to ensure workers are still on location at least 2 hours after torch application.
- 2.3.2. Never apply the torch directly to any wood surfaces. Conform with fire safety recommendations of the manufacturer and the CRCA.
- 2.3.3. Throughout roofing installation, maintain the Place of the Work in a clean condition and have one approved ABC fire extinguisher within 6 m of each roofing torch. Torches must never be placed near combustible or flammable Products.

## **2.4. ROOFING MATERIALS**

- 2.4.1. Roofing Membrane and Flashing Sheets
  - 2.4.1.1. Roof Membrane (Modified Bitumen – Cap Sheet):
    - .1 Modified bituminous membranes, white granulated top and thermofusible bottom surfaces, 250gm/sq.m., non-woven polyester composite reinforced, conforming to CGSB 37.56-M and ASTM D-6162
    - .2 Thickness: 4mm
  - 2.4.1.2. Roof Membrane (Modified Bitumen – Base Sheet):
    - .1 Modified Bituminous membranes, thermo-fusible top & bottom surfaces, 180gm/sq.m., non-woven polyester reinforced, conforming to CAN/CGSB-37.56.
    - .2 Thickness: 3mm
  - 2.4.1.3. Flashing Membrane (Modified Bitumen – Cap Sheet):
    - .1 Modified bituminous membranes, white granulated top and thermofusible bottom surfaces, 250gm/sq.m., non-woven polyester reinforced, conforming to CGSB 37.56-M and ASTM D-6162
  - 2.4.1.4. Flashing Membrane (Modified Bitumen – Base Sheet):
    - .1 Modified Bituminous membranes, thermo-fusible top & self-adhering bottom surfaces, 180gm/sq.m., non-woven polyester reinforced, conforming to CAN/CGSB-37.56.
  - 2.4.1.5. Auxiliary Roofing Membrane Materials



- .1 General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.
  - .2 Mastic sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skinning, and non-drying.
  - .3 Metal flashing sheet: Metal flashing sheet is specified in Section 07 62 00.
  - .4 Miscellaneous accessories: Provide miscellaneous accessories recommended by roofing manufacturer.
  - .5 Aggregate surfacing: gravel with no foreign material, ASTM D1863/D1863M- 05(2011) e1, water washed, dry, free of dirt and dust, hard, dry, clean, and graded in sizes from 9 mm to 12 mm.
- 2.4.2. Roof Insulation
- 2.4.2.1. General:
- .1 Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- 2.4.2.2. Insulation (Top Layer):
- .1 High density, bitumen-coated stone wool insulation board conforming to ASTM C726
    - (A) Basis of design: Rock Wool TopRock DD Plus
- 2.4.2.3. Tapered Insulation:
- .1 Fully tapered polyisocyanurate insulation to provide a slope of as noted in the Contract Documents per design.
  - .2 Crickets are to be used at all openings and/or mechanical curbs. Flat areas around the drains are not to exceed 50ft<sup>2</sup>. Meeting and exceeding the requirements of CAN/CSA-A247-M86 and CAN/ULC-S706.
- 2.4.2.4. Insulation (Bottom Layer):
- .1 Polyisocyanurate insulation
  - .2 Type: closed cell polyisocyanurate foam roof board insulation with inorganic coated glass facer, meeting the requirements of CAN/ULC S704, Type 2 Class 3 materials and ASTM C1289, Type II, Class 2, Grade 2.
  - .3 Board size:
    - (A) 1220 mm x 1220 mm (4 ft x 4 ft).
- 2.4.2.5. Insulation Sump:
- .1 Polyisocyanurate, pre-manufactured, one-piece drain sump. Meeting the requirements of CAN/ULC S704.
  - .2 Drain sumps to be 2440mm x 2440mm (8'x8')
- 2.4.3. Vapour Retarder:
- 2.4.3.1. Self-adhesive bottom side, and tri-laminated woven polyethylene facer & SBS modified bitumen. Underside covered with silicone release film.
- 2.4.4. Primer (Vapour Retarder):
- 2.4.4.1. As recommended by material manufacturer.
- 2.4.5. Gypsum Fasteners:
- 2.4.5.1. Corrosion resistant plates and fasteners as required and approved by the insulation manufacturer.
- 2.4.6. Substrate Boards
- 2.4.6.1. Coverboards
- .1 Cellulose fibreboard:
    - (A) Asphalt treated and coated fiberboard to CAN/ULC S706-02,
  - .2 Thickness: 12.7 mm (1/2").
- 2.4.6.2. Gypsum Boards:
- .1 ASTM C1177/C1177M-08, glass-mat, water-resistant gypsum substrate, factory primed.
  - .2 Thickness:
    - (A) 12.7 mm (1/2").

- .3 Acceptable Products:
  - (A) .5" Gypsum board 4'x8'. DensDeck Prime/EONIC by Georgia Pacific or approved alternate
- 2.4.7. Self-Adhering Membrane (Perimeter Parapets):
  - 2.4.7.1. Self-adhering, self-sealing, composite membrane consisting of a high softening point with SBS rubberized asphalt compound.
- 2.4.8. Self-Adhering Membrane Adhesive (Perimeter Parapets):
  - 2.4.8.1. Rubber based adhesive for self adhering membranes.
- 2.4.9. Asphalt Materials
  - 2.4.9.1. Asphalt primer: CGSB 37-GP-9Ma-1983.
  - 2.4.9.2. Roofing asphalt: CAN/CSA A123.4-04, Type 2 or Type 3.

## 2.5. ACCESSORIES

- 2.5.1. General:
  - 2.5.1.1. Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with roofing assembly.
- 2.5.2. Fasteners:
  - 2.5.2.1. Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.
- 2.5.3. Insulation adhesive:
  - 2.5.3.1. Modified asphaltic insulation adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- 2.5.4. Wood Blocking, Plywood Sheathing:
  - 2.5.4.1. Construction grade; free from warping and visible decay; pressure-treated spruce, to CAN/CSA O80 SERIES-08.
- 2.5.5. Cant Strip:
  - 2.5.5.1. Insulation cant strips; perlite: ASTM C728-13, perlite insulation board, cut to *Provide* 45 degree transition from horizontal to vertical surfaces
  - 2.5.5.2. Cant Strip Adhesive:
    - .1 solvent free, fastener free, insulation attachment; Fas-n-Free Adhesive by Tremco or approved alternate
- 2.5.6. Metal Flashing:
  - 2.5.6.1. 26 gauge pre-painted galvanized; Series 8000 baked enamel finish; colour to match be confirmed by the Owner, to ASTM A653/A653M-10. 24-gauge metal for all cleats and hook strips.
- 2.5.7. Pitch Pan:
  - 2.5.7.1. Pre-manufactured type; 16 oz. copper, fully soldered, minimum 152.4 mm (6") high above finished roof level, complete with copper caps and sealant.
- 2.5.8. Pitch Pan Sealant:
  - 2.5.8.1. M-1 Structural sealant and 1-part pourable sealer by ChemLink or Joint & Termination Sealant #9600 and Semi-Self Leveling Sealer #4500 by Lucas or approved alternate.
- 2.5.9. Sealant:
  - 2.5.9.1. single component; moisture cure; polyurethane sealant conforming to ASTM-C920.
- 2.5.10. Fasteners:
  - 2.5.10.1. 25 mm square or round head, ring shanked galvanized or non-ferrous type, length as required to suit application.
- 2.5.11. Drains:
  - 2.5.11.1. boxed copper retro drain with flange, with dome and seals by Platinum Technologies Inc.
- 2.5.12. Control Flow Mechanism:

- 2.5.12.1. By Platinum Technologies Inc.
- 2.5.13. Vent Stack:
  - 2.5.13.1. insulated aluminum vent stack with factory applied polyurethane foam insulation and vent stack cap. By Platinum Technologies Inc.
- 2.5.14. Tall Cones:
  - 2.5.14.1. all sizes (1.5" – 12"): By Platinum Technologies Inc.
- 2.5.15. Gooseneck Flashing: 30" Stainless Steel Gooseneck 1.9" I.D. and Spun Aluminum Base
- 2.5.16. Termination Bar:
  - 2.5.16.1. 10' Alum Term Bar – Item NO. – Term-10 (#90354) By Platinum Technologies Inc.
- 2.5.17. Gas Line Supports:
  - 2.5.17.1. Plastic gas line support with prefabricated insulation cushion.
- 2.5.18. Foam Gasket:
  - 2.5.18.1. EMSEAL MST Multi-Use Sealant Tape or EMSEAL UST Sealant Tape.
- 2.5.19. NOTE: The contractor must supply all primers, mastics, and membranes from a single source Manufacturer. No alternates will be accepted without written approval from the Consultant.

## 2.6. EXPANSION JOINTS

- 2.6.1. Description:
  - 2.6.1.1. Manufactured from a proprietary copolymer with internal polyester reinforcement, monolithic seam vulcanization.
  - 2.6.1.2. Movement and fabrication: Tri-directional movement capability, joint waterproofing system shall be factory fabricated in one piece for the entire contiguous expansion joint or where length of joint exceeds manufacturer's shipping and handling guidelines shall be lapped and vulcanized by manufacturer's mechanics on site, repair of damaged materials shall be performed by manufacturer's mechanics.
  - 2.6.1.3. Compatible with adhesives and membranes associated with expansion joint construction in accordance with manufacturer's installation instructions.
  - 2.6.1.4. Warranted by manufacturer to cover full warranty duration specified in this Section.
  - 2.6.1.5. Hydrostatic pressure limit: Working pressure in column of water shall perform under static limit not to exceed 10 m (33 ft).
- 2.6.2. Acceptable Products; to suit type of roofing assembly and movement design requirements:
  - 2.6.2.1. Situra Inc. 'RedLINE'.
  - 2.6.2.2. Situra Inc. 'FlamLINE'.
  - 2.6.2.3. Or equivalent.

## 3 EXECUTION

### 3.1. EXAMINATION

- 3.1.1. Examine substrates, areas, and conditions, with roofing installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 3.1.1.1. Verify that roof openings and penetrations are in place and curbs are set and braced.
  - 3.1.1.2. Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3.1.1.3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 23.
  - 3.1.1.4. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2. PREPARATION**

- 3.2.1. Supply and install perimeter safety warning as prescribed by the Ontario Occupational Health and Safety Code and all local codes before starting any other work.
- 3.2.2. The ground areas around the building are to be protected as much as possible. All disposal boxes must be placed on planks. The interior areas of the building, where the roofing contractor has access, are to be protected.
- 3.2.3. It is the responsibility of the roofing contractor to contact the Owner to mark the exact location of buried utilities.
- 3.2.4. Inspect the structural deck and report any deficiencies to the Owner's Representative. Do not apply any new roofing over deficiencies, other than temporary waterproofing, until all deficiencies have been corrected.
- 3.2.5. Do not install new roofing than can be completely waterproofed in one day.
- 3.2.6. The roofing contractor shall be responsible for all roof leaks at the building once they begin to set-up and load materials onto the roof at the beginning of the project.
- 3.2.7. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

### **3.3. METHOD OF INSTALLATION**

- 3.3.1. Prepare surfaces and complete waterproofing work in conformance with roofing manufacturer's printed installation instructions.
- 3.3.2. Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.
- 3.3.3. Roofing work must be completed in a continuous fashion as surfaces are readied and weather conditions permit.
- 3.3.4. Seal seams that are not covered by a cap sheet membrane in the same Day. Do not install cap sheet when moisture is present at/in the base sheet seams.
- 3.3.5. Whenever membranes are torch-applied, a continuous and even bead of molten bitumen must be visible as the membrane is unrolled and torched.
- 3.3.6. Lay roofing membrane free from wrinkles, air pockets, fishmouths, tears, and prominent lap joints. Full bond cap sheet to base sheet. Seams shall be lapped and fully bonded.
- 3.3.7. Prior to installation of base sheet and cap sheet, allow sheet to relax after unrolling. Relax time to be as recommended by manufacturer based on concurrent ambient temperature.
- 3.3.8. Extend roofing to outer edges of roof and up vertical surfaces at least 200 mm (8") above horizontal roofing, and full height beneath counter flashing and top of curb flashing.
- 3.3.9. Complete roofing up to line of termination for each Day's work.

### **3.4. GYPSUM BOARDS**

- 3.4.1. Ensure gypsum boards are mechanically fastened in place over the steel deck. All gypsum board edges and ends are to be butted tight. Gypsum boards are to be staggered.
- 3.4.2. Ensure that all gypsum boards are fully supported. Mechanically fasten the gypsum boards with 10 fasteners per 4'x8' board within the field, 16 fasteners within 12' of perimeters and 32 fasteners within 12' of each corner. It is the roofing contractor's responsibility to confirm the location of any conduits, on the underside of the metal deck, prior to and during the fastening of gypsum boards.
- 3.4.3. Ensure substrate board is immediately protected with membrane.
- 3.4.4. Tape all seams in substrate board prior to the installation of the air / vapour barrier. Use 150 mm (6") wide strips of self adhering base sheet to prevent leakage into the building.
- 3.4.5. Should any conduits be damaged, it will be the roofing contractor's responsibility to repair them at their own costs.

### **3.5. VAPOUR RETARDER**

- 3.5.1. Verify all substrates to receive the vapour retarder primer are clean, dry and free from any contaminants that could affect adhesion of the primer and/or vapour retarder.
- 3.5.2. All substrates to receive vapour retarder are to be primed. The primer is to be applied by brush, roller or sprayer. Allow primer to be dry to touch prior to applying the vapour retarder.
- 3.5.3. Over the clean, dry and primed substrates (metal deck, wood blocking, etc.) apply 1-ply of self adhered vapour retarder membrane fully adhered to the gypsum boards.
- 3.5.4. Roll out the vapour retarder and allow it to relax prior to application. Cut lengths to fit the application. Set in place and pull back the release film 152.4mm to 304.8mm (6" to 12") and place it on the prepared surface. Remove the release film from the remainder of the sheet and apply pressure to ensure proper contact with prepared surface.
- 3.5.5. Overlaps:
  - 3.5.5.1. side laps to be 76.2mm (3") and end laps to be 152.4mm (6")
- 3.5.6. Commence the vapour retarder application at the lowest edge of drain. Proceed up the slope from the lowest point on the roof.
- 3.5.7. At terminations and penetrations, the vapour retarder is to be extended up the vertical surface, above the insulation a minimum of 50.8mm (2"). Where cant strips are to be installed the vapour retarder is to be extended 50.8mm (2") above the top of the cant strip.

### **3.6. INSULATION (BOTTOM LAYERS)**

- 3.6.1. Ensure vapour retarder is clean, dry, continuous, and ready for insulation application.
- 3.6.2. Install 3-layers of 3.0" polyisocyanurate insulation in adhesive. Insulation is to be placed with all joints staggered a minimum of 609.6mm (2') per row.
- 3.6.3. Verify all substrates to receive insulation are clean, dry and free from contaminants that could affect adhesion of the foamable adhesive and installation of the board.
- 3.6.4. Apply foamable adhesive directly to the vapour retarder or insulation in a ribbon pattern. The ribbons are to be between 12.7mm to 19mm (1/2" to 3/4") wide ribbons. The ribbons are to be spaced 6" continuously across each board within the field, 4" continuously across each board within 12' from a perimeter and 4" continuously across each board within 10' of a corner.
- 3.6.5. As foamable adhesive is applied, embed the insulation immediately. Do not allow the adhesive to skin over.
- 3.6.6. Keep insulation a minimum of 75mm (3") from heat emitting devices and a minimum of 52mm (2") from sidewalls of CAN/ULC S604 Type "A" chimneys and CN/CGA 149.2 Type B & L vents, (commonly called B-Vents or Hot Stacks).
- 3.6.7. Ensure that all insulation boards are fully supported, joints staggered, and all edges are butted tight with no gaps between boards.
- 3.6.8. Do not apply more insulation than can be covered with membranes in the same Workday.
- 3.6.9. Install sloped prefabricated insulation sumps 2438.4mm x 2438.4mm (8'x8') around all roof drains. Adjust the insulation thickness to accommodate the sumps.
- 3.6.10. No damaged or wet insulation will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the Project is completed.

### **3.7. TAPERED INSULATION**

- 3.7.1. Verify all substrates to receive tapered insulation boards are clean, dry and free from contaminants that could affect adhesion of the and installation of the board.
- 3.7.2. Install tapered insulation over the polyisocyanurate insulation in adhesive, as designed.
- 3.7.3. Verify all substrates to receive insulation are clean, dry and free from contaminants that could affect adhesion of the foamable adhesive and installation of the board.
- 3.7.4. Apply foamable adhesive directly to the vapour retarder or insulation in a ribbon pattern. The ribbons are to be between 12.7mm to 19mm (1/2" to 3/4") wide ribbons. The ribbons are to be spaced 6" continuously across each board within the field, 4" continuously

across each board within 12' from a perimeter and 4" continuously across each board within 10' of a corner.

- 3.7.5. As foamable adhesive is applied, embed the insulation immediately. Do not allow the adhesive to skin over.
- 3.7.6. Tapered insulation boards are to be butted tight to the next board, outside perimeters, curbs and walls.
- 3.7.7. Ensure that all boards are fully supported, joints staggered, and all edge are butted tight with no gaps between boards.
- 3.7.8. No damaged or wet boards will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the project is completed.

### **3.8. INSULATION (TOP LAYER)**

- 3.8.1. Ensure tapered insulation is clean, dry, continuous, and ready for insulation application.
- 3.8.2. Install 1-layers of 3.0" stone wool insulation in adhesive. Insulation is to be placed with all joints staggered a minimum of 609.6mm (2') per row.
- 3.8.3. Verify all substrates to receive insulation are clean, dry and free from contaminants that could affect adhesion of the foamable adhesive and installation of the board.
- 3.8.4. Apply foamable adhesive directly to the tapered insulation in a ribbon pattern. The ribbons are to be between 12.7mm to 19mm (1/2" to 3/4") wide ribbons. The ribbons are to be spaced 6" continuously across each board within the field, 4" continuously across each board within 12' from a perimeter and 4" continuously across each board within 10' of a corner.
- 3.8.5. As foamable adhesive is applied, embed the insulation immediately. Do not allow the adhesive to skin over.
- 3.8.6. Keep insulation a minimum of 75mm (3") from heat emitting devices and a minimum of 52mm (2") from sidewalls of CAN/ULC S604 Type "A" chimneys and CN/CGA 149.2 Type B & L vents, (commonly called B-Vents or Hot Stacks).
- 3.8.7. Ensure that all insulation boards are fully supported, joints staggered, and all edges are butted tight with no gaps between boards.
- 3.8.8. Do not apply more insulation than can be covered with membranes in the same Workday.
- 3.8.9. No damaged or wet insulation will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the Project is completed.

### **3.9. MEMBRANE APPLICATION – BASE SHEET**

- 3.9.1. Unroll the modified bituminous base sheet membranes and allow them to relax, as per manufacturer's written instructions. Ensure the modified bituminous base membranes are clean and dry.
- 3.9.2. Over the overlay boards, apply 1-ply base sheet membrane fully torched in place
- 3.9.3. Ensure that approximately 6.35mm (1/4") bleed out is achieved at all laps.
- 3.9.4. Ensure the roofing substrates and/or construction elements pose no fire hazards during the use of torch equipment. Do not torch on to wood substrates or at locations that could project flames onto combustible materials.
- 3.9.5. Ensure that the cap sheet membranes lie flat, with no wrinkles, fishmouths, or blisters, and are fully bonded.

### **3.10. MEMBRANE APPLICATION – CAP SHEET**

- 3.10.1. Unroll the granulated modified bituminous cap sheet membranes and allow them to relax, as per manufacturer's written instructions. Ensure the modified bituminous base membranes are clean and dry.
- 3.10.2. Offset all cap sheet membranes 457.2mm (18") from the base sheet membranes.
- 3.10.3. Beginning at the drains, perpendicular to the slope and shingled to shed water, install the modified bituminous cap sheet torched in place to the base sheet. The modified bituminous cap sheet field membranes are to be terminated at the top of the cant strip.

- 3.10.4. Install the modified bituminous cap sheet membrane in parallel courses with the end laps staggered a minimum of 914.4mm (36") from each other and a minimum of 914.4mm (36") from the base sheet membranes. Side laps are to be 76.2mm (3") and end laps are to be 152.4mm (6"). All corners, at end laps are to be cut as per membrane manufacturer's requirements.
- 3.10.5. Ensure that approximately 6.35mm (1/4") bleed out is achieved at all laps.
- 3.10.6. Ensure the roofing substrates and/or construction elements pose no fire hazards during the use of torch equipment. Do not torch on to wood substrates or at locations that could project flames onto combustible materials.
- 3.10.7. Ensure that the cap sheet membranes lie flat, with no wrinkles, fishmouths, or blisters, and are fully bonded.

### **3.11. ASPHALT APPLICATION**

- 3.11.1. Asphalt Heating:
  - 3.11.1.1. Heat roofing asphalt and apply within plus or minus 14°C (25°F) of equiviscous temperature unless otherwise required by roofing system manufacturer. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 14°C (25°F) of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.
- 3.11.2. Apply asphalt at EVT and do not spread more than 1830 mm (6 ft) of hot asphalt in front of each roll and reduce distance accordingly during cold weather. Ensure hot asphalt in kettle is in constant use and circulation to avoid distillation.
- 3.11.3. Apply asphalt at minimum rate of 1.2 kg/m<sup>2</sup> (25 lb/100 ft<sup>2</sup>) and as specified herein for aggregate surfacing flood coat.

### **3.12. NIGHT SEAL**

- 3.12.1. Roofer is responsible to have all roofs closed-in and in a watertight condition at the end of each production day.
- 3.12.2. It is the Foreman's responsibility to thoroughly check this detail at the end of each day before leaving the roof.

### **3.13. MEMBRANE FLASHINGS**

- 3.13.1. Install flashings, including laps, splices, joints, bonding, adhesion and attachment as required and in accordance with manufacturer's written instructions and details.
- 3.13.2. Install flashings to ensure the roof is watertight at the end of each working day.
- 3.13.3. Membrane flashings will be comprised of 1-ply modified bituminous base sheet membrane in self-adhered in place and 1-ply granulated modified bituminous cap sheet membrane torched in place.
- 3.13.4. The contractor is responsible to disconnect and reconnect any electrical conduit, metal railings, ladders, cabling, and/or gas lines which affect the roof installation.
- 3.13.5. Flashing membranes are to be terminated 304.8mm (12") above the base of vertical surfaces at all locations.
- 3.13.6. PERIMETER (OUTSIDE PERIMETERS):
  - 3.13.6.1. After the application of the modified bituminous base sheet field membranes, apply 1- ply modified bituminous base sheet flashing membranes self-adhered in place, extending onto the field of the roof a minimum of 101.6mm (4").
  - 3.13.6.2. Once the modified bituminous cap sheet field membranes have been installed, 1-ply modified bituminous granulated cap sheet flashing membranes are to be fully torched in place, extending onto the field of the roof a minimum of 101.6.35mm (4"). Cap sheet flashing membrane to be installed in 1-meter

- widths with 76.2mm (3") side laps. Cap sheet flashing side laps to be staggered 101.6.35mm (4") from the cap sheet field membrane overlaps.
- 3.13.6.3. Continuously seal the top edge of the granulated modified bituminous cap sheet membrane flashings with elastomeric sealant.
  - 3.13.6.4. At high wall locations, a termination bar is to be installed through the flashing membranes, approximately 12.7mm (0.5") below the top of the membrane. It is to be secured 152.4mm (6") on centre.
  - 3.13.6.5. Fully cover the membrane flashings with new pre-painted metal flashings.
- 3.13.7. MASONRY WALL (INSIDE PERIMETER):
- 3.13.7.1. Flashing membranes at masonry walls are to be terminated 304.8mm at the top of the masonry walls. If weep holes are present in the masonry, flashing membranes are to be kept one brick course below the weep holes.
  - 3.13.7.2. Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
  - 3.13.7.3. Unroll the modified bituminous membrane flashings and allow them to relax, as per manufacturer's written instructions. Ensure existing modified bituminous cap sheet membranes are clean and dry.
  - 3.13.7.4. After the application of the base sheet field membranes, install 1-ply modified bituminous base sheet membrane flashings adhered in place extending up the wall and down onto the field of the roof.
  - 3.13.7.5. After the application of the base sheet flashings and cap sheet field membranes, install 1-ply modified bituminous cap sheet membrane flashings torched in place extending up the wall and down onto the field of the roof. Ensure the laps of the new ply does not coincide with the laps of the existing ply.
  - 3.13.7.6. Termination bars are to be installed through the flashing membranes, approximately 12.7mm (1/2") below the top of the membranes. It is to be secured 152.4mm (6") on centre.
  - 3.13.7.7. Fully cover the membrane flashings with new pre-painted metal flashings and apply a continuous bead of sealant between the masonry and new metal flashings.
- 3.13.8. METAL WALL:
- 3.13.8.1. Where peel & stick membrane is found behind the metal siding, it is to be peeled up and protected during the new membrane flashing installation. Once the new membrane flashings have been installed, the peel & stick membrane is to be shingled over the new membrane flashings. If required, cut existing wall panels to accommodate the new roof height. Install new metal drip edge along the base of the metal panels.
  - 3.13.8.2. Unroll the modified bituminous membrane flashings and allow them to relax, as per manufacturer's written instructions. Ensure existing modified bituminous cap sheet membranes are clean and dry.
  - 3.13.8.3. After the application of the base ply field membranes, install 1-ply modified bituminous base sheet membrane flashings adhered in place extending up the wall and down onto the field of the roof.
  - 3.13.8.4. After the application of the base sheet flashings and cap sheet field membranes, install 1-ply modified bituminous cap sheet membrane flashings torched in place extending up the wall and down onto the field of the roof. Ensure the laps of the new ply does not coincide with the laps of the existing ply.
  - 3.13.8.5. Termination bars are to be installed through the flashing membranes, approximately 12.7mm (1/2") below the top of the membranes. It is to be secured 152.4mm (6") on centre.



- 3.13.8.6. Continuously seal the top edge of the membrane flashings with elastomeric sealant.
- 3.13.8.7. Below metal drip edge, install new metal flashings to tie-in the drip closure, as it was existing. Fully cover the membrane flashing with pre-painted metal flashings. Dimensions for the new metal can be taken from the existing flashings.
- 3.13.9. **EQUIPMENT CURB FLASHINGS:**
  - 3.13.9.1. Ensure all unit curbs are a minimum of 304.8mm (12") above the finished roof level.
  - 3.13.9.2. If required, temporarily disconnect each HVAC/fan unit, completely lift the unit off the curb and set it on the roof while flashing the curb. The curb is to be set on plywood, protecting the roof membrane. Once the curb has been flashed, the unit is to be lifted off the roof and set back on the curb. Then once the unit has been reinstalled and reconnected it is to be tested to ensure it is working properly. The unit work must be performed only by qualified HVAC contractors. Roofing contractor is responsible for these costs in his bid price.
  - 3.13.9.3. Apply one coat of quick dry asphalt primer on all surfaces to receive asphalt at a rate of 150 sq. ft. per gal. Ensure that all surfaces are clean and dry before primer application.
  - 3.13.9.4. After the application of the modified bituminous base sheet field membrane, apply 1 ply of modified bituminous base sheet flashing membrane self-adhered in place, extending over top of the curb, and down onto the field of the roof a minimum of 101.6.35mm (4").
  - 3.13.9.5. After the application of the modified bituminous cap sheet field membrane, apply 1 ply of modified bituminous cap sheet flashing membrane fully torched in place, extending a minimum of 101.6.35mm (4") beyond the 1st ply onto the field of the roof and extending over top of the curb. Ensure that the laps of the 2nd ply do not coincide with the laps of the 1st ply.
  - 3.13.9.6. The cap sheet flashing membrane is to be nailed every 150.8mm (6") o.c. at the top of the curb.
  - 3.13.9.7. Fully cover the membrane flashings with new pre-painted 26-gauge metal.
  - 3.13.9.8. Install new foam gasket over top of the metal flashings prior to reinstalling mechanical equipment. Ensure foam gasket is continuous, creating a permanent seal between the mechanical equipment/skylights and metal flashings.
- 3.13.10. **EQUIPMENT SLEEPERS/SEPARATION CURB:**
  - 3.13.10.1. Ensure all sleepers/separation curbs a minimum of 304mm (12") above the finished roof level. Wood blocking and cant strip to be pressure treated. Ensure positive drainage between sleepers and under the mechanical equipment.
  - 3.13.10.2. If required temporarily disconnect each HVAC/fan unit, completely lift the unit off the sleepers and set it on the roof while flashing the sleepers. The HVAC/fan unit is to be set on plywood, protecting the roof membrane. Once the sleepers have been flashed, new metal is to be installed, the unit is to be lifted off the roof and set back on the curb. Once the unit has been reinstalled and reconnected, it is to be tested to ensure it is working properly. The unit work must be performed only by qualified HVAC contractors. The roofing contractor is responsible for these costs in his/her bid price.
  - 3.13.10.3. Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
  - 3.13.10.4. After the application of the 1-ply base sheet field membranes, apply 1-ply of modified base sheet membrane flashing self-adhered in place extending on

- the roof surface a minimum of 101.6mm (4") on each side of the sleeper/separation curb.
- 3.13.10.5. After the installation of the 1-ply cap sheet field membrane, apply 1 ply granulated modified bituminous cap sheet torched in place extending a minimum of 101.6mm (4") beyond the base sheet membrane onto the roof surface on each side of the sleeper/separation curb.
- 3.13.10.6. The cap sheet flashings are to be extended a minimum of 203.2mm (8") beyond the toe of the cant strip onto the field of the roof, on both sides of the sleepers.
- 3.13.10.7. Fully cover the membrane flashings with new pre-painted metal.
- 3.13.11. PITCH PANS:
- 3.13.11.1. Pitch pans must be a minimum of 152.4mm (6") high with a 102mm (4") primed roof flange. The sides of the pan will be a minimum of 52 mm (2") from the projection. Where possible use a gooseneck instead of a pitch pan. Non-flexible pipes will require a pitch pan. Gooseneck flashing to be used with flexible electrical feed lines.
- 3.13.11.2. Over the new 2-ply roofing membranes, embed the flange of the pitch pan/gooseneck in elastomeric sealant.
- 3.13.11.3. Install one (1) ply of modified bituminous base sheet membrane self-adhered in place over the flange and applied tight to the upright and extending a minimum of 204mm (8") beyond the flange.
- 3.13.11.4. Apply one (1) ply of modified bituminous cap sheet membrane self-adhered in place, extending a minimum of 102mm (4") beyond the ply of modified bituminous base sheet membrane onto the roof surface. Elastomeric sealant is to be applied where the modified bituminous membranes meet the pitch pan along the base.
- 3.13.11.5. Ensure the penetration and the inside walls of the new pitch pans are clean and free from any dirt or debris before applying any sealant.
- 3.13.11.6. Apply M1 structural sealant around the inside walls and base of the pitch pan. Apply M1 sealant around the roof projection.
- 3.13.11.7. Fill all pitch pans using 1-part pourable sealant.
- 3.13.11.8. Install new pitch pans as required at mechanical units and at other roof penetrations/projections. No conduits, satellite cables, or gas lines are to be carried through the curb flashings. The roofing Contractor is responsible for the disconnection and reconnection, where required using a Mechanical / Electrical Sub-Contractor.
- 3.13.12. VENTS/PLUMBING STACKS:
- 3.13.12.1. All plumbing vent (soil stack) pipes are to be extended to suit, so that the inside portion of the cap is within the plumbing vent pipe. Stacks to be a minimum of 304.8mm (12") above the finished roof surface. All stacks are to be pre-insulated as listed in the Materials section. Mechanically fasten cap with Two (2) self-tapping, stainless steel metal screws.
- 3.13.12.2. Mechanically fasten a metal cone flashing down to the metal deck. The cone must extend up past the finished roof level a minimum of 52mm (2"). Install the roofing vapour retarder so that it extends above the insulation surface and onto it 152.4mm (6"). The insulation should butt up against the metal cone.
- 3.13.12.3. Over the new two (2) ply roofing membranes, embed the flange of the soil stack in elastomeric sealant.
- 3.13.12.4. Install one (1) ply of modified bituminous base sheet membrane self-adhered in place over the flange applied tight to the upright and extending a minimum of 204mm (8") beyond the flange.
- 3.13.12.5. Apply one (1) ply of granulated modified bituminous cap sheet membrane self-adhered in place extending a minimum of 102mm (4") beyond

- the ply of modified bituminous base sheet membrane onto the roof surface. Elastomeric sealant is to be applied where the modified bituminous membranes meet the stack flashings along the base.
- 3.13.12.6. Stack is to be insulated. Mechanically fasten cap with TWO (2) self-tapping, stainless steel metal screws.
- 3.13.13. FURNACE STACKS:
- 3.13.13.1. Prime all flanges, paint all furnace stacks using Double "D" aluminum paint.
- 3.13.13.2. Mechanically fasten a metal tall cone flashing down to the metal deck. The tall cone must extend up past the finished roof level a minimum of 52mm (2"). Install the roofing vapour retarder so that it extends above the insulation surface and onto it 152.4mm (6"). The insulation should butt up against the metal cone.
- 3.13.13.3. Over the new 2-ply roofing membranes, embed the flange of the tall cone flashing in elastomeric sealant.
- 3.13.13.4. Install one (1) ply of modified bituminous base sheet membrane self-adhered in place over the flange applied tight to the upright and extending a minimum of 204mm (8") beyond the flange.
- 3.13.13.5. Apply one (1) ply granulated modified bituminous cap sheet membrane extending a minimum of 102mm (4") beyond the ply of modified bituminous base sheet membrane onto the roof surface. Elastomeric sealant is to be applied where the modified bituminous membranes meet the tall cone stack flashings along the base.
- 3.13.13.6. Hand insulate with portion of batt insulation after the tall cone is installed over the mechanical pipe.
- 3.13.13.7. Replace any damaged rain collars and re-caulk all collars.
- 3.13.14. OVERFLOW SCUPPERS:
- 3.13.14.1. Install new fully soldered stainless-steel scupper drain. The new scupper drains are to have a 152.4mm x 200mm tail piece to accept new 24-gauge pre-painted metal, open faced downpipes.
- 3.13.14.2. Apply one coat of quick dry primer on all surfaces to receive asphalt and membranes at a rate of 150 sq. ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
- 3.13.14.3. The field membranes are to be extended directly into the scupper opening fully covering the wood blocking.
- 3.13.14.4. The new scupper drain is to be primed to accept asphalt and membranes. New scupper is to be set into a full bed of mastic.
- 3.13.14.5. Install 1-ply modified bituminous base sheet membrane flashing self-adhered in place over the flange. The base sheet flashings are to extend a minimum of 152.4mm(6") beyond the flange of the scupper onto the field of the roof in all directions and be carried into the scupper. The granulated modified bituminous cap sheet field membranes are to be carried into the scupper over the modified bituminous base sheet flashings.
- 3.13.14.6. .6 New metal flashings are to be installed fully covering the membrane flashings and picture framing the scupper along the outside perimeter of the roof.
- 3.13.15. EXPANSION JOINT:
- 3.13.15.1. Build up expansion joint with wood blocking in accordance with Section 07 95 13 Expansion Joint Cover Assemblies, and the Detail Drawings.
- 3.13.15.2. Mechanically fasten 26-gauge metal closure, 609.6mm (2') on centre, over the metal deck as per detail. Metal closure is to span two flutes on each side of the joint.
- 3.13.15.3. All surfaces to receive self-adhering membrane and primer are to be clean and dry. Prime all surfaces to receive self-adhering membrane. Install

- self-adhering membrane, fully bonded, over metal closure and onto existing membrane 76.2mm (3") on both side of expansion joint.
- 3.13.15.4. Roll out the vapour retarder and allow it to relax prior to application. Cut lengths to fit application. Set in place and pull back the release film 152.4mm to 304.8mm (6" to 12") and place it on the prepared surface. Remove the release film from the remainder of the sheet and apply pressure to ensure proper contact with prepared substrate. Ensure the membranes lie flat, with no wrinkles, fishmouths, or blisters and is well bonded.
- 3.13.15.5. Overlaps: side and end laps to be 76.2mm (3"). Ensure the vapour retarder is properly supported. All end laps are to be staggered.
- 3.13.15.6. Construct wood blocking as per details. Leave a 76.2mm (3") gap, centered over the metal closure. Offset blocking layers 304.8mm (12"). Assemble wood blocking using two staggered rows of nailing. Space nails in any row a maximum of 609.6mm (24") on center. Wood blocking is to be continuous and butted.
- 3.13.15.7. Fill the 76.2mm (3") gap with stone wool batt insulation. The gap is to be filled from the top of the metal closure to the top of the wood blocking. Insulation is to be continuous and butted tight.
- 3.13.15.8. Mechanically fasten 26-gauge metal closure, 609.6mm (2') on center, over the top of the wood blocking as per detail. Metal closure is to span the 76.2mm (3") gap and the wood blocking. metal closure is to be continuous across the joint.
- 3.13.16. BASE SHEET & CAP SHEET FLASHINGS:
- 3.13.16.1. Apply one coat of quick dry primer on all surfaces to receive modified bituminous membranes at a rate of 150 sq.ft. per gallon. Ensure that all surfaces are clean and dry before primer application.
- 3.13.16.2. Unroll the modified bituminous membranes and allow them to relax, as per manufacturer's written instructions.
- 3.13.16.3. Side laps are to be 76.2mm (3") and end laps are to be 152.4mm (6"). End laps are to be staggered a minimum of 304.8mm (12").
- 3.13.16.4. Base sheet flashing membranes are to be installed in 1-meter widths with 76.2mm (3") side laps. The base sheet flashings are to be extended a minimum of 101.6mm (4") beyond the edge of the self-adhering membrane onto the field of the roof. The base sheet flashing membranes are to be self-adhered in place.
- 3.13.16.5. Cap sheet flashing membranes are to be installed in 1-meter widths with 76.2mm (3") sides laps and are to be staggered from the base sheet flashing membranes. The cap sheet flashing is to be self-adhered in place and extended 101.6mm (4") beyond the edge of the base sheet flashing membrane onto the field of the roof.
- 3.13.16.6. Fully cover the expansion joint with new pre-painted metal flashings.
- 3.13.17. ROOF DRAINS:
- 3.13.17.1. Plug the drains temporarily while working around them.
- 3.13.17.2. Sump the area around the new drains 12.7mm (0.5") deep and cantered equally over the drain in all directions. 2440mm x 2440mm (8'x8') drain sumps are to be installed.
- 3.13.17.3. Over the new two (2) ply roofing membranes, install the new drain in a full bed of elastomeric sealant. Check the drainpipes on the underside of the deck to ensure the installation of the proper length of down-pipe. Ensure that the pipe does not impede the flow of water. Plug the drains temporarily while working around them.
- 3.13.17.4. Apply one (1) coat of primer to the flange of the drain.
- 3.13.17.5. Install one (1) ply of modified bituminous base sheet membrane extending a minimum of 609.6mm (24") from the centre of the drain.

3.13.17.6. Apply one (1) ply of granulated modified bituminous cap sheet extending a minimum of 102mm (4") beyond the ply of modified bituminous base sheet membrane onto the surface of the roof.

3.13.17.7. The new metal strainer and control flow mechanism are to be installed immediately following the installation of the flashing membranes. Therefore, if the roof has ten (10) drains and only two (2) drains have been flashed (that particular day), those two (2) drains are to have the metal strainer and the control flow mechanism installed at the end of that workday.

### **3.14. SCUPPERS/MECHANICAL CONDENSATE PIPE/ROOF ACCESS**

- 3.14.1. Install new concrete patio pavers on 25.4mm (1") extruded polystyrene insulation. The extruded polystyrene insulation is to be cut 50.8mm (2") smaller (all the way around) than the concrete patio pavers. Therefore, if the concrete paver is 609.6mm x 609.6mm (2'x2') the extruded polystyrene insulation should be 508mm x 508mm (1'8"x 1'8").
- 3.14.2. Install four concrete patio pavers pm 25.4mm (1") extruded polystyrene insulation, in a square pattern at roof hatch and all access doors.

### **3.15. FIELD QUALITY CONTROL**

- 3.15.1. Conduct quality control in accordance with Section 01 45 00 and as follows:
  - 3.15.1.1. Inspection and testing:
    - .1 Prior to installation of cap sheet membrane, base sheet membrane installation shall be reviewed by manufacturer and inspection and testing company, who shall each submit field review reports to the Consultant.
    - .2 Independent inspection and testing company shall perform:
      - .1 Inspections and *Provide* inspection reports.
      - .2 Tests and *Provide* test reports:
      - .3 Core cuts (if requested).
- 3.15.2. Manufacturer's field review to be in accordance with Section 01 45 00.

### **3.16. ADJUSTING AND CLEANING**

- 3.16.1. Remove applicator's equipment and debris as work progresses, and at completion of the work of this Section in accordance with Sections 01 77 00.
- 3.16.2. Remove bituminous markings from finished surfaces.
- 3.16.3. Repair or replace defaced or disfigured finishes caused as a result of the work of this Section.

### **3.17. FINISH**

- 3.17.1. Perform a daily clean up to collect all wrappings, empty containers, and any other debris from the project site.
- 3.17.2. Upon completion, all debris is to be disposed of in a legally acceptable manner.
- 3.17.3. Prior to the final inspection, the Contractor is to perform a pre-inspection to review all work and to verify that all flashings have been completed as well as the application of all caulking.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, and Handling
- .7 2.1. Prefinished Aluminum Flashing
- .8 2.2. Prefinished Metal Finishes
- .9 2.3. Accessories
- .10 2.4. Fabrication
- .11 3.1. Flexible Flashing Underlayment Installation
- .12 3.2. Roof Flashing Installation
- .13 3.3. Installation of Roof Accessories
- .14 3.4. Installation Tolerances
- .15 3.5. Field Quality Control
- .16 3.6. Adjusting and Cleaning
- .17 3.7. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:  
1.3.1.1. Supply and installation of prefinished metal (aluminum) flashings.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Shop drawings:  
1.4.2.1. Submit shop drawings including the following:
- (1) Plans, elevations, sections, and attachment details.
  - (2) Detail fabrication and installation layouts, expansion-joint locations, and key details. Distinguish between shop and field assembled work.
  - (3) Include identification of material, thickness, weight, and finish for each item and location in the work.
  - (4) Include details for forming, including profiles, shapes, seams, and dimensions.
  - (5) Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - (6) Include details of termination points and assemblies.
  - (7) Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contracting from fixed points.
  - (8) Include details of roof penetrations flashing.
  - (9) Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.
  - (10) Include details of special conditions.
  - (11) Include details of connections to adjoining work.
- 1.4.3. Samples:  
1.4.3.1. Submit full-size samples of each specified flashing material formed to detailed profile including corner, curb, cap, and parapet flashing, and coping including lock-joints and hold-down clips.

- 1.4.3.2. Submit 2 - 50 mm x 50 mm (2" x 2") samples of each type of sheet metal material, colour and finish.

## **1.5. QUALITY ASSURANCE**

### **1.5.1. Qualifications:**

- 1.5.1.1. Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval of *Product* manufacturers.
- (1) *Work* of this section shall be installed by a *Subcontractor* that is a member in good standing of the Canadian Roofing Contractors Association (CRCA).
  - (2) *Work* of this section shall be installed by a Subcontractor that is a member in good standing of the Canadian Roofing Contractors Association (CRCA) and Ontario Industrial Roofing Contractors Association (OIRCA), who has been a member for at least 5 years.
  - (3) Sealant shall be applied by a Subcontractor of recognized standing, having preferably not less than 5 years of proven experience in this type of work, and who has the necessary equipment and skilled mechanics to carry out the work of this section satisfactorily and can substantiate this to satisfaction of the *Consultant*.

### **1.5.2. Quality standards:**

- 1.5.2.1. Quality of fabrication and installation of sheet metal work shall comply with recommendations published by Sheet Metal and Air Conditioning Contractors National Association.

## **1.6. DELIVERY, STORAGE, AND HANDLING**

- 1.6.1. Comply with AAMA CW-10 – Care and Handling of Architectural Aluminum from Shop to Site.
- 1.6.2. Keep materials and equipment free from debris, ice, snow and contaminants. Allow air to circulate around metal components, sheets and break shapes.
- 1.6.3. Protect holes, and reglets from water and ice during freezing weather.

## **1.7. WARRANTY**

- 1.7.1. Warrant work of this section in accordance with Section 01 78 36.

## **2 PRODUCTS**

### **2.1. PREFINISHED ALUMINUM FLASHING**

- 2.1.1. Aluminum flat sheet: Flat aluminum sheet to ASTM B209/B209M-21a, to the following minimum thickness and alloy:
- 2.1.1.1. Painting quality: 5005H14 to ANSI H35.1/H35.1M-2017.
  - 2.1.1.2. Minimum thickness:
    - (1) 1.02 mm (0.040").
    - (A) At parapets: 1.27mm (0.050").

### **2.2. PREFINISHED METAL FINISHES**

- 2.2.1. Provide the following finish to exposed prefinished metal (steel/aluminum as applicable):
- 2.2.1.1. Type 1; Finish: factory prefinished CSSBI 10000 Series.
    - (1) 10000 Series (Polyvinylidene Fluoride - PVDF) will not visibly (within 10 metres to the unaided naked eye) crack, chip, or peel (lose adhesion) for thirty-five (35) years from date of application. This does not include minute fracturing that may occur during the normal fabrication process. 10000 Series (Polyvinylidene Fluoride - PVDF) will not chalk in excess of a number eight (8) rating, in accordance with ASTM D4214-07(2015)

method D659 at any time for thirty-five (35) years from date of installation (35.5 yrs from application); will not change colour more than five (5.0) Hunter ΔE units as determined by ASTM D2244-15.

- (2) Colour to later selection by the *Consultant* from the manufacturer's full range.

### 2.3. ACCESSORIES

- 2.3.1. Isolation coating:
  - 2.3.1.1. to CAN/CGSB-1.108, bituminous type.
- 2.3.2. Sealants:
  - 2.3.2.1. in accordance with Section 07 92 00, colour as selected by the Consultant from the manufacturer's full range.
  - 2.3.2.2. Concealed flashing sealants; hooked-type expansion joints with limited movement: Butyl sealant to ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
- 2.3.3. Cleats:
  - 2.3.3.1. of matching metal to flashing material, continuous, and of greater thickness than flashing material. Offset joints in cleats 305 mm (12") with joints in perimeter edge metal. Allow a 12.7 mm (1/2") gap between pieces.
- 2.3.4. Fasteners:
  - 2.3.4.1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  - 2.3.4.2. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head:
    - (1) Exposed screws: 38 mm (1-1/2") long minimum at 450 mm (18") on centre maximum. Heads matching colour of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM washer under heads of exposed fasteners.
    - (2) Blind fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    - (3) Cleat fasteners: Corrosion-resistant barbed angular ring or screw shank nail; length to achieve approximately 32 mm (1-1/4") penetration into nailer; fasten at 150 mm (6") on centre.
  - 2.3.4.3. Fasteners for prefinished aluminum sheet: Aluminum or Series 300 stainless steel.
  - 2.3.4.4. Fasteners for prefinished galvanized steel sheet: Series 300 stainless steel or hot dip galvanized steel to ASTM A153/A153M-09 and ASTM A653/A653M-13 Class G185
  - 2.3.4.5. Fasteners and plates to meet the requirements of Factory Mutual 4470-Standard for wind uplift and corrosion resistance.
- 2.3.5. Flexible flashing membrane; high temperature grade for use at locations where membrane is not protected by insulation:
  - 2.3.5.1. Description:
    - (1) Thickness: 0.76 mm (30 mils) minimum.
    - (2) Self-adhesive grade rubberized membrane backed by high density polyethylene.
    - (3) Primer for substrate.
    - (4) High temperature grade to resist softening at 105°C minimum.
  - 2.3.5.2. Acceptable Products:
    - (1) Henry 'Blueskin PE 200 HT'.
    - (2) Firestone 'Clad-Gard SA'.
    - (3) GCP Applied Technologies 'Ultra'.
    - (4) Soprema 'LASTOBOND SHIELD HT'.
- 2.3.6. Flexible flashing membrane; standard temperature grade for use at locations where membrane is protected by material with insulating properties:



- (1) Description:
  - (2) Thickness: 1 mm (40 mils) minimum.
  - (3) Self-adhesive grade rubberized membrane backed by high density polyethylene.
  - (4) Primer for substrate.
- 2.3.6.2. Acceptable Products:
- (1) Bakor 'Blueskin Roof RF200'.
  - (2) Grace 'Ice & Water Shield'.
  - (3) Soprema 'LASTOBOND SHIELD'.
  - (4) Or equivalent.

## **2.4. FABRICATION**

- 2.4.1. Fabricate metal flashings and other sheet metal work in accordance with applicable SMACNA "Architectural Sheet Metal Manual (Seventh Edition) details and as indicated.
- 2.4.2. Form pieces in 3048 mm (10 ft) maximum lengths. Make allowance for expansion at joints.
- 2.4.3. Sealed joints: Form non-expansion but movable joints in metal to accommodate sealant.
- 2.4.4. Expansion provisions: Form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with sealant concealed within joints.
  - 2.4.4.1. Joints that *Provide* expansion and contraction capabilities should be located near the corners within approximately 610 mm (24") from each direction of the corner measured from the interior side.
- 2.4.5. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, and of greater thickness of metal being secured.
- 2.4.6. Hem exposed edges on underside 12.7 mm (1/2"). Mitre and seal corners with sealant.
- 2.4.7. At parapets, Provide 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.
- 2.4.8. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- 2.4.9. Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- 2.4.10. Provide 25.4 mm (1") minimum overlap between bottom of wood blocking or flashing anchorage support and edge of drip or termination of flashing.
- 2.4.11. Shop fabricate inside and outside corners.

## **3 EXECUTION**

### **3.1. FLEXIBLE FLASHING UNDERLAYMENT INSTALLATION**

- 3.1.1. Apply primer to concrete masonry and precast concrete substrates.
- 3.1.2. Install in a consecutive weatherboard method starting at bottom or base of wall and working up.
- 3.1.3. Provide minimum of 50 mm (2") side laps and 75 mm (3") end laps.
- 3.1.4. Cut to manageable lengths, position membrane for alignment, remove protective poly-film and firmly apply pressure to assure adhesion.
- 3.1.5. Eliminate wrinkles or gaps, roll entire membrane surface (including seams) with a counter top or "J-roller" to ensure full contact and adhesion.
- 3.1.6. Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the air barrier membrane and around the perimeter edge of membrane terminations.
- 3.1.7. Flashing membrane shall be applied in weatherboard fashion starting at bottom of base of wall and working up, in and around the full perimeter of openings, to *Provide* water tight protection and according to the following procedures:
  - 3.1.7.1. Apply the first strip horizontally immediately below the sill, cut it sufficiently long to extend past each side of the window, so that it projects even with the vertical jamb flashing to be applied later. Turn sill flashing up 50 mm (2") at ends of sill.
  - 3.1.7.2. Sill flashing shall overlap wall membrane. Overlap jamb at head flashing membrane in the same manner.

### **3.2. ROOF FLASHING INSTALLATION**

- 3.2.1. Install sheet metal work in accordance with SMACNA's "Architectural Sheet Metal Manual (Seventh Edition)".
- 3.2.2. Provide watertight flashing installing capable of resisting specified uplift pressures in accordance with roofing specifications, thermally induced movement and exposure to weather.
- 3.2.3. Provide minimum 10% slope for drainage towards roof at parapet locations, with minimum 2% sloped to drain at remaining flashing locations.
- 3.2.4. Provide continuous cleats for attachment of flashings at exterior face of wall and fasten at 150 mm (6") spacing and not less than 2 fasteners per cleat.
- 3.2.5. Provide radius (3-piece) copings for curved wall condition unless otherwise indicated.
- 3.2.6. Prefabricate corner copings in 610 mm (24") x 610 mm (24") sections.
- 3.2.7. Concealed fastenings and cleats, from view except where exposed flashings are accepted by the Consultant prior to installation.
  - 3.2.7.1. Roof side fastening of copings shall be accomplished using either cleats or exposed colour matched screws with EDPM backed metal washers fastened through oversized holes in coping to allow for thermally induced movement and spaced at maximum spacing of 610 mm (24") centre to centre and not less than 2 fasteners per section of coping.
- 3.2.8. Flash joints using S-lock forming tight fit over hook strips/cleats; unless otherwise indicated.
- 3.2.9. Install surface mounted flared joint true and level, and caulk top of reglet with sealant at reglets.
- 3.2.10. Insert metal flashings to other materials and flashings to form weather-tight junction.
- 3.2.11. Provide prefinished metal flashing over equipment curbs which are covered with roofing membrane.
- 3.2.12. Turn top edge of flashing into recessed reglet or mortar joint where indicated, to minimum depth of 25 mm (1"). Wedge flashing securely into joint. Seal flashing at reglet and cap flashing with sealant.
- 3.2.13. Expansion provisions:
  - 3.2.13.1. Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3048 mm (10 ft) and Provide uniform joint spacing with no joints allowed within 610 mm (24") of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25.4 mm (1") deep, filled with sealant concealed within joints.
- 3.2.14. Provide vapour permeable synthetic building paper separation between galvanized steel and treated wood where applicable.
- 3.2.15. Install flexible flashing membrane in accordance with the manufacturer's printed installation instructions.

### **3.3. INSTALLATION OF ROOF ACCESSORIES**

- 3.3.1. Incorporate devices to which roofing and flashing may be secured.
- 3.3.2. Install work to ensure that roofing and flashings will be properly applied to maintain building envelope weather-tight.

### **3.4. INSTALLATION TOLERANCES**

- 3.4.1. Installation tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 6 mm in 6 m (1/4 inch in 20 feet) on slope and location lines as indicated and within 3.2 mm (1/8") offset of adjoining faces and of alignment of matching profiles.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.
  - 3.5.1.1. The work of this Section will be inspected and tested in conjunction with inspection and testing of roofing work.

**3.6. ADJUSTING AND CLEANING**

- 3.6.1. Remove deposits, stains or protections and wash metals left unpainted and exposed to view as recommended by manufacturer of metal or paint finish.

**3.7. PROTECTION**

- 3.7.1. The *Consultant* will advise the *Contractor* of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering.

**END OF SECTION**

## 1 GENERAL

### 1.1. GENERAL INSTRUCTIONS

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 1.

### 1.2. SECTION INCLUDES

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Delivery, Storage, and Handling
- .6 2.1. Roof Hatches; Ladder Access
- .7 2.2. Fabrication
- .8 3.1. Installation

### 1.3. SUMMARY

- 1.3.1. Section includes:
  - 1.3.1.1. Roof hatches.

### 1.4. SUBMITTALS

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Show profiles, accessories, locations, and dimensions.
  - 1.4.3.2. Include details of interface with work of other sections.

### 1.5. DELIVERY, STORAGE, AND HANDLING

- 1.5.1. Package and brace products to prevent damage in shipment and handling. Protect finish surfaces by sturdy wrappings or covering.

## 2 PRODUCTS

### 2.1. ROOF HATCHES; LADDER ACCESS

- 2.1.1. Description: Preassembled, insulated cover and insulated metal curb, welded corner construction, c/w padlock latch, hinge, handle, and other hardware as required.
- 2.1.2. Cover: Break formed, hollow-metal design with concealed insulation, overlapping flange, and internally reinforced live load to meet Ontario Building Code.
  - 2.1.2.1. Aluminum: Cover and frame; 2.3 mm (0.09") (11 gauge) aluminum with a 127 mm (5") beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken.
- 2.1.3. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
- 2.1.4. Hinges: Heavy-duty pintle hinges with 9.5 mm (3/8") type 316 stainless steel hinge pins.
- 2.1.5. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
- 2.1.6. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
- 2.1.7. Hardware:
  - 2.1.7.1. Aluminum: Engineered composite compression spring tubes. Steel compression springs with electrocoated acrylic finish. Type 316 Stainless steel hinges. All other hardware is zinc plated/chromate sealed.
- 2.1.8. Size:
  - 2.1.8.1. 914 mm x 762 mm (36" x 30") size.
- 2.1.9. Finish:
  - 2.1.9.1. Aluminum: Powder Coat Standard finish: Yellow.
- 2.1.10. Acceptable *Products*:

- 2.1.10.1. The Bilco Company model 'Type S-50-TB.'
- 2.1.10.2. Or equivalent.
- 2.1.11. Provide safety post for access.
  - 2.1.11.1. Basis-of-Design Manufacturer: Type LU Ladder Safety Post by The BILCO Company or equivalent.
  - 2.1.11.2. Furnish and install at all roof hatches, ladder safety post Model LU-1. The ladder safety post shall be pre-assembled from the manufacturer.
  - 2.1.11.3. Performance characteristics:
    - (1) Tubular post shall lock automatically when fully extended.
    - (2) Safety post shall have controlled upward and downward movement.
    - (3) Release lever shall disengage the post to allow it to be returned to its lowered position.
    - (4) Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" (356mm) on center and clamp brackets to accommodate ladder rungs up to 1-3/4" (44mm) in diameter.
  - 2.1.11.4. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
  - 2.1.11.5. Material of construction: Shall be steel (Model LU-1).
  - 2.1.11.6. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
  - 2.1.11.7. Hardware: All mounting hardware shall be Type 316 stainless steel.
  - 2.1.11.8. Finishes: Factory finish shall be yellow powder coat steel (Model LU-1)

## **2.2. FABRICATION**

- 2.2.1. Fit joints and junctions between components tightly, to prevent entry of water into component voids and interior of building. Cap open ends of sections exposed to view.
- 2.2.2. Fabricate work with materials and component sizes, complete with metal gauges, reinforcing, anchors, and fastenings of adequate strength to ensure that it will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended and specified use. Conceal and weld connections wherever possible.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Install in accordance with manufacturer's written installation requirements.
- 3.1.2. Incorporate devices to which roofing, and flashing may be secured, and install work to ensure that roofing and flashings will be properly installed to maintain weather-tight building.
- 3.1.3. Verify under work of this section that installed products function properly.
- 3.1.4. Adjust hardware to function smoothly and without binding and to ensure that components fit in a weather-tight fashion.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery Storage, and Handling
- .8 1.8. Field Conditions
- .9 2.1. Manufacturers
- .10 2.2. Performance/Design Requirements
- .11 2.3. Materials
- .12 3.1. Manufacturer's Instructions
- .13 3.2. Preparation
- .14 3.3. Installation
- .15 3.4. Identification
- .16 3.5. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Materials installed in cavities, joints, around penetrations, and openings in floors, walls, partitions, and other building components to restrict the spread of fire and smoke.
- 1.3.2. Section excludes:
  - 1.3.2.1. Firestopping and smoke seals, for mechanical, electrical and communications penetrations of fire resistant assemblies, and firestopping and smoke seals within their respective assemblies. Refer to Divisions 21, 22, and 23 and Divisions 26, 27, 28

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination:
  - 1.4.1.1. Coordinate joint firestopping and smoke seal work with Section 01 33 00, section titled Project Firestopping Manual and Coordination.
  - 1.4.1.2. Coordinate with other sections to assure that pipes, conduit, cable, and other items that penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.
  - 1.4.1.3. Schedule the Work to assure that penetrations and other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- 1.4.2. Conduct a pre-installation meeting in accordance with Section 01 31 19.
  - 1.4.2.1. Representatives for mechanical and electrical work and independent inspection and testing company shall attend pre-installation meeting.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. *Product* data: Submit data and installation instructions for Products and prefabricated devices, providing descriptions sufficient for identification at the *Place of the Work*.
  - 1.5.2.1. Materials list of Products proposed for use in the work of this Section; complying with listed systems designs.

- 1.5.2.2. Listing agency's detailed drawing showing opening, penetrating items, and firestopping materials, identified with listing agency's name and number or designation, fire rating achieved, and date of listing.
- 1.5.2.3. Manufacturer's specifications, detail sheets, and other data needed to prove compliance with the specified requirements;
- 1.5.2.4. Certificates:
  - (1) Submit the following certification documents with closeout submittals
    - (A) Manufacturer's certification: Submit manufacturer's certification that installed firestopping and smoke seal Products are suitable for the use indicated and comply with specified requirements.
    - (B) Installation certification: Installer shall submit certification that all joint firestopping system installations are completed and that installations comply with listed systems designs
- 1.5.2.5. Submit fire resistance rating test listings for firestopping and smoke seal systems.
- 1.5.2.6. Manufacturer's engineering judgment identification number and shop drawing details when no ULC, c-UL or other Canadian listed assembly is available for an application. Engineered judgment must include both project name and *Subcontractor's* name who will install firestop system as described in shop drawing.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Submit drawings indicating fire resistance rated assembly number, required temperature, hose stream, and flame rating, material thicknesses, installation methods and materials of firestopping and smoke seals, primers, supports, damming materials as applicable, reinforcements, anchorages, fastenings and methods of installation for each condition to be encountered.
  - 1.5.3.2. Designate on shop drawings static through penetrations and dynamic joint systems, relative positions, expansion and control joints in rated slabs and walls, firestopping details at receptacles and similar poke-through devices and surrounding permanent materials. Identify re-entry locations.
  - 1.5.3.3. Engineered shop drawings; for engineering judgements:
    - (1) Where Project conditions require modification to an accredited third party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered shop drawings detailing the modifications to the listed system design as an engineering judgment or equivalent fire-resistance-rated assembly, for each Project location and condition.
    - (2) Submit the manufacturer's engineering judgment identification number and shop drawing details prepared by a professional engineer. The engineering judgment submittal shall include both Project name, Project location, and Subcontractor's name who will install firestop system as described in engineering judgement shop drawings.
    - (3) Provide complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.
    - (4) For perimeter fire barrier systems:
      - (A) Submit engineered shop drawings for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.
- 1.5.4. Manufacturers' instructions:
  - 1.5.4.1. Manufacturer of the Products proposed for use in the work of this Section shall prepare a firestopping manual scheduling the products to be used for each assembly and installation required in the Work.
  - 1.5.4.2. Manual shall include manufacturer's Product data sheets as specified under this specification section.
  - 1.5.4.3. Firestopping manual shall be submitted within 4 weeks of the *Contract* award.

## **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. *Provide* work of this Section, executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval, training and certification of *Product* manufacturers.
    - (1) Submit proof of manufacturer's installer certification for each installer of firestopping and smoke sealant systems.
    - (2) Manufacturer's willingness to sell its firestopping Products to the *Contractor* or to a *Subcontractor* or installer engaged by the *Contractor* does not in itself confer qualification on the buyer.
  - 1.6.1.2. Applicator shall designate a single individual as project foreperson who shall be present at the *Place of the Work* at all times when the work of this Section is being performed.
- 1.6.2. Regulatory requirements:
  - 1.6.2.1. Firestop systems shall be listed in accordance with CAN/ULC-S115-05 and tested assemblies shall achieve a fire resistance rating in accordance with the Ontario Building Code.
  - 1.6.2.2. Proposed firestopping and smoke seal materials and methods shall conform to applicable governing codes having local jurisdiction.

## **1.7. DELIVERY STORAGE, AND HANDLING**

- 1.7.1. Deliver the materials to the *Place of the Work* in the manufacturer's unopened containers, containing the classification label, with labels intact and legible at time of use.
- 1.7.2. Store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
- 1.7.3. Do not use damaged or adulterated materials and materials exceeding their expiry date.

## **1.8. FIELD CONDITIONS**

- 1.8.1. Comply with manufacturer's instructions relative to temperature and humidity conditions, before, during and after installation.

## **1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36.

# **2 PRODUCTS**

## **2.1. MANUFACTURERS**

- 2.1.1. General: Manufacturers of firestopping and smoke seal system Products and installation specialists for the work of this section are limited to applicable assemblies as required for the Work and having listing mark on packaging.
- 2.1.2. Acceptable manufacturers for work of this section:
  - 2.1.2.1. 3M Canada Inc.
  - 2.1.2.2. A/D Fire Protection Systems Inc.
  - 2.1.2.3. Dow Corning.
  - 2.1.2.4. Hilti Canada Corp.
  - 2.1.2.5. Nuco – Self-Seal Firestopping Products.
  - 2.1.2.6. Tremco Commercial Sealants & Waterproofing.
  - 2.1.2.7. STI Firestop
  - 2.1.2.8. Or equivalent.

## **2.2. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.2.1. Firestop and smoke sealant systems shall consist of material, or combination of materials installed to retain integrity of fire-rated construction by effectively impeding spread of flame, smoke, and/or hot gasses through perimeter joint or gaps, construction joints, or at perimeter fire containment in or adjacent to fire-rated barriers.
- 2.2.2. Smoke sealants applied over firestopping materials or combination smoke seal/firestop seal material shall form air tight barriers to prevent passage of gas and smoke.



- 2.2.3. Fire-resistance rating of firestopping system shall be equivalent to rating of adjacent floor, wall or other fire separation assembly.
- 2.2.4. Firestopping system at fire rated assemblies with assembly STC rating requirements shall provide STC rating equal to STC rating of fire rated assembly.
- 2.2.5. Confirm locations of exposed/non-exposed firestopping/smoke seal surfaces with Consultant prior to application.
- 2.2.6. Provide movement capability at movement joints in accordance with design requirements for movement joint.
- 2.2.7. Head-of-wall joints; with dynamic designation:
  - 2.2.7.1. Joint assemblies shall permit vertical movement allowing wall to move independent of structure due to forces including, but not limited to, live loads, dead loads, thermal expansion/contraction, and wind sway. Such movement shall not damage the wall assembly or its fire protection components.
    - (1) Provide head-of-wall joints with dynamic designation.
- 2.2.8. Regulatory Requirements:
  - 2.2.8.1. Joint firestop systems shall be listed in accordance with CAN/ULC-S115-11 and shall achieve required fire resistance rating in accordance with building code.
  - 2.2.8.2. Proposed firestopping and smoke seal materials and methods shall conform to applicable governing codes having local jurisdiction.
- 2.2.9. Provide also smoke sealants applied over firestopping materials or combination smoke seal/firestop seal material to form air tight barriers to retard the passage of gas and smoke.
- 2.2.10. Provide firestopping and smoke sealant system assemblies as practical and as required to coordinate with the schedule and sequencing of the *Work*.

### **2.3. MATERIALS**

- 2.3.1. Single source responsibility for firestopping and smoke seal materials:
  - 2.3.1.1. Obtain firestopping and smoke seal materials from single manufacturer for each different Product required.
  - 2.3.1.2. Manufacturer shall instruct applicator in procedures for each material.
- 2.3.2. Firestopping and smoke seal systems shall conform to the following:
  - 2.3.2.1. VOC content not to exceed 250 grams per litre minus water.
  - 2.3.2.2. Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gasses in compliance with requirements of CAN/ULC- S115-11 and not to exceed opening sizes for which they are intended.
  - 2.3.2.3. Provide firestopping materials and systems with fire-resistance rating not less than the fire-resistance rating of applicable adjacent assembly.
  - 2.3.2.4. Listed in accordance with CAN/ULC-S115-11.
  - 2.3.2.5. For services that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, Provide firestop system with "F" rating as required by the Ontario Building Code.
  - 2.3.2.6. For combustible pipe penetrations through a fire separation required to have a fire-resistance rating, Provide firestop system with "F" rating as required by the Ontario Building Code.
  - 2.3.2.7. For services that penetrate a fire wall or a horizontal fire separation that is required to have a fire-resistance rating, Provide firestop system with "FT" rating as required by the Ontario Building Code.
  - 2.3.2.8. For joints in fire-separations, Provide firestop system as required by the Ontario Building Code.
  - 2.3.2.9. Products shall be compatible with abutting dissimilar membranes, architectural coatings, finishes at floors, walls and ceilings. Check with requirements of the *Contract Documents* and manufacturer of selected materials being installed.
- 2.3.3. Smoke sealants for overhead and vertical joints shall be non-sagging; sealants for floors shall be self-levelling.

- 2.3.4. Smoke sealants at vertical through penetrations in areas with floor drains shall be waterproof type.
- 2.3.5. Smoke seal sealant colour at exposed locations: Grey. (Red will not be accepted).
- 2.3.6. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems).
- 2.3.7. Metal deck/wall penetration conditions with sprayed fireproofing: spray-on fire-rated firestop mastic.
- 2.3.8. Joint firestopping and smoke seal for head-of-wall joints at metal decking:
  - 2.3.8.1. Firestopping: Trapezoidal shaped firestop thermal material shaped to match metal deck profile for head-of-wall joints at metal deck locations.
  - 2.3.8.2. Smoke sealant: Smoke seal firestop surfaces with listed smoke sealant by spraying, brushing, or troweling material in accordance with listed system design.

### 3 EXECUTION

#### 3.1. MANUFACTURER'S INSTRUCTIONS

- 3.1.1. Compliance:
  - 3.1.1.1. Comply with manufacturer's written *Product* data including *Product* technical bulletins, *Product* installation instructions and *Product* packaging instructions.

#### 3.2. PREPARATION

- 3.2.1. Examine sizes, anticipated movement and conditions to establish correct thickness and installation of back-up materials.
- 3.2.2. Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease, moisture, frost and other foreign matter which may otherwise impair effective bonding.
- 3.2.3. Prime and mask adjacent surfaces. Mask areas adjacent to sprayed firestopping to limit firestopping overspray to area not greater than 25 mm (1") of minimum required.
- 3.2.4. Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless listed assembly permits such insulation to remain within assembly, or where mechanical trades have installed special fire rated insulated sleeves.
- 3.2.5. Secure pipe, conduit, cable, and other items that penetrate firestopping and smoke seal systems.

#### 3.3. INSTALLATION

- 3.3.1. Mix and apply firestopping, gas and smoke seals in accordance with manufacturer's written instructions and tested designs to achieve required flame rated seal, to prevent the passage of gas and smoke and, where specifically designated, the passage of fluids.
- 3.3.2. Provide temporary forming and packing as required and other accessories in accordance with manufacturers' written instructions. Apply materials with sufficient pressure to properly fill and consolidate the mass to seal openings.
- 3.3.3. Provide fill materials for through-penetration firestop systems by techniques to achieve the following results:
  - 3.3.3.1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
  - 3.3.3.2. Install materials so that they contact and adhere to substrates formed by openings and penetrating items.
- 3.3.4. *Provide* joint fillers to *Provide* support of firestop materials during application and at the position required to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance required.
- 3.3.5. For materials that will remain exposed after completing the Work, finish to *Provide* smooth, uniform surfaces. Tool or trowel exposed surfaces.
- 3.3.6. Seal joints to ensure an air and water resistant seal, capable of withstanding compressions and extensions due to thermal, wind or seismic joint movement.

- 3.3.7. Notify the Consultant when random completed installations are ready for review, as directed by the Consultant, prior to concealing or enclosing firestopping and as applicable, smoke seals.
- 3.3.8. Remove temporary forming and dams only after materials have gained sufficient strength.

### **3.4. IDENTIFICATION AND DOCUMENTATION**

- 3.4.1. Identify through-penetration firestopping and smoke seal systems with pressure-sensitive, self-adhesive, printed vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping system installation where labels will be visible to anyone seeking to remove penetrating items or firestopping and smoke seal systems. Include the following information on labels:
  - 3.4.1.1. The words: "Warning: Through-Penetration Firestopping system – Do Not Disturb";
  - 3.4.1.2. Applicator's name, address and phone number;
  - 3.4.1.3. Designation of applicable testing and inspection agency;
  - 3.4.1.4. Date of installation;
  - 3.4.1.5. Manufacturer's name for firestopping and smoke seal system materials.
- 3.4.2. Provide documentation for each joint firestop system application addressed. This documentation is to identify each joint location on the entire Project.
- 3.4.3. Documentation for installed joint firestop systems is to include:
  - 3.4.3.1. Sequential location number.
  - 3.4.3.2. Project name.
  - 3.4.3.3. Date of installation.
  - 3.4.3.4. Detailed description of joint firestop system location.
  - 3.4.3.5. Listed firestop system design number or engineered judgment number.
  - 3.4.3.6. Type of joint.
  - 3.4.3.7. Width of joint.
  - 3.4.3.8. Overall length of joint.
  - 3.4.3.9. Number of sides addressed.
  - 3.4.3.10. Hourly rating of firestop joint system to be achieved.
  - 3.4.3.11. Installers name.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Quality control to be in accordance with Section 01 45 00.
- 3.5.2. Field tests and inspections:
  - 3.5.2.1. Inspection consultant to review installation of the work of this section and to perform random tests to verify its completion in accordance with the requirements of the Contract Documents.
  - 3.5.2.2. Give at least 48 hours' notice before operations commence, and arrange for a pre-job conference with the Contractor, Subcontractor, inspection and testing company, manufacturer, and the Consultant present.
  - 3.5.2.3. Inspection and testing company shall examine penetration firestopping in accordance with ASTM E2174-09 and ASTM E2393-20a as applicable. Inspection and testing company shall examine firestopping and shall determine, in general, that firestopping has been installed in accordance with the requirements of the Contract Documents and the tested and listed firestop system.
  - 3.5.2.4. Representatives of the manufacturer(s) shall have access to the Work. Contractor shall Provide assistance and facilities for such access in order that the manufacturer(s) representative(s) may properly perform its function.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Field Conditions
- .7 1.7. Extended Warranty
- .8 2.1. Sealants
- .9 2.2. Accessories
- .10 3.1. Manufacturer's Recommendations
- .11 3.2. Preparation
- .12 3.3. Masking
- .13 3.4. Installation
- .14 3.5. Interior Sealant Schedule
- .15 3.6. Field Quality Control
- .16 3.7. Adjusting and Cleaning
- .17 3.8. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Exterior building sealants.
  - 1.3.1.2. Interior building sealants.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Submit manufacturer's and *Product* name for each sealant which will be used in the *Work* prior to commencing the *Work*.
- 1.4.3. Product data sheets:
  - 1.4.3.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
  - 1.4.3.2. Submit manufacturer's and Product name for each sealant which will be used in the Work prior to commencing the Work.
  - 1.4.3.3. For Products specified to comply with SWR Institute Sealant Validation Program, provide written confirmation from SWRI of Product compliance.
- 1.4.4. Test and evaluation reports:
  - 1.4.4.1. Test sealant in contact with samples of materials to be sealed to verify adhesion will be achieved and no staining of the material will result. Prepare sample joints at the *Place of the Work* of each type of sealant for each joint condition.
    - (1) Submit test results to the *Consultant* prior to application of sealants.
  - 1.4.4.2. Test sealant in contact with samples of porous materials to be sealed to ensure that no staining of the material will result in accordance with ASTM C1248-18
    - (1) Submit test results to the *Consultant* prior to application of sealants.
- 1.4.5. Samples
  - 1.4.5.1. Submit 2440 mm (96") long sealant joint mock-up.
  - 1.4.5.2. Submit "wet sample" sealant colour samples for each sealant *Product* and colour.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:

- 1.5.1.1. *Provide* work of this Section, executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers. Installer to comply with quality assurance articles referenced in ASTM C1193-13 for installation of joint sealants.

- 1.5.2. Conduct quality control in accordance with Section 01 45 00.

## **1.6. FIELD CONDITIONS**

- 1.6.1. Verify substrates and ambient air temperature at the *Place of the Work* before, during and after application to ensure compliance with manufacturer's recommendations. Surfaces shall be frost-free, dust-free, clean and completely dry at time of installation.
- 1.6.2. Weather Conditions:
  - 1.6.2.1. In accordance with manufacturer's instructions, do not apply silicone joint sealants in snow, rain, fog or mist, or when such conditions are expected. Allow joint surfaces to attain dry conditions as recommended by manufacturer before sealant application.
- 1.6.3. Sealant and substrate materials:
  - 1.6.3.1. Conform to sealant manufacturer's specifications and recommendations. Keep organic sealant materials heated to at least 16°C when working at temperatures below 10°C.
- 1.6.4. Do not proceed with installation of joint sealants under the following conditions:
  - 1.6.4.1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or are below 5° C (40° F).
  - 1.6.4.2. When joint substrates are wet.
  - 1.6.4.3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
  - 1.6.4.4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **1.7. EXTENDED WARRANTY**

- 1.7.1. Warrant work of this section for a period of 2 years, in accordance with Section 01 78 36.
- 1.7.2. Repair or replace joint sealants which fail to perform as air tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, or general durability; or appear to deteriorate or become unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship or in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.
- 1.7.3. Defects shall include, but are not limited to:
  - 1.7.3.1. Staining from abutting materials or filler.
  - 1.7.3.2. Migrating, bleeding into, or staining abutting materials.
  - 1.7.3.3. Unsightly surface deformation by causes other than movement.
  - 1.7.3.4. Excessive colour change, chalking, or dust pick-up.
  - 1.7.3.5. Failing adhesively or cohesively where maximum elongation is less than 25% of designed width of exposed joints.
  - 1.7.3.6. Hardening to more than 25% over specified hardness.

## **2 PRODUCTS**

### **2.1. SEALANTS**

- 2.1.1. General:
  - 2.1.1.1. Colours: Sealant colours shall match colours of adjacent materials, as selected and approved by the *Consultant*:
    - (1) Colours shall be selected from manufacture's full range of colours, generally to match adjacent finished colours
  - 2.1.1.2. Comply with ASTM C920-11 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920-11 classifications for type, grade, class, and uses.

- 2.1.1.3. Provide joint sealants, primer(s) and backings that are compatible with one another and with joint substrates under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience.
- 2.1.1.4. For sealants to be applied to porous substrates: Provide products that have undergone testing according to ASTM D1248-12 and have not stained porous joint substrates indicated for Work.
- 2.1.1.5. Sealant supplied shall not exude any material(s) which travels into adjacent materials, or travels onto surfaces of adjacent materials; causing damage, or attracting soiling, which becomes apparent during the service life of the building.
- 2.1.2. Interior sealants shall have VOC limit of less than 50 g/L.
- 2.1.3. Sealant designations:
  - 2.1.3.1. Type 1 – Urethanes Two Part.
    - (1) Non-sag, multi-component, epoxidized polyurethane sealant to CAN/CGSB 19.24-M90, Type 2, Class B.
    - (2) Location: use at all locations except where noted otherwise.
    - (3) Acceptable *Product*: Dymeric, as manufactured by Tremco Ltd. or equivalent.
  - 2.1.3.2. Type 2 – Silicones One Part.
    - (1) One-part, acetoxysilicone sealant, mildew resistant, to CAN/CGSB 19.22-M89.
    - (2) Location: for washroom fixtures and vanity tops.
    - (3) Acceptable *Product*: Tremsil 200, as manufactured by Tremco Ltd. or equivalent.
  - 2.1.3.3. Type 3 – Acrylics One Part.
    - (1) Acrylic terpolymer sealant, solvent release, to CGSB 19-GP-5M-1984.
    - (2) Location: at interior joints between windows, door frames, and screen frames.
    - (3) Acceptable *Product*: Mono 555, as manufactured by Tremco Ltd. or equivalent.
  - 2.1.3.4. Type 4 – Acoustical Sealant.
    - (1) Siliconized acrylic latex sealant, to CGSB 19.21-M87.
    - (2) Location: at all perimeter joints and openings in gypsum board systems.
    - (3) Acceptable *Product*: Tremflex 834, as manufactured by Tremco Ltd. or equivalent.
  - 2.1.3.5. Type 5 – Urethanes Two Part.
    - (1) Non-sag, multi-component, chemically cured, polyurethane sealant to CAN/CGSB 19.24-M90, Type 2, Class B.
    - (2) Location: at control joints in masonry assemblies.
    - (3) Acceptable *Product*: Dymeric511, as manufactured by Tremco Ltd. or equivalent.
  - 2.1.3.6. Type 6 – Urethanes Two Part.
    - (1) Non-sag, multi-component, chemically cured, polyurethane sealant to CAN/CGSB 19.24.
    - (2) Location: at all locations calling for EPDM membrane.
    - (3) Acceptable *Product*: Lexcan pourable sealer or equivalent.
  - 2.1.3.7. Type 7 – Urethanes One Part.
    - (1) Non-sag, single component, polyurethane sealant to CAN/CGSB 19.13-M87.
    - (2) Location: at metal flashing and trim.
    - (3) Acceptable *Product*: RC-1 Sealant as manufactured by Lexsoco or equivalent.
  - 2.1.3.8. Type 8 – Polyurethane One Part
    - (1) Non-sag, single component, moisture curing, modified polyurethane sealant to CGSB 19.12, class MC-2-25-B-N.

- (2) Location: as toe bead filling void beneath glazing strip in Window Wall in accordance with Section 08500 Aluminum Windows.
  - (3) Acceptable *Product*: DyMonic, as manufactured by Tremco Ltd. or equivalent.
- 2.1.3.9. Type 9 – Structural Silicone.
  - (1) Non-sag, single component, elastomeric, chemical curing, neutral core, medium modulus silicone sealant to CAN/CGSB 19.13-M87, MCG-2-25-A-L.
  - (2) Location: as structural silicone sealant in Window Wall in accordance with Section 08500 Aluminum Windows.
  - (3) Acceptable *Product*: Spectrum 2, as manufactured by Tremco Ltd. or equivalent.
- 2.1.3.10. Type 10 – Acrylics One Part.
  - (1) Single component, elastomeric, water based, acrylic firestop sealant to CAN/ULC-S115-11.
  - (2) Location: fire rated joints and penetrations in fire rated systems.
  - (3) Acceptable *Product*: TREMstop Acrylic, as manufactured by Tremco Ltd. or equivalent.
- 2.1.3.11. Interior sealant, mildew resistant one part silicone sealant in accordance with the following:
  - (1) Comply with:
    - (A) ASTM C920-11, Type S, Grade NT, Class 25
    - (B) CAN/CGSB 19.22-M89.
  - (2) Acceptable Products:
    - (C) GE Silicones "Sanitary SCS1700 Sealant";
    - (D) BASF Building Systems "OmniPlus";
    - (E) Dow Corning "786";
    - (F) Tremco, Inc. "Tremsil 200";
    - (G) Or equivalent.

## 2.2. ACCESSORIES

- 2.2.1. General:
  - 2.2.1.1. *Provide* component joint sealant primers, backings and fillers that are compatible with joint substrates and other sealants or joint fillers specified and approved for applications indicated under joint sealant schedule.
- 2.2.2. Cylindrical sealant backings:
  - 2.2.2.1. *Provide* joint backings that meet ASTM C1330-02, Type O (open-cell polyurethane), or Type B (non-absorbent bi-cellular backing materials with surface skin), sized 25 percent or greater than joint opening with proper density to control sealant depth and profile. Follow joint sealant manufacturer's recommendations with backing selections for optimum joint sealant performance, in accordance with the following schedule:
  - 2.2.2.2. Use open cell foam with non-absorbing closed cell skin (Sof-Rod) for vertical joints; round shape for open joints and triangular shape for angular joints.
  - 2.2.2.3. Use closed cell foam for horizontal joints.
- 2.2.3. Bond-breaker tape:
  - 2.2.3.1. Polyethylene tape or other approved plastic tape as recommended by joint sealant manufacturer to prevent 3-sided joint adhesion to rigid, inflexible joint fillers or joint surfaces at back of joint where such adhesion would restrict proper sealant movement or result in sealant failure.
- 2.2.4. Masking Tape:
  - 2.2.4.1. Non-staining, non-absorbent and compatible with joint sealants and adjacent surfaces.
- 2.2.5. Sealant primers:
  - 2.2.5.1. Use primers only as recommended by sealant manufacturer where required to enhance adhesion of sealant to specific joint substrates indicated and as

determined for use from pre-construction mock-up testing. Select primers in consultation with sealant manufacturer and manufacturer of substrate material which do not have a detrimental effect on sealant adhesion or in-service performance.

2.2.6. Cleaners for nonporous surfaces:

2.2.6.1. Provide non-staining, chemical cleaners of type which are acceptable to manufacturer of sealant and sealant backing material, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

2.2.6.2. *Provide* cleaner conditioner required for glass and glazed surfaces as recommended by sealant manufacturer.

### 3 EXECUTION

#### 3.1. MANUFACTURER'S RECOMMENDATIONS

3.1.1. Unless specified otherwise herein, comply with the recommendations and directions of the manufacturer whose materials are being used in the work of this Section.

#### 3.2. PREPARATION

3.2.1. Prior to installation, clean substrates of substances that could impair the bond of joint sealants. Clean and prepare joint surfaces immediately before installing joint sealants. Protect adjacent work areas and finished surfaces from damage during joint sealant installation.

3.2.2. Clean porous joint surfaces by using heavy-duty brushing, light abrasive, mechanical abrading or combination of these methods to produce a clean, sound surface for optimum bond with joint sealants per manufacturer's recommendations. Provide a dry, dust-free and cleaned substrate for optimum results.

3.2.3. Non-porous surfaces should be cleaned using the two-cloth solvent wipe method as referenced in ASTM C1193-16 and outlined by joint sealant manufacturer's instruction. IPA (isopropyl alcohol) is not a degreasing solvent yet may be used in new construction for non-porous joint cleaning and preparation. Use xylene, toluene or MEK for degreasing solvent and general cleaning of non-porous surfaces.

3.2.4. Rusting or scaling surfaces must be prepared using abrasive cleaning methods as recommended by joint sealant manufacturer prior to joint sealant installation. Efflorescence, mould, mildew and algae must be removed and neutralized prior to joint sealant installation.

3.2.5. Coordinate cleaning, priming and installation to avoid contamination of wet, freshly coated or adjacent finished surfaces. Prepare finish-coated surfaces per joint sealant manufacturer's specific recommendations.

3.2.6. Test materials for indications of staining or poor adhesion before any sealing is commenced. Submit reports in writing to the *Consultant* of results.

#### 3.3. MASKING

3.3.1. Where necessary to prevent contamination or marring surfaces of adjacent materials, mask areas adjacent to joints with masking tape prior to priming or sealing application. Remove tape immediately after joint has been completed and an initial set achieved.

#### 3.4. INSTALLATION

3.4.1. Review the complete Contract Documents for extent of sealant work required.

3.4.2. Comply with joint sealant manufacturer's installation instructions for products, primers and applications indicated unless more stringent project-specific instructions or requirements apply.

3.4.3. Apply joint sealants for continuous waterproof sealant joint protection. Vertical joints should be lapped over horizontal joints as recommended by sealant manufacturer. Comply with installation recommendations in ASTM C1193-16 for use of joint sealants as applicable to each specific sealant installation.



- 3.4.4. Install sealant primers only when recommended by sealant manufacturer and demonstrated at pre-construction tests after joint surface preparation has been completed and when surfaces are verified as clean and dry. Allow any primer installation to completely dry or cure prior to installation of backing or joint sealants.
- 3.4.5. Install joint sealants in accordance with joint sealant manufacturer's instructions using proven techniques that comply with the following and in proper sequence with installation of primers and backings.
  - 3.4.5.1. Using proper joint sealant dispensing equipment, place sealants by pushing sealant beads into opening to fully wet-out joint sealant substrates. Fill sealant joint opening to full and proper configuration.
  - 3.4.5.2. Install, providing uniform cross-sectional shapes and depths in relation to joint width for optimum sealant movement capability per joint sealant manufacturer's instructions.
- 3.4.6. Joint sealant tooling is required for non-sag joint sealant installations. Immediately after placing fresh sealants and before skinning or curing begins, tool sealants using metal spatulas designed for this purpose in accordance with manufacturer's recommendations. *Provide* a smooth, uniform sealant finish, eliminating air pockets and ensuring good contact for optimum sealant adhesion within each side of the joint opening.
  - 3.4.6.1. *Provide* concave joint configuration as indicated per figure 5-A in ASTM C1193-16 unless otherwise indicated. Dry tooling is required for joint sealants, and wet tooling agents are not allowed.
  - 3.4.6.2. Remove excess sealant from surfaces adjacent to joint openings using metal spatula, promptly cleaning any sealant residue from adjacent finished surfaces. Remove masking after joint sealant is installed.
- 3.4.7. Allow single-component sealants to fully cure before adhesion testing is performed as recommended by joint sealant manufacturer.
- 3.4.8. Match approved sealant mock-up for colour, finish and overall aesthetics. Remove, refinish or re-install work not in compliance with the Contract Documents.
- 3.4.9. When surfaces of adjacent materials are to be painted, perform sealant work before these surfaces are painted.
- 3.4.10. Check to make sure shop paint is compatible with primer and sealant. When incompatible, inform the Consultant and change primer and sealant to compatible type acceptable to the Consultant.
- 3.4.11. Check form release agent used on concrete for compatibility with primer and sealant. If they are incompatible inform the Consultant and change primer and sealant to compatible type, or clean concrete to sealant manufacturer's acceptance.
- 3.4.12. Install joint backing material, filler strips, gaskets, bond breakers and similar type material of comparable performance characteristics. Install bond breaker tape or packing over asphalt impregnated fibre board as recommended by sealant manufacturer.
- 3.4.13. Where joints are 12.7 mm (1/2") or deeper, insert backing material in continuous uniform compression with setback from finished face of adjoining materials equal to required depth of sealant (width/depth ratio) as specified herein.
- 3.4.14. On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.
- 3.4.15. Pack joints tightly with sealant backing set at depth specified for sealant. Fill other voids with filler.
- 3.4.16. Install bond breaker tape in bottom of joints in lieu of sealant backing where proper depth cannot be obtained when backing is installed.
- 3.4.17. Maintain correct sealant depth. Sealant depth shall be 1/2 the width of the joint, maximum depth shall be 12.7 mm (1/2"), minimum depth shall be 6 mm (1/4"). Comply with manufacturer's written recommendations.
- 3.4.18. Fillet bead sealant joints to be sized to *Provide* proper contact area with substrates, in accordance with manufacturer's written recommendations.
- 3.4.19. Apply sealants using pressure-operated guns fitted with suitable nozzles in accordance with manufacturer's directions. Apply sealants in such manner as to ensure good adhesion to sides of joints and to completely fill voids in joints.

- 3.4.20. Apply sealants so that surfaces of joints are smooth, full bead, free from ridges, wrinkles, sags, air pockets and embedded impurities. Tool sealant surfaces to produce a smooth surface.
- 3.4.21. Remove droppings and excess sealant as work progresses, before material achieves initial set. Do not use soap and water in tooling.
- 3.4.22. Install sealant materials and primers when surfaces are prepared, and ambient temperature and weather conditions are prevalent, consistent with manufacturer's recommendations. Primer is mandatory for gun applied sealants.
- 3.4.23. Install sealant with exterior face of sealant set back 10 mm (3/8") from face of adjacent materials at building movement joints, unless otherwise indicated.
- 3.4.24. Do not apply sealants to areas where installation of paints, coatings or flooring is in progress. Apply sealants after such work is complete and fully cured.

### **3.5. INTERIOR SEALANT SCHEDULE**

- 3.5.1. Include in work of this section sealants to seal open joints in surfaces exposed to view, and to make building weather-tight and air-tight, as applicable, as indicated, and as otherwise specified, except where specified under the work of other sections.
- 3.5.2. Install sealant to:
  - 3.5.2.1. Movement and control joints on exposed insitu concrete walls
  - 3.5.2.2. Interior control and expansion joints in floor and wall surfaces.
  - 3.5.2.3. Raked out joints at junctions of masonry with concrete walls and columns, and at intersection of masonry walls and partitions where joint reinforcement is installed.
  - 3.5.2.4. Perimeters of exterior and interior door and window frames.
  - 3.5.2.5. Joints at tops of non-load bearing masonry walls at the underside of insitu concrete.
  - 3.5.2.6. Exposed interior control joints in gypsum board.
  - 3.5.2.7. Millwork junctions with walls.
- 3.5.3. Mildew resistant sealant at wet areas:
  - 3.5.3.1. Perimeter joints of wet fixtures such as:
    - (1) Water closets.
    - (2) Janitor sinks.
    - (3) Showers.
  - 3.5.3.2. Wall tile joints, tile to tile at shower corners. Gap between tile backer board and edge of shower base.
  - 3.5.3.3. Counter/wall junctions at countertops.

### **3.6. FIELD QUALITY CONTROL**

- 3.6.1. Conduct quality control in accordance with Section 01 45 00.
  - 3.6.1.1. Field-adhesion testing: Installer to keep daily log of sealant installation recording self-performed field-adhesion test at each elevation of the project and as follows:
    - (1) Record field adhesion testing on digital video camera and submit to Consultant.
    - (2) Document and perform field adhesion testing in accordance with manufacturer's recommended field-adhesion requirements and submit written reports co-signed by sealant manufacturer's representative. Coordinate with Section 01 45 00.
    - (3) Perform 5 field adhesion tests for the first 300 m (1000 lineal feet) and one test in each 300 m (1000 lineal feet) of sealant joint length thereafter. One (1) test per floor height and per elevation is also recommended. When the sealant is used to weatherseal between 2 dissimilar substrates, the sealant adhesion to each side of the joint should be individually tested.
    - (4) Field test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand-Pull Tab, in Appendix X-1 in ASTM C1193-16 and in compliance with manufacturer's specific recommendations.

- (5) Evaluation: In compliance with joint sealant manufacturer, joint sealants tested and not indicating adhesive failure within the substrates are considered satisfactory results. For joint sealants that fail to adhere to the substrate, clean, re-install and then re-test until satisfactory results are obtained.

3.6.1.2. Manufacturer's field review to be in accordance with Section 01 45 00.

3.6.1.3. Provide manufacturer's field service consisting of periodic site visits by manufacturer or their distributor representative for observation of joint sealant application.

### **3.7. ADJUSTING AND CLEANING**

- 3.7.1. Clean off excess sealant or sealant residue adjacent to sealant joint installations as the work progresses by methods approved by joint sealant manufacturer. Do not damage adjacent surfaces with harmful removal techniques and protect finished surfaces beyond those that have been masked. Protect installed sealants during and after final curing from damage resulting during construction. Remove and replace damaged joint sealants.
- 3.7.2. Remove temporary coverings and masking protection from adjacent work areas upon completion. Remove construction debris from the Site on a planned and regular basis.
- 3.7.3. Remove droppings and clean off excess sealant or sealant residue adjacent to sealant joint installations as the work progresses by methods approved by joint sealant manufacturer before material achieves initial set.
- 3.7.4. Do not damage adjacent surfaces with harmful removal techniques and protect finished surfaces beyond those that have been masked.
- 3.7.5. Remove and replace damaged joint sealants.
- 3.7.6. Remove temporary coverings and masking protection from adjacent work areas upon completion.

### **3.8. PROTECTION**

- 3.8.1. Protect installed sealants during and after final curing from damage resulting during construction.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. References
- .4 1.4. Summary
- .5 1.5. Administrative Requirements
- .6 1.6. Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Warranty
- .10 2.1. Manufacturers
- .11 2.2. Regulatory Requirements
- .12 2.3. Performance Criteria
- .13 2.4. Materials
- .14 2.5. Manufactured Units
- .15 2.6. Accessories
- .16 2.7. Fabrication
- .17 2.8. Finishes
- .18 2.9. Hardware Reinforcements And Preparations
- .19 2.10. Frame Anchorage
- .20 2.11. Sizes And Tolerances
- .21 2.12. Hardware Locations
- .22 3.1. Examination
- .23 3.2. Installation
- .24 3.3. Installation - Finishing Hardware
- .25 3.4. Adjusting And Cleaning

### **1.3. REFERENCES**

- 1.3.1. AAMA/WDMA/CSA 101/I.S. 2/A440-17: North American Fenestration Standard /Specification for Windows, Doors and Skylights.
- 1.3.2. ASTM A653/A653M-22: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.3.3. ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- 1.3.4. CSA W59-18: Welded Steel Construction (Metal Arc Welding).
- 1.3.5. CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- 1.3.6. CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).
- 1.3.7. CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 1.3.8. CSDMA Recommended Dimensional Standard for Steel Doors and Frames.
- 1.3.9. CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- 1.3.10. NFPA 80-2007: Fire Doors and Other Opening Protectives.
- 1.3.11. ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
- 1.3.12. ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- 1.3.13. CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
- 1.3.14. CAN/ULC-S105:2016 (R2020): Standard Specification for Fire Door Frames Meeting Performance Required by CAN/ULC-S104.

- 1.3.15. CAN/ULC-S106-15 (R2020): Standard Method for Fire Tests of Window and Glass Block Assemblies.
- 1.3.16. ULC List of Equipment and Materials.

#### **1.4. SUMMARY**

- 1.4.1. Section includes:
  - 1.4.1.1. Metal frames (steel frames, transom frames).
  - 1.4.1.2. Thermally broken metal door frames (thermally broken steel frames).

#### **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Coordination:
  - 1.5.1.1. Cooperate fully with finish hardware distributor's representative during preparation of shop drawings and execution of shop fabrication.
  - 1.5.1.2. Coordinate installation of doors and frames with installation of hardware specified in section 08 71 00.

#### **1.6. SUBMITTALS**

- 1.6.1. Submit required submittals in accordance with Section 01 33 00.
- 1.6.2. Submit copy of NAAMM-HMMA 840-17 standard.
- 1.6.3. Product data sheets:
  - 1.6.3.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.6.4. Shop drawings:
  - 1.6.4.1. Include details of each door and frame type, finish hardware types and locations, frame profiles, door and frame elevations, mitre details, fire protection rating, glazing preparation details and anchor details and locations.
  - 1.6.4.2. Include schedule identifying each unit, with door marks and numbers relating to numbering on the Drawings and in the door schedule.
  - 1.6.4.3. Electrified hardware requirements and preparations shall be clearly indicated on shop drawings.

#### **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Manufacturers:
    - (1) Provide doors and frames manufactured by a firm specializing in the design and production of hollow metal steel doors and frames.
    - (2) Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).

#### **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Store Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 1.8.2. Inspect materials thoroughly upon receipt and report immediately discrepancies, deficiencies and damages, in writing, to supplier.
- 1.8.3. Note damages incurred during shipment on carriers' bill of lading and report immediately, in writing, to supplier.
- 1.8.4. Store materials properly on planks, out of water and covered to protect from damage from adverse weather conditions. Remove wet packaging immediately.
- 1.8.5. Remove wrappings or coverings from doors upon receipt at the Place of the Work, and store in a vertical position, spaced with blocking to permit air circulation between them.

#### **1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.9.2. Extended warranties:
  - 1.9.2.1. Labour, materials, and workmanship covering against twisting, buckling, weld failure and corrosion.
  - 1.9.2.2. Repair or replace steel frames that fail within the specified warranty period.

- 1.9.2.3. Re-install hardware and re-hang repaired or replaced doors.
- 1.9.2.4. Duration: 3 years.

## **2 PRODUCTS**

### **2.1. MANUFACTURERS**

- 2.1.1. Manufacturers having Product considered acceptable for use:
  - 2.1.1.1. All Steel Doors 2000 Limited.
  - 2.1.1.2. Artek Door (1985) Limited.
  - 2.1.1.3. Baron Metal Industries Inc.
  - 2.1.1.4. Daybar Industries Limited.
  - 2.1.1.5. Fleming Door Products Ltd.
  - 2.1.1.6. Gensteel Doors.
  - 2.1.1.7. Metal Door Limited.
  - 2.1.1.8. Trillium Steel Doors Limited.
  - 2.1.1.9. Vision Hollow Metal Limited.
- 2.1.2. Substitution Procedures: Refer to Section 01 25 00.

### **2.2. REGULATORY REQUIREMENTS**

- 2.2.1. Fire Rated Frame Assemblies: Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104 and CAN/ULC-S106.

### **2.3. PERFORMANCE CRITERIA**

- 2.3.1. Exterior Hollow Metal Frames:
  - 2.3.1.1. To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
    - (1) Air Leakage of Glazed Frames (ASTM E283): < 1.0 L/s•m<sup>2</sup> @ 75 Pa.
    - (2) Assembly Thermal Transmittance (ANSI/NFRC 100): As noted on Drawings.
    - (3) Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200): As noted on Drawings.
- 2.3.2. Fire rating requirements:
  - 2.3.2.1. Fire rated labelled frames:
    - (1) tested in accordance with CAN/ULC-S104-15 and listed by a nationally recognized agency having a factory inspection service and shall be constructed as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
  - 2.3.2.2. Install fire labelled steel frame products in accordance with NFPA 80-2022, except where indicated otherwise

### **2.4. MATERIALS**

- 2.4.1. Sheet Steel:
  - 2.4.1.1. Fabricated from tensioned levelled steel to ASTM A924/A924M-20, galvanized to ASTM A653/A653M, Commercial Steel CS, Type B.
  - 2.4.1.2. Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, and other defects.
  - 2.4.1.3. Equivalent minimum base steel thicknesses for gauges shall be in accordance with Appendix 1 of CSDMA "Recommended Specifications for Commercial Steel Door and Frame Products".
  - 2.4.1.4. Finish: Galvanneal coating designation ZF120 (A40).
  - 2.4.1.5. Bituminous Coating: Fibrous asphalt emulsion.
  - 2.4.1.6. Air Sealant Foam: As specified in Section 07 27 36.
  - 2.4.1.7. Touch-up Primer: Zinc-rich alkyd primer.
  - 2.4.1.8. Welding Materials: To CSA W59.
- 2.4.2. Adhesives:
  - 2.4.2.1. Heat resistant, single component, polyurethane reactive (water) hot melt, thermoset adhesive.

- 2.4.2.2. Rigid insulation cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
- 2.4.2.3. Lock seam doors: fire resistant, resin reinforced polychloroprene, high viscosity sealant-adhesive.
- 2.4.3. Primer: rust inhibitive for touch-up.

## **2.5. MANUFACTURED UNITS**

- 2.5.1. Exterior Hollow Metal Multi-Opening Frame:
  - 2.5.1.1. Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; two-piece construction with continuous thermal break; sizes and configurations as indicated on Drawings;
    - (1) Basis of Design:
      - (A) Thermal Series Frame by Fleming Door Products Ltd.
- 2.5.2. Interior Hollow Metal Door Frame:
  - 2.5.2.1. Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes as indicated on Drawings;
    - (1) Basis of Design:
      - (A) F-Series Frame by Fleming Door Products Ltd.
- 2.5.3. Interior Hollow Metal Double Egress Door Frame:
  - 2.5.3.1. Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes as indicated on Drawings;
    - (1) Basis of Design:
      - (A) DE-Series Frame by Fleming Door Products Ltd.
- 2.5.4. Interior Hollow Metal Multi-Opening Frame:
  - 2.5.4.1. Sheet steel, 1.60 mm nominal coated thickness, with paintable galvanneal finish; fire rating as scheduled; sizes and configurations as indicated on Drawings;
    - (1) Basis of Design:
      - (A) MN- or ST-Series Frame by Fleming Door Products Ltd.

## **2.6. ACCESSORIES**

- 2.6.1. Reinforcements:
  - 2.6.1.1. Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
    - (1) Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
    - (2) Hinge Reinforcements: 3.51 mm.
    - (3) Door Closer and Holder Reinforcements: 2.74 mm.
- 2.6.2. Anchors:
  - 2.6.2.1. Cold-rolled commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
    - (1) T-Strap Type: 1.30 mm.
    - (2) Stirrup-strap Type: 50 x 250 mm size, 1.60 mm thick.
    - (3) Jamb Floor Type: 1.60 mm thick.
    - (4) Stud Type: 1.00 mm thick.
- 2.6.3. Jamb Spreaders:
  - 2.6.3.1. 1.00 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.
- 2.6.4. Mortar Guard Boxes:
  - 2.6.4.1. 0.84 mm nominal coated thickness, cold-rolled commercial quality steel, regular galvanneal finish.
- 2.6.5. Glazing Stops:
  - 2.6.5.1. Rolled steel channel shape, butted corners; prepared for countersink style tamper-proof screws.
- 2.6.6. Threshold Saddles:
  - 2.6.6.1. Thermally broken aluminum threshold; 273x3AFG Thermal Barrier Saddle by Pemko.

- 2.6.7. Bumpers:
  - 2.6.7.1. Resilient rubber.
- 2.6.8. Thermal Break:
  - 2.6.8.1. Rigid neoprene or polyvinyl chloride (PVC) extrusion.

## **2.7. FABRICATION**

- 2.7.1. General: Applicable to frames, transom panel frames, sidelights, and window assemblies.
- 2.7.2. Exterior and thermally broken frames:
  - 2.7.2.1. Fabricated from:
    - (1) 1.60 mm (0.063") 16 gauge steel.
    - (2) 1.98 mm (0.078") 14 gauge steel for frames noted as heavy duty.
- 2.7.3. Fabricate frames as welded units.
- 2.7.4. Conform to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- 2.7.5. Fabricate fire-rated frames to CAN/ULC-S105.
- 2.7.6. Provide fire labels to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- 2.7.7. Fabricate frames with fixed mullions, to profiles shown, with hardware reinforcement plates welded in place.
- 2.7.8. Welding
  - 2.7.8.1. Perform welding to CSA W59.
  - 2.7.8.2. Fill open joints, seams, and depressions with filler or by continuous brazing or welding.
  - 2.7.8.3. Grind exposed welds smooth and flush, to true sharp arrises and profiles.
  - 2.7.8.4. Sand welds to a smooth, true, uniform finish.
- 2.7.9. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame.
- 2.7.10. Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.
- 2.7.11. Reinforce frames wider than 1 220 mm with roll formed steel channels fitted tightly into frame head, flush with top.
- 2.7.12. Fit frames with channel or angle spreaders, minimum two per frame, to ensure proper frame alignment. Install stiffener plates to spreaders between frame trim where required to prevent bending of trim and to maintain alignment when setting and during construction.
- 2.7.13. Provide adjustable T-strap anchors in frames to be installed in masonry openings, spaced at 600 mm OC.
- 2.7.14. Where frames are required to terminate at finished floor, Provide plates for anchorage to floor slab.
- 2.7.15. Prepare interior door frames for single stud door silencers, as follows:
  - 2.7.15.1. Single Door Frames: Three on strike jamb.
  - 2.7.15.2. Double Egress Door Frames: Two on head for each door leaf.
- 2.7.16. Fabricate frames and screens to accommodate scheduled glazing. Secure glazing stops to frames with counter sunk oval head sheet metal screws.
- 2.7.17. Prepare frames for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components.
- 2.7.18. Thermally-Broken Frames:
  - 2.7.18.1. Provide wall and floor anchors suitable for installation, purpose made not to permit thermal conductivity.
  - 2.7.18.2. Do not fix sections together with screws, grommets or other thermally conductive fastening device.
  - 2.7.18.3. Provide full frame width drip caps.
  - 2.7.18.4. Conform to accepted Shop Drawings.
- 2.7.19. Where required due to *Site* access, when required for co-ordination or installation, or shipping limitations, frame product shall be fabricated in sections for splicing in the field.



- 2.7.19.1. Field spliced jambs, heads and sills shall be provided with 1.60 mm (0.063") 16 gauge steel splice plates securely welded into one section, extending 100 mm (4") minimum each side of splice joint.
- 2.7.19.2. Field splices at closed sections (mullions or center rails) shall be 1.60 mm (0.063") 16 gauge steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100 mm (4") minimum into closed sections when assembled.
- 2.7.19.3. Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the installation company responsible for installation after assembly.
- 2.7.20. On factory assembled frame product, provide 2 temporary steel shipping bars welded to the base of the jambs or mullions to maintain alignment during shipping and handling. Remove shipping bars prior to anchoring of frames to floor.
- 2.7.21. Each door opening shall be prepared for single stud door silencers. Silencers shall be shipped loose for installation by installer, after finish painting.
  - 2.7.21.1. Single interior doors: 3 at strike jamb.
  - 2.7.21.2. Pair of interior doors: 2 at header.
  - 2.7.21.3. Dutch doors: 4 at strike jamb.
  - 2.7.21.4. Weather-stripped doors: None required.
  - 2.7.21.5. Sound, light, or smoke sealed doors: None required.
  - 2.7.21.6. Transom panels: 2 at each jamb.
- 2.7.22. Prior to shipment, mark each frame with an identification number as shown on the approved submittal drawings.
- 2.7.23. Provide mullions and transom bars of closed construction type. For fixed condition, attach members to frame with butt-welded joints. For removable condition, attach members with removable mullion anchors.
- 2.7.24. Conceal fastenings unless otherwise indicated.
- 2.7.25. Fasten removable stops by counter-sunk Phillips head screws at approximately 225 mm (9") on centre symmetrically spaced on stop length.
- 2.7.26. Anchor frames to floor by 1.60 mm (0.063") 16 gauge thick angle clips, welded to frame and provide with 2 holes for floor anchorage.
- 2.7.27. Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- 2.7.28. Protect strike and hinge reinforcements using guard boxes welded to frames at masonry construction.
- 2.7.29. Reinforce head of frames wider than 1220 mm (48").
- 2.7.30. Brace frame units to prevent distortion in shipment and protect finish.
- 2.7.31. Where removable mullions provided under this section are indicated, head or transom mullion shall be reinforced. *Provide* loose mounting bracket/shoe mechanical fasteners and installation instructions.
- 2.7.32.

## **2.8. FINISHES**

- 2.8.1. Paintable Galvanneal Coating:
  - 2.8.1.1. To ASTM A653/A653M, Grade ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.
- 2.8.2. Regular Galvanneal Coating:
  - 2.8.2.1. To ASTM A653/A653M, Grade ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

## **2.9. HARDWARE REINFORCEMENTS AND PREPARATIONS**

- 2.9.1. Frame product shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- 2.9.2. Frame products shall be factory blanked and reinforced only for mortised hardware that is not fully templated.

- 2.9.3. Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware are required frame product shall be reinforced only, with drilling and tapping done by field installation.
- 2.9.4. Templated holes 12.7 mm (1/2") diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by installation on Site. Templated holes less than 12.7 mm (1/2") diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- 2.9.5. Hinge reinforcements shall be 3.51 mm (0.138") 10 gauge steel minimum, high frequency type shall be provided.
- 2.9.6. Frames shall be prepared for 114 mm (4.5") standard weight hinges minimum unless otherwise indicated.
- 2.9.7. Doors and frames in excess of 2450 mm (96") rabbet height shall be prepared for 114 mm (4.5") heavy weight 4.6 mm (0.180") hinges minimum.
- 2.9.8. Lock, strike and flush bolt reinforcements shall be 1.60 mm (0.063") 16 gauge steel minimum, with extruded tapped holes that Provide equivalent number of threads as 2.74 mm (0.108") 12 gauge.
- 2.9.9. Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 1.30 mm (0.051") 18 gauge steel minimum.
- 2.9.10. Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts.
- 2.9.11. Provide hardware mortises on perimeter frame members to be grouted in masonry or concrete partitions with 0.84 mm (0.033") 22 gauge steel grout guards.
- 2.9.12. Electrified hardware:
  - 2.9.12.1. Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and inter-connected with CSA approved 12.7 mm (1/2") diameter conduit and connectors.
  - 2.9.12.2. Refer to electrical documents for general electrical rough-in details. At door locations indicated in electrical documents as requiring rough-in only of electrical (ie. where no electrically or electronically operated hardware is specified in the hardware schedule), Provide enclosures, boxes, and conduit to permit future installation of devices without removal of grout, demounting of frames, or installation of exposed conduits.
  - 2.9.12.3. Frames:
    - (1) Frames with electrified devices shall include electrical connection boxes sized to accommodate devices specified in Section 08 71 00. At time of frame manufacture, electrical connection boxes shall be supplied by Divisions 26, 27 and 28 for installation into frame by work of this section.
    - (2) Frame electrical connection boxes shall be positioned flush to edge of frame face return. Clearance shall be maintained to allow wall material to be consistently applied for length of frame member. Frame connection boxes shall be welded in place and positioned to allow necessary clearance for electrical *Subcontractor* to install conduit and connection components, with conduit layout in a manner that takes conduit up to ceiling in an uninterrupted configuration and to accommodate wire installation.

## **2.10. FRAME ANCHORAGE**

- 2.10.1. Frame products shall be provided with anchorage appropriate to floor, wall and frame construction.
- 2.10.2. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb.
- 2.10.3. Frame products installed in steel stud partitions shall be provided with 1.00 mm (0.039") 20 gauge steel snap-in or "Z" stud type anchors.

- 2.10.4. Frame products for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 1.34 mm (0.053") (16 gauge) minimum or 3.96 mm (0.156") diameter wire. Straps shall be not less than 50 mm (2") x 254 mm (10") in size, corrugated and/or perforated.
- 2.10.5. Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4 mm (1/4") diameter, located not more than 150 mm (6") from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 1.60 mm (0.063") 16 gauge anchor bolt guides.
- 2.10.6. Anchor bolts and expansion shell anchors for the above preparations shall be provided by the installation company.
- 2.10.7. Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 1.60 mm (0.063") 16 gauge steel floor anchors. Each anchor shall be provided with 2 holes for mounting to the floor and shall be securely welded to the inside of the jamb profile.
- 2.10.8. On sidelights or windows exceeding 3 m (9'-10") in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 2.74 mm (0.108") 12 gauge steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on Site, by the Subcontractor responsible for installation.

## **2.11. SIZES AND TOLERANCES**

- 2.11.1. Manufacturing tolerances on formed frame profiles shall be  $\pm 0.8$  mm ( $\pm 0.031$ ") for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbets shall be  $\pm 1.6$  mm ( $\pm 0.063$ ") and  $\pm 0.4$  mm ( $\pm 0.016$ ") respectively. Hardware cut-out dimensions shall be as per template dimensions,  $\pm 0.4$  mm ( $+0.015$ ").

## **2.12. HARDWARE LOCATIONS**

- 2.12.1. Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in this section.
- 2.12.2. Top of upper hinge preparation for 114.3 mm (4.5") hinges shall be located 180 mm (7.5") down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm (4.5") hinges shall be located 310 mm (12.625") from finished floor as defined in paragraph 2.8 of this section. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts.
- 2.12.3. Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm (40-5/16") from finished floor. Strikes for deadlocks shall be centered at 1220 mm (48") from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.
- 2.12.4. Preparations not noted above shall be as per hardware manufacturer's templates.
- 2.12.5. Hardware preparation tolerances shall comply with the ANSI A115 standards.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Provide necessary grounds, bracing and strapping for fitting and adequate for securing of the work.
- 3.1.2. Cooperate with work of other sections to ensure fastenings set by others are provided and located, their work is installed to their specifications and that those responsible for back priming are notified in sufficient time for them to schedule work.

### 3.2. **INSTALLATION**

- 3.2.1. Install Products to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 3.2.2. Install Products plumb, square, aligned, without twist and at correct elevation in accordance with NAAMM-HMMA 840-1708.
- 3.2.3. Fire labelled product shall be installed in accordance with NFPA 80-2022.
- 3.2.4. Install threshold saddles across bottom of exterior door frames.
- 3.2.5. Frame product installation tolerances:
  - 3.2.5.1. Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be  $\pm 1.6$  mm ( $\pm 1/16$ ").
  - 3.2.5.2. Squareness tolerance, measured through a line 90 from one jamb at the upper corner of the product, to the opposite jamb, shall be  $\pm 1.6$  mm ( $\pm 1/16$ ").
  - 3.2.5.3. Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be  $\pm 1.6$  mm ( $\pm 1/16$ ").
  - 3.2.5.4. Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be  $\pm 1.6$  mm ( $\pm 1/16$ ").
- 3.2.6. Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install temporary wood spreaders at mid-point of frame rabbet height to maintain frame widths. Remove wood spreaders after product has been built-in.
- 3.2.7. Provide vertical support at center of head for openings exceeding 1250 mm (48") in width.
- 3.2.8. Secure anchorages and connections to adjacent construction.
- 3.2.9. Coordinate with masonry and wallboard construction for anchor placement.
- 3.2.10. Execute installation and assembly using skilled forces under supervision of a competent joinery foreperson.
- 3.2.11. Fill designated frames set in masonry walls and partitions solid with non-shrink grout or mortar, as specified in Section 04 05 10.
- 3.2.12. Connect exterior frames to air/vapour barrier transition sheet membranes to achieve an airtight seal.
- 3.2.13. Fill gaps between exterior frames and adjacent wall assemblies with air sealant foam, as specified in Section 07 27 36.
- 3.2.14. Seal exterior gaps between frames and walls with joint sealant as specified in Section 07 92 21.
- 3.2.15. Seal interior gaps between frames and walls with joint sealant as specified in Section 07 92 23.
- 3.2.16. Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
- 3.2.17. Remove grout or other bonding material from products immediately following installation.
- 3.2.18. Provide appropriate anchorage for floor and wall construction. Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite the strike jamb. On each jamb, install 2 anchors for openings up to and including 1525 mm (60") high and install 1 anchor for each additional height of 760 mm (30") of height or fraction thereof, except as indicated below. Frames placed in previously placed concrete, masonry or structural steel shall be Provided with anchors located not more than 150 mm (6") from top and bottom of each jamb, and intermediate anchors at 660 mm (26") on centre maximum.
- 3.2.19. Secure frames set in previously constructed concrete or masonry openings by countersunk expansion bolts at same centres as for adjustable Tee wall anchors. Reinforce frame at fastening location to prevent indentation of frame by fastening device.
- 3.2.20. Fill and grind smooth "punch and dimpled" frame installations.
- 3.2.21. Prior to Site touch-up, exposed surfaces of galvaneal steel to be finished shall be cleaned to remove foreign matter. Refer to paint manufacturers recommendations for additional information and requirements of Section 09 91 00.
- 3.2.22. Touch-up exposed field welds shall be finished to present a smooth uniform surface and with a rust inhibitive primer.

- 3.2.23. Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation, and handling shall be with a rust inhibitive primer.
- 3.2.24. Finish paint in accordance with Section 09 91 00.
- 3.2.25. Install door silencers.
- 3.2.26. Adequately fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.
- 3.2.27. Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- 3.2.28. Make allowance for deflection to ensure structural loads are not transmitted to frames.
- 3.2.29. Adjust operable parts for correct clearances and function.

### **3.3. *INSTALLATION - FINISHING HARDWARE***

- 3.3.1. Install finishing hardware in accordance with ANSI A115.1G-1994, manufacturers' templates and instructions, and Section 08 71 00.

### **3.4. *ADJUSTING AND CLEANING***

- 3.4.1. Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- 3.4.2. Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by Supplier's instructions.
- 3.4.3. Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.
- 3.4.4. Clean hardware after installation in accordance with Supplier's instructions.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Sections
- .4 1.4. References
- .5 1.5. Administrative Requirements
- .6 1.6. Product Data
- .7 1.7. Shop Drawings
- .8 1.8. Quality Assurance
- .9 1.9. Delivery, Storage And Handling
- .10 1.10. Warranty
- .11 2.1. Manufacturers
- .12 2.2. Regulatory Requirements
- .13 2.3. Performance Criteria
- .14 2.4. Materials
- .15 2.5. Manufactured Units
- .16 2.6. Fabrication
- .17 2.7. Finishes
- .18 2.8. Hardware Reinforcements And Preparations
- .19 2.9. Sizes And Tolerances
- .20 2.10. Hardware Locations
- .21 3.1. Examination
- .22 3.2. Installation
- .23 3.3. Tolerances
- .24 3.4. Installation - Finishing Hardware
- .25 3.5. Adjusting And Cleaning

### **1.3. RELATED SECTIONS**

- 1.3.1. Section 08 12 13 - Hollow Metal Frames.
- 1.3.2. Section 08 71 00 - Door Hardware.
- 1.3.3. Section 08 80 00 - Glazing.
- 1.3.4. Section 09 90 00 - Painting and Coating.

### **1.4. REFERENCES**

- 1.4.1. AAMA/WDMA/CSA 101/I.S. 2/A440-17: North American Fenestration Standard / Specification for Windows, Doors and Skylights.
- 1.4.2. ASTM A653/A653M-22: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.4.3. ASTM E283-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- 1.4.4. CSA W59-18: Welded Steel Construction (Metal Arc Welding).
- 1.4.5. CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- 1.4.6. CSDMA Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction).
- 1.4.7. CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 1.4.8. CSDMA Recommended Dimensional Standard for Steel Doors and Frames.
- 1.4.9. CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.

- 1.4.10. NFPA 80-2007: Fire Doors and Other Opening Protectives.
- 1.4.11. ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors.
- 1.4.12. ANSI/NFRC 200-2017: Procedure for Determining Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- 1.4.13. CAN/ULC-S104-15 (R2020): Standard Method for Fire Tests of Door Assemblies.
- 1.4.14. CAN/ULC-S702.1-14 (R2019): Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- 1.4.15. CAN/ULC-S705.1-18: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.
- 1.4.16. ULC List of Equipment and Materials.

## **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Coordination:
  - 1.5.1.1. Cooperate fully with finish hardware distributor's representative during preparation of shop drawings and execution of shop fabrication.
  - 1.5.1.2. Coordinate installation of doors with installation of hardware specified in section 08 71 00.

## **1.6. PRODUCT DATA**

- 1.6.1. Submit Product data as specified in Section 01 33 00.
- 1.6.2. Submit copy of NAAMM-HMMA 840-17 standard.
- 1.6.3. Product Data:
  - 1.6.3.1. Manufacturer's standard data sheets, indicating materials, component sizes and thicknesses, and available finishes.

## **1.7. SHOP DRAWINGS**

- 1.7.1. Submit Shop Drawings as specified in Section 01 33 00.
- 1.7.2. Shop Drawings:
  - 1.7.2.1. Include details of each door and frame type, finish hardware types and locations, frame profiles, door and frame elevations, mitre details, fire protection rating, glazing preparation details and anchor details and locations.
  - 1.7.2.2. Include schedule identifying each unit, with door marks and numbers relating to numbering on the Drawings and in the door schedule.
  - 1.7.2.3. Electrified hardware requirements and preparations shall be clearly indicated on shop drawings.

## **1.8. QUALITY ASSURANCE**

- 1.8.1. Qualifications:
  - 1.8.1.1. Manufacturers:
    - (1) Provide doors manufactured by a firm specializing in the design and production of hollow metal steel doors.
    - (2) Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).

## **1.9. DELIVERY, STORAGE AND HANDLING**

- 1.9.1. Store hollow metal doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 1.9.2. Inspect materials thoroughly upon receipt and report immediately discrepancies, deficiencies and damages, in writing, to supplier.
- 1.9.3. Note damages incurred during shipment on carriers' bill of lading and report immediately, in writing, to supplier.
- 1.9.4. Store materials properly on planks, out of water and covered to protect from damage from adverse weather conditions. Remove wet packaging immediately.
- 1.9.5. Remove wrappings or coverings from doors upon receipt at the Place of the Work, and store in a vertical position, spaced with blocking to permit air circulation between them.

## **1.10. WARRANTY**

- 1.10.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.10.2. Extended warranties:
  - 1.10.2.1. Labour, materials, and workmanship for work of this section.
  - 1.10.2.2. Repair or replace steel doors and frames that fail within the specified warranty period.
  - 1.10.2.3. Re-install hardware and re-hang repaired or replaced doors.
  - 1.10.2.4. Duration: 3 years.

## **2 PRODUCTS**

### **2.1. MANUFACTURERS**

- 2.1.1. Manufacturers having Product considered acceptable for use:
  - 2.1.1.1. All Steel Doors 2000 Limited.
  - 2.1.1.2. Artek Door (1985) Limited.
  - 2.1.1.3. Baron Metal Industries Inc.
  - 2.1.1.4. Daybar Industries Limited.
  - 2.1.1.5. Fleming Door Products Ltd.
  - 2.1.1.6. Gensteel Doors.
  - 2.1.1.7. Metal Door Limited.
  - 2.1.1.8. Trillium Steel Doors Limited.
  - 2.1.1.9. Vision Hollow Metal Limited.
- 2.1.2. Substitution Procedures: Refer to Section 01 25 00.

### **2.2. REGULATORY REQUIREMENTS**

- 2.2.1. Fire Rated Doors:
  - 2.2.1.1. Permanently labelled to NFPA standards for fire rated class indicated, as tested to CAN/ULC-S104.

### **2.3. PERFORMANCE CRITERIA**

- 2.3.1. Exterior Hollow Metal Doors:
- 2.3.2. To AAMA/WDMA/CSA 101/I.S. 2/A440, and meeting the following performance criteria:
  - 2.3.2.1. Air Leakage of Glazed Doors (ASTM E283):  $< 5.1 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ .
  - 2.3.2.2. Assembly Thermal Transmittance (ANSI/NFRC 100):
    - (1) Glazed Doors:  $U < 3.94 \text{ W/m}^2 \text{ degrees C}$ .
    - (2) Opaque Doors:  $U < 2.56 \text{ W/m}^2 \text{ degrees C}$ .
- 2.3.3. Assembly Solar Heat Gain Coefficient (ANSI/NFRC 200):  $\text{SHGC} < 0.40$ .
- 2.3.4. Fire rating requirements:
  - 2.3.4.1. Fire rated labelled doors:
    - (1) Tested in accordance with CAN/ULC-S104-15 and listed by a nationally recognized agency having a factory inspection service and shall be constructed as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
  - 2.3.4.2. Install fire labelled steel door products in accordance with NFPA 80-2022, except where indicated otherwise

### **2.4. MATERIALS**

- 2.4.1. Sheet Steel:
  - 2.4.1.1. Fabricated from tensioned levelled steel to ASTM A924/A924M-20, galvanized to ASTM A653/A653M, Commercial Steel CS, Type B.
  - 2.4.1.2. Steel shall be free of scale, pitting, coil breaks, surface blemishes, buckles, waves, and other defects.
  - 2.4.1.3. Equivalent minimum base steel thicknesses for gauges shall be in accordance with Appendix 1 of CSDMA "Recommended Specifications for Commercial Steel Door and Frame Products".
  - 2.4.1.4. Finish: Galvanneal coating designation ZF120 (A40).
- 2.4.2. Door Core Materials:



- 2.4.2.1. Polyisocyanurate:
  - (1) Closed cell, faced board, thermal value: RSI 2.17 (R12.3) minimum, conforming to ASTM C1289-22.
- 2.4.2.2. Semi-Rigid Board Insulation:
  - (1) To CAN/ULC-S702.1, Type 1; mineral fibre semi-rigid board having an aged thermal resistance of RSI > 0.68 per 25 mm of thickness.
- 2.4.2.3. Honeycomb Filler:
  - (1) Structural small cell kraft paper honeycomb; 36.3 kg per ream; 16.5 kg/m<sup>3</sup> minimum density; sanded to required thickness.
- 2.4.3. Reinforcements:
  - 2.4.3.1. Commercial quality steel, regular galvanneal finish, nominal coated thicknesses as follows:
    - (1) Flush Bolt, Lock and Strike Reinforcement: 1.60 mm
    - (2) Hinge Reinforcements: 3.51 mm.
    - (3) Door Closer and Holder Reinforcements: 2.74 mm.
- 2.4.4. Touch-up Primer:
  - 2.4.4.1. Zinc-rich alkyd primer.
- 2.4.5. Welding Materials:
  - 2.4.5.1. To CSA W59.

## **2.5. MANUFACTURED UNITS**

- 2.5.1. Exterior Hollow Metal Flush Doors: 45 mm thick, constructed as follows:
  - 2.5.1.1. Door Faces:
    - (1) Sheet steel panels, 1.60 mm, 16 gauge steel, nominal coated thickness, flush design, paintable galvanneal finish.
  - 2.5.1.2. Vertical Steel Stiffeners:
    - (1) Sheet steel profiles, 0.76 mm nominal coated thickness, 22 mm deep, interlocking design, regular galvanneal finish.
  - 2.5.1.3. Door Edges:
    - (1) Mechanically interlocked.
  - 2.5.1.4. Glazing Stops:
    - (1) Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - 2.5.1.5. Core:
    - (1) Polyisocyanurate.
  - 2.5.1.6. Manufacturer and Product Name Basis of Design:
    - (1) Trio-E by Fleming Door Products Ltd.
- 2.5.2. Interior Hollow Metal Flush Doors - Heavy Duty, Fire Rated: 45 mm thick, fire rating as scheduled; constructed as follows:
  - 2.5.2.1. Door Faces:
    - (1) Sheet steel panels, 1.60 mm, 16 gauge steel, nominal coated thickness, flush design, paintable galvanneal finish.
  - 2.5.2.2. Vertical Steel Stiffeners:
    - (1) Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvanneal finish.
  - 2.5.2.3. Door Edges:
    - (1) Continuously welded.
  - 2.5.2.4. Glazing Stops:
    - (1) Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - 2.5.2.5. Core:
    - (1) Semi-rigid board insulation.
- 2.5.3. Interior Hollow Metal Flush Doors - Heavy Duty, Non-Rated: 45 mm thick; constructed as follows:
  - 2.5.3.1. Door Faces:

- (1) Sheet steel panels, 1.60 mm, 16 gauge steel, nominal coated thickness, flush design, paintable galvalume finish.
- 2.5.3.2. Vertical Steel Stiffeners:
  - (1) Sheet steel profiles, 1.00 mm nominal coated thickness, 44 mm deep, interlocking design, regular galvalume finish.
- 2.5.3.3. Door Edges:
  - (1) Continuously welded.
- 2.5.3.4. Glazing Stops:
  - (1) Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
- 2.5.3.5. Core:
  - (1) Semi-rigid board insulation.
- 2.5.4. Interior Hollow Metal Flush Doors - Medium Duty, Fire Rated: 45 mm thick, fire rating as scheduled; constructed as follows:
  - 2.5.4.1. Door Faces:
    - (1) Sheet steel panels, 1.30 mm nominal coated thickness, flush design, paintable galvalume finish.
  - 2.5.4.2. Door Edges:
    - (1) Tack welded or mechanically interlocked.
  - 2.5.4.3. Glazing Stops:
    - (1) Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - 2.5.4.4. Core:
    - (1) Semi-rigid board insulation.
- 2.5.5. Interior Hollow Metal Flush Doors - Medium Duty, Non-Rated: 45 mm thick; constructed as follows:
  - 2.5.5.1. Door Faces:
    - (1) Sheet steel panels, 1.30 mm nominal coated thickness, flush design, paintable galvalume finish.
  - 2.5.5.2. Door Edges:
    - (1) Tack welded or mechanically interlocked.
  - 2.5.5.3. Glazing Stops:
    - (1) Rolled steel channel shape, butted corners; prepared for countersunk tamper-proof screws.
  - 2.5.5.4. Core:
    - (1) Honeycomb filler.

## **2.6. FABRICATION**

- 2.6.1. Fabricate doors to CSDMA Recommended Specifications for Commercial Steel Door and Frame Products.
- 2.6.2. Provide fire labels on fire rated doors to CSDMA Canadian Fire Labeling Guide for Commercial Steel Door and Frame Products.
- 2.6.3. Provide continuous faces free from joints, tool markings and abrasions; with hardware reinforcement plates welded in place.
- 2.6.4. Fabricate of composite metal face construction with each face formed from flush sheet steel without visible seams, free of scale, pitting, coil brakes, buckles and waves.
- 2.6.5. Formed edges shall be true and straight with minimum radius for the thickness of steel used.
- 2.6.6. Lock and hinge edges shall be bevelled 3 mm in 50 mm (1/8" in 2") unless hardware or door swing dictates otherwise.
- 2.6.7. Top and bottom of doors shall be provided with inverted, recessed, 1.60 mm (0.063") 16 gauge steel end channels, welded to each face sheet at 50 mm (2") on centre maximum.
- 2.6.8. Prior to shipment, mark each door with an identification number as shown on the approved submittal drawings.
- 2.6.9. Exterior doors shall be provided with factory installed flush PVC top caps. Fire labelled exterior doors shall be provided with factory installed flush steel top caps.

- 2.6.10. Welding
  - 2.6.10.1. Perform welding to CSA W59.
  - 2.6.10.2. Fill open joints, seams, and depressions with filler, or by continuous brazing, or welding.
  - 2.6.10.3. Grind exposed welds smooth and flush, to true sharp arrises and profiles.
  - 2.6.10.4. Sand welds to a smooth, true, uniform finish.
- 2.6.11. Glazing:
  - 2.6.11.1. Fabricate doors to accommodate scheduled glazing. Secure glazing stops to doors with counter sunk oval head sheet metal screws.
  - 2.6.11.2. For glazing materials up to and including 8 mm (5/16") thick, doors shall be provided with 0.81 mm (0.032") (20 gauge) steel glazing trim and snap-in glazing stops.
  - 2.6.11.3. For glazing materials greater than 8 mm (5/16") thick, doors shall receive 0.81 mm (0.032") (20 gauge) steel trim and screw fixed glazing stops. Screws shall be #6 x 32 mm (1-1/4") oval head Tek TM (self-drilling) type at 305 mm (12") on centre maximum.
  - 2.6.11.4. Glazing trim and stops shall be accurately fitted (within 0.39 mm (0.015") tolerance), butted at corners, with removable glazing stops located on the 'push' side of the door.
- 2.6.12. Prepare doors for scheduled door hardware and building security system devices. Blank, mortise, reinforce, drill and tap components.
- 2.6.13. Reinforce and stiffen designated doors with vertical steel stiffeners spaced at 152 mm OC, continuous for full height of door, laminated as follows:
  - (1) Exterior Doors:
    - (A) To inner door face.
  - (2) Interior Doors:
    - (A) To both door faces.
- 2.6.14. Completely fill door cores with specified core materials.
- 2.6.15. Reinforce door edges with channel reinforcing.
- 2.6.16. Bevel stiles minimum 3 mm.
- 2.6.17. Continuously Welded Door Edges:
  - 2.6.17.1. Continuously weld door edge seams to a smooth, seamless appearance.
- 2.6.18. Tack Welded Door Edges:
  - 2.6.18.1. Tack weld door edge seams at 150 mm OC and fill remaining seam with body filler.
- 2.6.19. Mechanically Interlocked Door Edges:
  - 2.6.19.1. Mechanically interlock door edge seams with hemmed vertical edges.
- 2.6.20. Provide flush top edge and bottom closures on exterior doors, sealed watertight.
- 2.6.21. Fabricate closing stiles of paired doors as indicated or scheduled.
- 2.6.22. Provide 2.36 mm (0.093") (12 gauge) 'flat' or 'Z' astragal at meeting stiles of pairs of doors for fire rating according to the manufacturers listing and as scheduled.
- 2.6.23. Where indicated in schedule, prepare doors and panels for installation of fire-rated door grilles. If required to meet door grille manufacturer's rated design, provide reinforcement around door grille opening.

## **2.7. FINISHES**

- 2.7.1. Paintable Galvanneal Coating:
  - 2.7.1.1. To ASTM A653/A653M, Grade ZF120; wiped zinc-iron coating, with streak-free matte grey appearance.
- 2.7.2. Regular Galvanneal Coating:
  - 2.7.2.1. To ASTM A653/A653M, Grade ZF75; wiped zinc-iron coating, with streak-free matte grey appearance.

## **2.8. HARDWARE REINFORCEMENTS AND PREPARATIONS**

- 2.8.1. Door product shall be blanked, reinforced, drilled and tapped at the factory for fully templated mortise hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- 2.8.2. Door products shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- 2.8.3. Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware are required frame product shall be reinforced only, with drilling and tapping done by field installation.
- 2.8.4. Templated holes 12.7 mm (1/2") diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by installation on Site. Templated holes less than 12.7 mm (1/2") diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- 2.8.5. Hinge reinforcements shall be 3.51 mm (0.138") 10 gauge steel minimum, high frequency type shall be provided.
- 2.8.6. Doors and frames in excess of 2450 mm (96") rabbet height shall be prepared for 114 mm (4.5") heavy weight 4.6 mm (0.180") hinges minimum.
- 2.8.7. Lock, strike and flush bolt reinforcements shall be 1.60 mm (0.063") 16 gauge steel minimum, with extruded tapped holes that Provide equivalent number of threads as 2.74 mm (0.108") 12 gauge.
- 2.8.8. Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 1.30 mm (0.051") 18 gauge steel minimum.
- 2.8.9. Reinforcements are not required for surface applied hardware supplied with thru-bolts and spacers or sex-bolts.
- 2.8.10. Provide hardware mortises on perimeter frame members to be grouted in masonry or concrete partitions with 0.84 mm (0.033") 22 gauge steel grout guards.
- 2.8.11. Electrified hardware:
  - 2.8.11.1. Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and inter-connected with CSA approved 12.7 mm (1/2") diameter conduit and connectors.
  - 2.8.11.2. Refer to electrical documents for general electrical rough-in details. At door locations indicated in electrical documents as requiring rough-in only of electrical (ie. where no electrically or electronically operated hardware is specified in the hardware schedule), Provide enclosures, boxes, and conduit to permit future installation of devices without removal of grout, demounting of frames, or installation of exposed conduits.
  - 2.8.11.3. Doors:
    - (1) Doors with electrified devices shall be manufactured to include wire raceway in door panel to accommodate electrified devices, such as electric hinge, power transfer units, electrified locks, electrified door closures and electrified exit devices. Construction of raceways shall Provide a continuous conduit or channel between entry and exit points to accommodate wire installation after door manufacture.
    - (2) Doors with electrified locks may require extended space to accommodate plug-type connection components or wire collection space. Coordinate with work of Section 08 71 00 and obtain hardware templates for electrified hardware clearly indicated on reviewed shop drawings and prior to door manufacture.

## **2.9. SIZES AND TOLERANCES**

- 2.9.1. Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of  $\pm 1.6$  mm (+0.063").

- 2.9.2. Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of  $\pm 1.2$  mm ( $\pm 0.047$ ").
- 2.9.3. Unless finishing hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3 mm ( $1/8$ ") clearance at jambs and head. A clearance of 19 mm ( $3/4$ ") between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be  $\pm 1.2$  mm ( $\pm 0.047$ ").

## **2.10. HARDWARE LOCATIONS**

- 2.10.1. Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in this section.
- 2.10.2. Top of upper hinge preparation for 114.3 mm (4.5") hinges shall be located 180 mm (7.5") down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3 mm (4.5") hinges shall be located 310 mm (12.625") from finished floor as defined in paragraph 2.8 of this section. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts.
- 2.10.3. Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033 mm (40-5/16") from finished floor. Strikes for deadlocks shall be centered at 1220 mm (48") from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer's templates.
- 2.10.4. Push and/or pulls on doors shall be centered 1070 mm (42") from finished floor.
- 2.10.5. Preparations not noted above shall be as per hardware manufacturer's templates.
- 2.10.6. Hardware preparation tolerances shall comply with the ANSI A115 standards.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Provide necessary grounds, bracing and strapping for fitting and adequate for securing of the work.
- 3.1.2. Cooperate with work of other sections to ensure fastenings set by others are provided and located, their work is installed to their specifications and that those responsible for back priming are notified in sufficient time for them to schedule work.

### **3.2. INSTALLATION**

- 3.2.1. Install doors to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- 3.2.2. Fire labelled product shall be installed in accordance with NFPA 80-2022.
- 3.2.3. Adjust operable parts for correct clearances and function.
- 3.2.4. Prior to Site touch-up, exposed surfaces of galvaneal steel to be finished shall be cleaned to remove foreign matter. Refer to paint manufacturers recommendations for additional information and requirements of Section 09 91 00.
- 3.2.5. Touch-up exposed surfaces that have been scratched or otherwise marred during shipment, installation, and handling shall be with a rust inhibitive primer.
- 3.2.6. Finish paint in accordance with Section 09 91 00.
- 3.2.7. Install door silencers.
- 3.2.8. Adequately fasten units and secure in place with concealed fixings wherever possible. Include grounds and furring where required.
- 3.2.9. Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- 3.2.10. Make allowance for deflection to ensure structural loads are not transmitted to frames.
- 3.2.11. Adjust operable parts for correct clearances and function.

### **3.3. TOLERANCES**

- 3.3.1. Diagonal Distortion:  $< 1.5$  mm measured with straight edge, corner to corner.

**3.4. INSTALLATION - FINISHING HARDWARE**

- 3.4.1. Install finishing hardware in accordance with ANSI A115.1G-1994, manufacturers' templates and instructions, and Section 08 71 00.

**3.5. ADJUSTING AND CLEANING**

- 3.5.1. Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- 3.5.2. Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by Supplier's instructions.
- 3.5.3. Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.
- 3.5.4. Clean hardware after installation in accordance with Supplier's instructions.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Administrative Requirements
- .6 1.6. Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Site Conditions
- .10 1.10 Warranty
- .11 2.1. Performance/Design Requirements
- .12 2.2. Products
- .13 2.3. Accessories
- .14 2.4. Fabrication - General
- .15 2.5. Fabrication - Doors
- .16 2.6. Factory Finish
- .17 3.1. Examination
- .18 3.2. Installation
- .19 3.3. Installation - Doors
- .20 3.4. Tolerances
- .21 3.5. Adjustment And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section includes:  
1.3.1.1. Solid core doors with wood veneer, non-rated.

### **1.4. REFERENCES**

- 1.4.1. Architectural Woodwork Standards 2nd Edition 2014, published jointly by the Architectural Woodwork Institute (AWI), the Architectural Woodwork Manufacturer Association of Canada (AWMAC), and the Woodwork Institute (WI).
- 1.4.2. ANSI/WDMA I.S. 1A-13 Industry Standard for Architectural Wood Flush Doors
- 1.4.3. CAN/ULC S-104-10 Standard Method for Fire Tests of Door Assemblies
- 1.4.4. NFPA 80-13 Standard for Fire Doors and Other Opening Protectives
- 1.4.5. NFPA 252-12 Standard Method of Fire Tests of Door Assemblies
- 1.4.6. ITS/Warnock Hersey Mark for Fire Door Test Certification
- 1.4.7. ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- 1.4.8. ASTM E413 - 10 Classification for Rating Sound Insulation.
- 1.4.9. FSC – Forest Stewardship Council Standard for Chain of Custody Certification, FSC-STD-40-004, V2-1.

### **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Coordination:
  - 1.5.1.1. Cooperate fully with finish hardware distributor's representative during preparation of shop drawings and execution of shop fabrication.
- 1.5.2. Definitions:
  - 1.5.2.1. Exposed surfaces:
    - (1) Surfaces visible when doors are opened, backs of hinged doors and edges of hinged doors exposed when opened.

- 1.5.2.2. Pre-machined:
  - (1) Factory prepared cut-outs for hardware and glazing. Site trimming of work will not be permitted, except trimming of door height.
- 1.5.2.3. Forest Stewardship Council (FSC):
  - (1) FSC is an international not-for-profit membership based organization geared to find solutions to the problems created by bad forestry practices and to reward good forest management.
- 1.5.2.4. Certificates of Chain-of-Custody:
  - (1) Certificates signed by manufacturer's certifying that wood used to make products was obtained from forests certified by an
- 1.5.2.5. FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Certificates shall include evidence that Vendor or Supplier is certified for chain-of-custody by an FSC-accredited certification body.

## 1.6. SUBMITTALS

- 1.6.1. Submit required submittals in accordance with Section 01 33 00.
- 1.6.2. Product data sheets:
  - 1.6.2.1. Submit manufacturer's *Product* data sheets for *Products* proposed for use in the work of this section.
- 1.6.3. Shop drawings:
  - 1.6.3.1. Indicate door location using numbering system per door schedule, size, and hand of each door, elevation of each door type; undercuts, bevelling, construction type core and edge construction not covered in product data; and special blocking requirements.
  - 1.6.3.2. Indicate dimensions and locations of factory machining criteria for hardware, extent of hardware blocking.
  - 1.6.3.3. Indicate dimensions and locations of cut-outs including trim for openings.
  - 1.6.3.4. Indicate door face finish requirements including veneer matching.
  - 1.6.3.5. Indicate doors to be factory finished and finish requirements.
  - 1.6.3.6. Dimensions and locations of cutouts, mortises and holes for hardware.
  - 1.6.3.7. Fire ratings for fire doors.
  - 1.6.3.8. Jointing, fastening and related items.
  - 1.6.3.9. Electrified hardware requirements and preparations shall be clearly indicated on shop drawings.
- 1.6.4. Verification samples:
  - 1.6.4.1. Submit 3 sets of samples minimum 300 mm (12") x 300 mm (12") of veneers showing full range of grain variation, finish and patterns proposed for wood specified.
    - (1) Submit samples as many times as required until approved by *Consultant*. First submission to include one set of samples per Consultant request plus one set lighter in tone and one set darker in tone.
    - (2) Submit cut-away sample of each type of door, to show stile and rail construction, core, cross banding, door face finish and edges.
    - (3) Submit solid lumber frames for light openings, minimum 150 mm (6") long, for each material, type and finish required.

## 1.7. QUALITY ASSURANCE

- 1.7.1. Perform work to Premium Grade in accordance with the Grade requirements specified in the Architectural Woodwork Standards 2<sup>nd</sup> Edition 2014, or as herein otherwise specified
- 1.7.2. Qualification in accordance with Section 01 45 00.
  - 1.7.2.1. Manufacturer: Five (5) years prior to award of contract.
    - (1) Manufacturer shall be a member in good standing of the Architectural Woodwork Institute or the Architectural Woodwork Manufacturers Association of Canada or the Woodwork Institute.
- 1.7.3. Source Limitations, Doors:
  - 1.7.3.1. Obtain doors through one source from a single manufacturer.



- 1.7.4. Certificates:
  - 1.7.4.1. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
  - 1.7.4.2. Declaring doors meet WDMA and North American Architectural Woodwork Standards 4.0 (NAAWS).
- 1.7.5. Composite wood material, including plywood, particleboard, fibreboard and laminate adhesives to have no added urea-formaldehyde (NAUF).

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- 1.8.2. Door numbers shall be marked with door numbers used on shop drawings in the top hinge cavity created by the machining for hinges.
- 1.8.3. Mark each door on top and bottom rail with opening number used on Shop Drawings.
- 1.8.4. Ensure complete protection of edges and finishes during shipment to the job site.
- 1.8.5. Store doors flat at the place of work in piles with bottom face on bottom of pile. Protect from moisture by placing water resistant material under skids supporting piles. Cover top of piles and provide air at sides of piles.
- 1.8.6. Deliver the wood doors only after the building is closed and dry and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period. Do not receive the doors in a damp area. Do not drag the doors on the ground, floor or across one another.

## **1.9. SITE CONDITIONS**

- 1.9.1. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

## **1.10. WARRANTY**

- 1.10.1. Warrant work of this Section against defects and deficiencies for period of five (5) years.
  - 1.10.1.1. Commencing at the date of Substantial Performance. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Owner and at no additional cost.
  - 1.10.1.2. The warranty includes re-installation of hardware, re-hanging and fitting, and finishing.
  - 1.10.1.3. Defects shall include, but not be limited to, delaminating, telegraphing of core construction in face veneers exceeding 0.254 mm (0.01") in a 75 mm (3") span, and warp exceeding 3 mm (1/8") in a 1066 mm (42") x 2133 mm (84") section.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Design, fabricate, and install work of this section in accordance with the Building Code and requirements of all other governing authorities.
- 2.1.2. Performance duty level:
  - 2.1.2.1. Door shall meet the requirements of ANSI/WDMA I.S. 1A-13 for interior flush doors, and ANSI/WDMA I.S. 6A for stile and rails doors, Heavy Duty performance level.
- 2.1.3. Quality of finish:
  - 2.1.3.1. Comply with the requirements for Premium Grade in accordance with the North American Architectural Woodwork Standards 4.0 (NAAWS).
- 2.1.4. Sound Transmission Class (STC):
  - 2.1.4.1. Doors indicated with an STC rating shall be in accordance with ASTM E90. Unless otherwise indicated, accessories required for acoustical rating

compliance shall be Provided by door manufacturer; accessories to approval by the Consultant.

- 2.1.5. STC rating: Refer to Door Schedule.

## **2.2. PRODUCTS**

- 2.2.1. Solid particleboard core, veneer faced, wood door, painted finish to North American Architectural Woodwork Standards 4.0 (NAAWS), Section 9 and as follow:  
2.2.1.1. Type PC-5, particle board core.
- 2.2.2. Solid lumber core door with stiles and rails bonded to the core and abrasive planed flat prior to application of the faces, stain finish to North American Architectural Woodwork Standards 4.0 (NAAWS), Section 9 and as follow:  
2.2.2.1. Type SLC-5.
- 2.2.3. Hollow honeycomb core; veneer faced, construction to North American Architectural Woodwork Standards latest Editio4.0 (NAAWS), Section 9 as follow:  
2.2.3.1. Type IHC-7, honeycomb cell core.
- 2.2.4. Wood Veneer: To North American Architectural Woodwork Standards 4.0 (NAAWS), Grade B for painted finish, equal width, uniform, clean, without open defects, patches, plastic repair, minimum 1.5 mm (1/16") thick after sanding.  
2.2.4.1. Specie: Birch, unless otherwise indicated.  
2.2.4.2. Cut: Plain sliced, unless otherwise indicated.  
2.2.4.3. Match between Veneer Leaves: Book match.  
2.2.4.4. Assembly of Veneer Leaves on Door Faces: Balance match.  
2.2.4.5. Doors in pair or sets: Pair match for doors hung in same opening or separated only by mullions.  
2.2.4.6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 3 m or more.
- 2.2.5. Door Edge:  
2.2.5.1. Edge Type A: Minimum 11 mm (7/16") thick, closed grain, solid hardwood edge.
- 2.2.6. Hardware Blocking, Non-Rated Doors: 150 mm glued block or structural composite lumber in particleboard core doors as follows:
- 2.2.7. Adhesive: Waterproof type, suitable for specific end use.  
2.2.7.1. Any adhesives, sealants or paints used onsite must have low VOC content.

## **2.3. ACCESSORIES**

- 2.3.1. Louvers  
2.3.1.1. Provide wood louvers as detailed on the elevations  
2.3.1.2. Provide metal Louvers for fire-rated doors
- 2.3.2. Glazing Stops  
2.3.2.1. Non-rated glazing stops: Wood species to match door finish.  
2.3.2.2. Fire-rated glazing stops: Wood species to match door finish
- 2.3.3. Glass and Glazing in Wood Doors:  
2.3.3.1. Glass and glazing for non-rated and fire rated to be provided by and installed by manufacture. Refer to Section 08 80 00.
- 2.3.4. Meeting edges for fire-rated door pairs  
2.3.4.1. Metal edges
- 2.3.5. Applied Moulding  
2.3.5.1. As selected from manufacturers standard profiles  
2.3.5.2. Affixed to door without the use of nails or staples.
- 2.3.6. Finishing hardware: In accordance with Section 08 71 01-Hardware Schedule.

## **2.4. FABRICATION - GENERAL**

- 2.4.1. Pre-machine work in factory.

- 2.4.2. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 2.4.2.1. Clearances: Provide 3.2 mm (1/8") maximum at heads, jambs, and between pairs of doors. Provide 3.2 mm (1/8") maximum from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, 6.4 mm (1/4") maximum from bottom of door to top of threshold unless otherwise indicated. Reseal top and bottom edges of wood doors if they are cut to fit, in accordance with door manufacturer's instructions and warranty requirements.
- 2.4.3. Bevel non-fire-rated doors 3-1/2 degrees (1/8" in 2") at lock and hinge edges.
- 2.4.4. Factory machine doors for finish hardware that is not surface applied. Do not machine for surface hardware. Locate hardware to comply with Door and Hardware Institute (DHI) Recommended Locations for Architectural Hardware for Flush Wood Doors (latest edition). Comply with final reviewed hardware schedules, door and frame shop drawings and hardware templates.
  - 2.4.4.1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- 2.4.5. Electrified hardware:
  - 2.4.5.1. Where electrically or electronically operated hardware is specified on the schedules or details or the final approved schedule and templates provided by the hardware supplier, doors with electrified devices shall be manufactured to include wire raceway in door panel to accommodate electrified devices, such as electric hinge, power transfer units, electrified locks, electrified door closures and electrified exit devices. Construction of raceways shall provide a continuous conduit or channel between entry and exit points to accommodate wire.
  - 2.4.5.2. Electrified hardware will be terminated with ElectroLynx or similar system approved by the Consultant, quick connect Molex connectors provided by Section 08 71 00 Finishing Hardware.

## **2.5. FABRICATION - DOORS**

- 2.5.1. Paint Grade Doors, Solid Core: Particleboard core, 5 ply construction in conformity with ANSI A208.1, full length stiles and rails bonded to core. North American Architectural Woodwork Standards 4.0 (NAAWS) Type A edge, and as indicated
- 2.5.2. Wood Veneer Door, Stained Finish, Solid structural composite lumber core, Type SCLC-5, structural composite lumber core, construction in conformity with North American Architectural Woodwork Standards 4.0 (NAAWS) Section 9.
- 2.5.3. Wood Veneer Doors, Stained Finish, Hollow Honeycomb Core; Type IHC-7, honeycomb cell core, construction to North American Architectural Woodwork Standards 4.0 (NAAWS) Section 9.
- 2.5.4. Completely seal wood edges and edges of cuts-outs in shop for doors schedule to receive paint finish. Apply sealer in accordance with the manufacturer's printed instructions.
- 2.5.5. Bevel edges of single acting doors 3 mm on lock side and 1.6 mm on hinge side.
- 2.5.6. Undercut doors for carpet in the plant.

## **2.6. FACTORY FINISH**

- 2.6.1. Natural wood faced wood doors: Factory finish in accordance North American Architectural Woodwork Standards 4.0 (NAAWS), system 11 - Polyurethane Catalyzed Factory finish work scheduled to match approved control sample. Apply finish in accordance with manufacturer's approved methods using approved equipment to cut outs, and exposed surfaces. Unfinished work will be listed as deficiencies.
- 2.6.2. Seal and finish exposed and semi-exposed surfaces, opaque catalysed lacquer colour and sheen as selected by the Consultant.

- 2.6.3. Clean surfaces free of dust before applying successive coat. Carefully sand with even strokes to provide perfect, scratch free surface.

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Verify that opening sizes and tolerances are acceptable and ready to receive this work.
- 3.1.2. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.
- 3.1.3. Provide necessary grounds, bracing and strapping for fitting and adequate for securing of the work.
- 3.1.4. Cooperate with work of other sections to ensure fastenings set by others are provided and located, their work is installed to their specifications and that those responsible for back priming are notified in sufficient time for them to schedule work.

#### **3.2. INSTALLATION**

- 3.2.1. Install work of this Section plumb, square, true, rigid and secure. Conceal fastenings in the finished work unless otherwise indicated on final reviewed shop drawings and in accordance with manufacturer's printed instructions.
- 3.2.2. Execute installation and assembly at the Place of the Work using skilled forces under supervision of a competent joinery foreperson.
- 3.2.3. Install work plumb, level and straight, and fasten it securely to backing to support itself and anticipated superimposed loads.
- 3.2.4. Build into construction as indicated, or specified in other sections of this specification, or both.
- 3.2.5. Adequately fasten units and secure them in place with concealed fixings wherever possible. Include grounds and furring where required.
- 3.2.6. Provide even margins between doors and jambs and doors and finished floor as follows:
  - 3.2.6.1. Hinge side: 3 mm.
  - 3.2.6.2. Latchside and head: 3 mm.
  - 3.2.6.3. Finished floor for non-rated assemblies: 12 mm.
  - 3.2.6.4. Finished floor for rated assemblies: 6 mm.
- 3.2.7. Allowable tolerances on deformation: Conforming with North American Architectural Woodwork Standards 4.0 (NAAWS).
- 3.2.8. Coordinate installation of wood doors in metal frames with Section 08 11 13.

#### **3.3. INSTALLATION - DOORS**

- 3.3.1. Install wood doors after finishing of walls.
- 3.3.2. Align and fit doors in frames with uniform clearances as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 3.3.2.1. Clearances: Provide 3.2 mm (1/8") maximum at heads, jambs, and between pairs of doors. Provide 3.2 mm (1/8") maximum from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, 6.4 mm (1/4") maximum from bottom of door to top of threshold unless otherwise indicated. Reseal top and bottom edges of wood doors if they are cut to fit, in accordance with door manufacturer's instructions and warranty requirements.
- 3.3.3. Seal top and bottom edges of wood doors are re-sealed if they are cut to fit, in accordance with door manufacturer's warranty requirements.
- 3.3.4. Pilot drill screw and bolt holes.

#### **3.4. TOLERANCES**

- 3.4.1. Conform to the Architectural Woodwork Standards 2nd Edition 2014 standards and testing methods for warp, cup, bow, and telegraphing.

**3.5. ADJUSTMENT AND CLEANING**

- 3.5.1. Adjust doors to swing freely, smoothly and easily, to remain stationary at any point, to close evenly and tightly against stops without binding, and to latch positively when doors are closed with moderate force.
- 3.5.2. Adjust hardware so that latches and locks operate smoothly and without binding, and closers act positively with the least possible resistance in use. Lubricate hardware if required by Supplier's instructions.
- 3.5.3. Ensure that doors equipped with closers operate to close doors firmly against anticipated wind and building air pressure, and to enable doors to be readily opened as suitable for function, location and traffic.
- 3.5.4. Clean hardware after installation in accordance with Supplier's instructions.
- 3.5.5. Sand and clean woodwork to leave free from finish defects in any exposed part.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Related Requirements
- .5 1.5. References
- .6 1.6. Submittals
- .7 1.7. Closeout Submittals
- .8 1.8. Delivery, Storage, and Handling
- .9 2.1. Performance/Design Requirements
- .10 2.2. Manufacturers
- .11 2.3. Access door performance Requirements
- .12 2.4. Architectural Access Panels drywall application
- .13 2.5. Architectural Access Panels ATC application
- .14 3.1. Examination
- .15 3.2. Access Doors
- .16 3.3. Access Panels for Drywall or atc
- .17 3.4. Installation
- .18 3.5. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
- 1.3.1.1. Fire rated and non-fire rated access doors and frame units
  - 1.3.1.2. Architectural access panels.

### **1.4. RELATED REQUIREMENTS**

- 1.4.1. Section 20 05 00 – Common Work Results for Mechanical.
- 1.4.2. Section 26 05 00 – Common Work Results for Electrical.

### **1.5. REFERENCES**

- 1.5.1. UL/ULC Fire Resistance Directory.

### **1.6. SUBMITTALS**

- 1.6.1. Submit required submittals in accordance with Section 01 33 00.
- 1.6.2. Product data sheets:
- 1.6.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.6.3. Shop drawings:
- 1.6.3.1. Indicate locations, types, and sizes of access panels.
  - 1.6.3.2. Submit catalogue details for each type of door illustrating profiles, dimensions, and methods of assembly.
  - 1.6.3.3. If access door is to be installed in a fire rated assembly, shop drawing to indicate the rating.
- 1.6.4. Before commencing installation of work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange the work to suit.

## **1.7. CLOSEOUT SUBMITTALS**

- 1.7.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.7.2. Operation and maintenance data:
  - 1.7.2.1. Submit operation and maintenance data for cleaning and maintenance of finishes for incorporation into manual.
  - 1.7.2.2. Submit manufacturer's ordering information for additional keys.
- 1.7.3. At time of instruction of Owner's operating staff, hand-over and obtain signed receipt for four sets of each type of key used to lock access doors in secure areas.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Deliver, store and handle materials in accordance with Section 01 60 00, and with manufacturer's written instructions.
- 1.8.2. Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- 1.8.3. Store and protect access doors from nicks, scratches, and blemishes.
- 1.8.4. Leave protective coatings in place until final cleaning of building.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Materials for fire resistance rated construction shall conform to requirements of indicated fire resistance rated assembly.

### **2.2. MANUFACTURERS**

- 2.2.1. Acudor Acorn.
- 2.2.2. Baird – ABCO.
- 2.2.3. Mifab.
- 2.2.4. Stelpro - Type 700.
- 2.2.5. Watts acquired LeHage in August 1993.
- 2.2.6. Watts Water Technologies (Canada) Inc.

### **2.3. ACCESS DOOR PERFORMANCE REQUIREMENTS**

- 2.3.1. Construction:
  - 2.3.1.1. Access doors shall be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch.
  - 2.3.1.2. Steel, prime coated, flush mounted with 180 degree opening door, round safety corners, concealed hinges, plaster lock and anchor straps.
  - 2.3.1.3. Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.
  - 2.3.1.4. Door construction to be minimum 14 gauge with 16 gauge frame.
  - 2.3.1.5. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.
  - 2.3.1.6. Provide for plaster surfaces recessed 16 gauge prime painted steel door and welded metal lath, ready to take plaster.
  - 2.3.1.7. Provide for tiled surfaces, recessed type 16 gauge primed steel doors to suit type of tile used.
  - 2.3.1.8. Provide other access doors of welded 12 gauge steel, factory prime coated, flush type.
- 2.3.2. Materials:
  - 2.3.2.1. Select finish for tiled/marble surfaces. Confirm with the architect. In a pinch, choose brushed satin.
  - 2.3.2.2. Tiled or marble surfaces: stainless steel with brushed satin finish.
  - 2.3.2.3. Other areas: prime coated steel.
  - 2.3.2.4. Constructed of stainless steel in areas finished with tile or marble surfaces.

- 2.3.2.5. Constructed of stainless steel with neoprene gasketed door in damp and high humidity areas.
- 2.3.2.6. Latching:
- 2.3.2.7. Fitted with screwdriver operated latches.
- 2.3.2.8. In areas subject to security risks (Public Corridors, Public Washrooms, etc.), fitted with keyed cylinder locks with similar keys.
- 2.3.3. Fire Ratings:
  - 2.3.3.1. When access doors are required to be located in fire rated walls, floor and ceilings, provide ULC tested and labelled units rated in accordance with the structures being penetrated i.e. 3/4 hour, 1 hour, 2 hour.
- 2.3.4. Minimum dimensions (or as indicated otherwise on drawings):
  - 2.3.4.1. 600 mm by 600 mm (24 in by 24 in) for personnel entry.
  - 2.3.4.2. 450 mm by 450 mm (18 in by 18 in) for hand entry.
  - 2.3.4.3. 300 mm by 300 mm (12 in by 12 in) for viewing only.
  - 2.3.4.4. Size doors to allow adequate operating/maintenance clearance for devices.
  - 2.3.4.5. Access doors shall be, wherever possible, of a standard size for each application.
- 2.3.5. Example products based on Acudor Acorn:
  - 2.3.5.1. Concealed plaster: PS-5010.
  - 2.3.5.2. Concealed drywall: BP58 Bauco Plus Access Doors'.
  - 2.3.5.3. Existing drywall: BP58 Bauco Plus Access Doors'.
  - 2.3.5.4. Fire-rated: FW-5050/FB-5060 to match assembly.

## **2.4. ARCHITECTURAL ACCESS PANELS DRYWALL APPLICATION**

- 2.4.1. Acceptable Product:
  - 2.4.1.1. Acudor Acorn 'BP58 Bauco Plus Access Doors'.
  - 2.4.1.2. Bauco Products Incorporated (APS - Access Panel Solutions) 'Bauco Plus II' access panels.
- 2.4.2. Description:
  - 2.4.2.1. Maximum gap between door and frames: 1.5 mm (1/16").
  - 2.4.2.2. Door:
    - (1) Aluminum frame with gypsum board inlay and structural nylon corner elements. Door is to be taped and finished to match surrounding surface.
  - 2.4.2.3. Frame:
    - (1) Recessed aluminum frame provides edge similar to drywall bead against which wall or ceiling surface can be finished. Finish edge flush with gypsum board in accordance with trim tolerances specified in Section 09 29 00.
  - 2.4.2.4. Materials:
    - (1) Extruded Aluminum Alloy 6063-T6. 12.7 mm (1/2") or 15.9 mm (5/8") gypsum board inlay, thickness shall be consistent with thickness of surrounding gypsum board. Fibreglass reinforced nylon. Zinc-plated screws, stainless steel springs and retaining wire.
  - 2.4.2.5. Hinge:
    - (1) concealed, two point pin hinge, non corroding, as suggested by manufacturer.
  - 2.4.2.6. Latch:
    - (1) Screwdriver cam latch.
  - 2.4.2.7. Finish:
    - (1) Finish gypsum board to Level 4 in accordance with Section 09 29 00.
    - (2) Paint completed installation in accordance with Section 09 91 00.

## **2.5. ARCHITECTURAL ACCESS PANELS ATC APPLICATION**

- 2.5.1. Acceptable Product:
  - 2.5.1.1. 'Best Access Doors' Metal Access Door For Acoustical Tile



- 2.5.1.2. Model Number: BAC-WB-AT
- 2.5.2. Description:
  - 2.5.2.1. Door:
    - (1) 14. ga. steel. Door is recessed to accept up to 1" thick acoustical tile.
  - 2.5.2.2. Frame
    - (1) 16 ga. steel.
  - 2.5.2.3. Hinge:
    - (1) Continuous piano hinge opens 180°, will be placed on long side of door unless otherwise requested.
  - 2.5.2.4. Latches:
    - (1) Flush, stainless steel cam operated with screwdriver. Latches are positioned opposite hinge as well as top and bottom on larger sizes.
  - 2.5.2.5. Finish:
    - (1) Baked white enamel over rust-inhibiting phosphate treated steel.
- 2.5.3. Location;
  - 2.5.3.1. Shall be provided at all ATC ceilings underneath mechanical unit to be serviced.
  - 2.5.3.2. Size of Panel shall suit the unit filter removal.

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Verification of Conditions:
  - 3.1.1.1. Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access door installation in accordance with manufacturer's written instructions.
- 3.1.2. Lay-in type ceiling tiles, properly marked, with lamacoid label on adjacent ceiling carrying channel, may serve as access panels. Where ceiling tiles are required to be clipped, provide the appropriate access clips.
- 3.1.3. Before commencing installation of work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange the work to suit.
- 3.1.4. Confirm exact access door dimensions and locations with the Consultant prior to ordering and prior to commencing installation. Arrange work to suit.

#### **3.2. ACCESS DOORS**

- 3.2.1. Locations to be reviewed and confirmed by Consultant.
- 3.2.2. Rigidly secure frames to furring or framing systems.

#### **3.3. ACCESS PANELS FOR DRYWALL OR ATC**

- 3.3.1. Locations to be reviewed and confirmed by Consultant.
- 3.3.2. Install before drywall has been taped and finished.
- 3.3.3. Fasten frame to drywall with standard drywall fasteners.

#### **3.4. INSTALLATION**

- 3.4.1. Access doors are to be installed by the trade responsible for the particular type of construction in which the doors are required.
- 3.4.2. Delete content in square brackets for new construction projects. Leave in for renovation projects.
- 3.4.3. Provide access doors for concealed valves, dampers, junction boxes, equipment, etc.
- 3.4.4. Provide access doors wherever equipment, valves, dampers, control devices, junction boxes, pull boxes, etc., are concealed behind walls or inaccessible ceilings.
- 3.4.5. Provide access doors to give access to all valves, cleanouts, strainers, duct access doors, and other mechanical devices which may need maintenance or repair which are concealed in inaccessible construction.

- 3.4.6. Access doors shall match wall and ceiling finishes.
- 3.4.7. Access doors in gypsum ceiling shall be recessed type.
- 3.4.8. Locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
- 3.4.9. Supply access doors, and make arrangements and pay for installation by trade in whose work they occur.
- 3.4.10. Size and locate access doors in applied tile, block, or in glazed or unglazed structural tile to suit joint patterns.
- 3.4.11. Access doors in ceilings, where acoustic tile is applied to plaster or gypsum board, to be dish type designed to receive tile insert.
- 3.4.12. Access doors are not required in removable ceilings. Provide coloured marking devices after completion of ceilings, at one corner of each panel below point requiring access. Colour code markers to show service or device above.
- 3.4.13. Provide access doors at locations where equipment requires inspection, service, maintenance, or adjustment, including but not limited to the following:
  - 3.4.13.1. Expansion joints.
  - 3.4.13.2. Plumbing cleanouts.
  - 3.4.13.3. Dampers.
  - 3.4.13.4. Fire dampers.
  - 3.4.13.5. Air valves.
  - 3.4.13.6. Air terminal units.
  - 3.4.13.7. Valves.
  - 3.4.13.8. Heating or cooling coils.
  - 3.4.13.9. Junction and pull boxes for power wiring or control wiring.
  - 3.4.13.10. Any concealed electrical devices.

### **3.5. PROTECTION**

- 3.5.1. Protect installed products and components from damage during construction.
- 3.5.2. Repair damage to adjacent materials caused by access door installation.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Closeout Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, and Handling
- .8 2.1. Performance/Design Requirements
- .9 2.2. Materials
- .10 2.3. Four-Fold Metal Doors
- .11 2.4. Motorized Operation
- .12 2.5. Fabrication
- .13 3.1. Examination
- .14 3.2. Electrical Wiring
- .15 3.3. Installation – General
- .16 3.4. Adjusting and Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Four-fold metal doors; motorized.
- 1.3.2. All costs associated with the work of this Section shall be included in the *Contract Price*.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this Section.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Include details of each door and frame type, hardware types and locations, frame profiles, door and frame elevations, anchor details and locations.
  - 1.4.3.2. Include schedule identifying each unit, with door marks and numbers relating to numbering on the Drawings and in the door schedule.
  - 1.4.3.3. Indicate materials, operating mechanisms, required clearances and electrical connections

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals.

### **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. Manufacturers: Doors shall be manufactured by a firm with a minimum of 10 years' experience in the fabrication and installation of specified doors.
    - (1) Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and

fabrication requirements specified, and include a list of 5 projects of similar design and complexity completed within the past 5 years.

- 1.6.1.2. Installers / applicators / erectors: Installation of doors shall be performed by the authorized representative of the manufacturer.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Package or crate, and brace Products to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Exterior door construction shall be designed to withstand wind load in accordance with the requirements of the Ontario Building Code.

### **2.2. MATERIALS**

- 2.2.1. General:
- 2.2.1.1. Single-source responsibility: *Provide* doors, tracks, motors, and accessories from one manufacturer for each type of door. *Provide* secondary components from source acceptable to manufacturer of primary components.
- 2.2.2. Steel:
- 2.2.2.1. Structural steel: ASTM A36/A36M.  
(1) Hot dip galvanizing: for irregular sections, conforming to CAN/CSA G164-M92, minimum zinc coating of 600 g/m<sup>2</sup> (21 oz. /ft<sup>2</sup>).
- 2.2.2.2. Steel sheets: Steel sheets of commercial quality, complying with ASTM A36/A36M cold-rolled steel sheet, or ASTM A1011/A1011M-10 hot-rolled steel sheet.  
(1) Zinc coated sheet steel: sheet steel to ASTM A653/A653M-11 with coating designation Z275 (G90) to ASTM A924/A924M-14.
- 2.2.3. Hardware: Door manufacturer's standard heavy-duty hardware components, galvanized.
- 2.2.4. Fasteners:
- 2.2.4.1. Zinc-coated steel.

### **2.3. FOUR-FOLD METAL DOORS**

- 2.3.1. Manufacturers/Acceptable Products:
- 2.3.1.1. Door Engineering and Manufacturing Company, tel: 1-800-959-1352.
- 2.3.1.2. Acceptable *Product*:
- (1) Door; complete with glazing panels: 'FF300 Series' as supplied by Northern Dock Systems Inc. or equivalent.
- 2.3.2. Construction:
- 2.3.2.1. Door assembly shall be fully welded minimum 2.5 mm (0.1") 11-gauge structural steel tube framing with sheet steel facing on the exterior and interior faces, hot- dipped galvanized after door fabrication.
- 2.3.2.2. Steel sheeting shall be formed on vertical edges with no visible welds on interior or exterior panel faces.  
(1) Face sheets fabricated from:  
(A) 1.5 mm (0.06") 16-gauge steel.
- 2.3.2.3. Frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 3 mm in 6000 mm (1/8" in 20').
- 2.3.2.4. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
- 2.3.2.5. Door panels thickness: 50 mm (2") thick minimum.
- 2.3.2.6. Insulation:  
(1) Fibreglass
- 2.3.2.7. Door finish:

- (1) All steel shall be painted with standard factory applied gray oxide primer.  
Finish paint shall be factory applied: Ral Color to be selected by Architect.
- 2.3.3. Operating hardware:
- 2.3.3.1. Hardware shall include guide tracks and brackets, trolleys, guides, not less than 3 pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation.
- 2.3.3.2. Jamb hinges shall be dual shear and have 2 thrust bearings and 2 needle bearing.
- 2.3.3.3. Fold hinges shall be dual shear with 2 thrust bearings.
- 2.3.3.4. Bearings shall be completely concealed within hinge barrels.
- 2.3.3.5. Hinge pins shall be non-removable, minimum 19 mm (3/4") diameter hardened steel.
- 2.3.3.6. Trolleys to be equipped with nylon, bronze or ball bearing rollers.
- 2.3.4. Weatherstripping:
- 2.3.4.1. Material shall be adjustable and readily replaceable and Provide a substantially weathertight installation.
- 2.3.4.2. Weatherstripping at and bottom shall be 1.6 mm (1/16") cloth inserted neoprene.
- 2.3.4.3. Weatherstripping shall be retained continuously.
- 2.3.4.4. Perimeter weatherstripping: Jamb and head weatherstripping, 1.6 mm (1/16") cloth-inserted neoprene bulb or closed cell neoprene.
- 2.3.5. Glazing panels:
- 2.3.5.1. Vision panels: *Provide* vision panels of type, size, shape and location as noted on the Drawings.
- (1) Glazing type: 25mm, Sealed, insulated, tempered, grey tinted units, with Low E coating on 2nd surface – Pilkington Energy Advantage.
- (2) Provide Bird-Friendly dots in accordance with *Contract Documents*.

## **2.4. MOTORIZED OPERATION**

- 2.4.1. Motorized operation:
- 2.4.1.1. Door opening speed: 0.6096 mm/s (2 fps).
- 2.4.1.2. Each four-fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
- 2.4.1.3. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.
- 2.4.1.4. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity.
- 2.4.1.5. Power supply: 3 phase 230 VAC, 60 Hertz, unless otherwise indicated.
- 2.4.1.6. Electric controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Control circuits shall not exceed a nominal 110 volts.
- (1) Controls shall include a self diagnostic programmable logic controller with digital message display and input LED. Controller shall include programmable close time delays and maximum open and close run-time timers.

- (2) Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
  - (3) Enclosures shall be NEMA 4 with programmable door logic controller, VFD for Speed Control, O/C/S Pushbuttons, Auto/Hand selector switch and power disconnect.
  - (4) Pushbuttons for each door shall have one momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
  - (5) Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
- 2.4.1.7. Safety edges: Electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
- 2.4.1.8. Photo eyes: One interior and one exterior mounted photo eye (sender/receiver type) with mounting brackets. Photo eyes shall be NEMA 4.
- 2.4.1.9. Remote control units:
- (1) Provide radio receiver and single button remote control units.
  - (B) Quantity; remote control units: as directed by the *Consultant*.
- 2.4.1.10. Wiring: Door manufacturer shall supply controls only. The *Contractor* shall ensure that the electrical *Subcontractor* installs controls and furnish and install conduits and wiring for *Site* power and control wiring.

## 2.5. FABRICATION

- 2.5.1. Fabricate work of this section with materials, and with component dimensions and gauges, reinforcing, attached anchors and fastenings of adequate strength to prevent warping, buckling, opening of joints and seams, loosening of hardware, distortion, and displacement within limits of intended and specified use.
- 2.5.2. Conceal and weld connections wherever possible.
- 2.5.3. Fit joints and junctions between components tightly and in true planes.
- 2.5.4. Isolate from each other dissimilar metals, and metal from concrete or masonry to prevent electrolysis. On aluminum, use bituminous paint in concealed locations and lacquer where exposed to view.
- 2.5.5. Finishing:
  - 2.5.5.1. File and grind exposed welds smooth.
  - 2.5.5.2. Zinc coating: clean and smooth ground surfaces at welds, fill if necessary, and prime all areas from which zinc coating has been removed with zinc rich paint applied in a minimum thickness of 0.102 mm (0.004").

## 3 EXECUTION

### 3.1. EXAMINATION

- 3.1.1. Examine building structure, finishes and conditions at the Place of the Work.
- 3.1.2. Notify the Consultant of any adverse conditions which could jeopardize system installation or system operation. Do not proceed until such conditions have been documented, assessed, rectified and approved for installation. Starting work indicates acceptance of conditions unless the *Consultant* is notified otherwise in writing.

### 3.2. ELECTRICAL WIRING

- 3.2.1. Power shall be brought up to circuit breaker/disconnect switch adjacent to controller under Electrical and in conformance with requirements specified therein.
- 3.2.2. Wiring from motor to switches, controls, starters, safety devices and other items requiring power shall be carried out under work of this section.
- 3.2.3. Use EMT conduit for fixed wiring. Use purpose-made and approved type flexible cables or cords at applicable locations; adequately support so as not to impede access or foul moving parts of equipment.

### **3.3. INSTALLATION – GENERAL**

- 3.3.1. Install doors and operators in accordance with door manufacturer's printed instructions.
- 3.3.2. Work shall be performed by qualified personnel approved by door manufacturer.
- 3.3.3. Fit doors snugly to edges of jambs and heads of frames. Doors shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward.
- 3.3.4. Furnish necessary appurtenances relating to door installation, including those required on door frames.
- 3.3.5. Upon completion of installation of doors and operating equipment, lubricate moving parts prior to putting into operation. Supply oil to gear reduction units and grease sprockets, bearings, cables, link chains and door guides. Check and re-adjust as required, items of operating hardware, including weatherstripping.
- 3.3.6. Install doors to operate freely and to close tight.
- 3.3.7. Full commissioning and training shall be completed after installation.

### **3.4. ADJUSTING AND CLEANING**

- 3.4.1. Adjust work of this section to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware.
- 3.4.2. Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at the Site only if approved.
- 3.4.3. Clean work on completion of installation.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract Documents, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Design Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 2.1. Manufacturer
- .10 2.2. Hardware
- .11 2.3. Accessories
- .12 2.4. Motorized Operation
- .13 2.5. Fabrication
- .14 2.6. Finishes
- .15 3.1. Examination
- .16 3.2. Electrical Wiring
- .17 3.3. Installation – General
- .18 3.4. Erection Tolerances
- .19 3.5. Field Quality Control
- .20 3.6. Adjusting And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Sectional overhead metal doors. All costs associated with the work of this Section shall be included in the Contract Price.

### **1.4. DESIGN REQUIREMENTS**

- 1.4.1. Provide a 45 mm thermally broken insulated flush overhead door, electrically operated complete with safety edge.
- 1.4.2. Design door assembly to withstand wind loads in closed position of 1 kPa positive 0.6 kPa negative, with operators to function against 0.4 kPa wind load. Maximum deflection under full design load to be 1/240 of opening width.
- 1.4.3. Calculate properties of steel sections and allowable stresses used in determination of structural performance in accordance with CSA S136-M.
- 1.4.4. Design door assembly to withstand minimum 100,000 cycles per annum, and 20 years total life cycle. Design door panel assemblies with thermal insulation factor 2.84 RSI.
- 1.4.5. Design electrical components for doors in accordance with CSA C22.1 and the Ontario Hydro Electrical Safety Code.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Include details of each door and frame type, hardware types and locations, frame profiles, door and frame elevations, anchor details and locations.



- 1.5.3.2. Include schedule identifying each unit, with door marks and numbers relating to numbering on the Drawings and in the door schedule.
- 1.5.3.3. Indicate materials, operating mechanisms, required clearances and electrical connections

## **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Operation and maintenance data:
  - 1.6.1.1. Submit manufacturer's maintenance instructions for incorporation into the operation and maintenance manuals in accordance with Section 01 77 00.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Manufacturers: Sectional doors shall be manufactured by a firm with a minimum of 5 years' experience in the fabrication and installation of sectional doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past 5 years.
  - 1.7.1.2. Installers / applicators / erectors: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Package or crate, and brace Products to prevent distortion in shipment and handling. Label packages and crates, and protect finish surfaces by sturdy wrappings.

# **2 PRODUCTS**

## **2.1. MANUFACTURER**

- 2.1.1. Acceptable products and manufacturers
  - 2.1.1.1. Thermospan 200-20 by Wayne-Dalton Corp.
  - 2.1.1.2. TX450-20 by Upwardor
  - 2.1.1.3. C200-20 by SDI
  - 2.1.1.4. or approved equivalent by Richards-Wilcox Canada.
    - (1) Colour: white
    - (2) Door to be sized at approximately 4200 x 4200 mm with rows of full-view and partial view, sealed insulated glazed panels with low E coating.

## **2.2. HARDWARE**

- 2.2.1. Door operator to include both electric edge and photo eyes sensors.
- 2.2.2. Doors must include emergency braking mechanism, in the event the operator fails.
- 2.2.3. All hardware to be galvanized steel.
- 2.2.4. Track: standard lift hardware with 75 mm size minimum 2.3 mm core thickness galvanized steel track.
- 2.2.5. Track supports: 2.3 mm (0.1") core thickness continuous galvanized steel angle track supports constructed of 32 mm (1-1/4") x 4.76 mm (0.2") steel angle neatly cut and connected. Punched steel angle is not acceptable.
- 2.2.6. Spring counter balance: heavy duty oil tempered torsion spring with manufacturer's standard brackets and as follows:
  - 2.2.6.1. Minimum rating: 100,000 cycles per annum.
  - 2.2.6.2. Drum: Die cast aluminum; size as recommended by door manufacturer to suit intended application.
  - 2.2.6.3. Shaft: Solid steel; size as recommended by door manufacturer to suit intended application
  - 2.2.6.4. Install cycle counter device.
- 2.2.7. Top roller carrier: galvanized steel minimum 2.3 mm thick, adjustable.
- 2.2.8. Rollers: 75mm (3inches) floating bearing less Nystroll nylon roller with stainless steel shaft

- 2.2.9. Roller brackets: adjustable, galvanized steel, minimum 2.5 mm thick.
- 2.2.10. Hinges: standard duty industrial 2.3 mm thick galvanized steel.
- 2.2.11. Cable: minimum 4 mm (0.2") diameter galvanized aircraft cable.

### **2.3. ACCESSORIES**

- 2.3.1. Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.
- 2.3.2. Track guards: 5 mm (1/4") thick formed sheet 1500 mm (59") high.
- 2.3.3. Pusher springs.
- 2.3.4. Weather stripping: aluminum vinyl C 'Arctic' standard.

### **2.4. MOTORIZED OPERATION**

- 2.4.1. Motorized Operation: Jackshaft type:
  - 2.4.1.1. Heavy duty: SDI Model S19.85, voltage to suit supply voltage.
  - 2.4.1.2. Auxiliary operation: include hand chain to operate door manually and independently of motor operator. Incorporate interlock to disconnect motor mechanically and electrically when auxiliary operator is engaged.
  - 2.4.1.3. Provide momentary relay contact for off-delay timers, and rated for 25 cycles per hour or 100 cycles per Day.
- 2.4.2. Electrical supply is 230V, 1HP, 60Hz.
- 2.4.3. Operator to open doors at a rate of 610 mm (24") per second.
- 2.4.4. Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval with CSA enclosure type 1.
- 2.4.5. Entrapment Protection:
  - 2.4.5.1. Photoelectric sensors
  - 2.4.5.2. Door operator to include both electric edge and photo eyes sensors on both sides of doors.
  - 2.4.5.3. Photo eye sensors to be mounted with metal hoods that protect sensors and provide shading from sunlight. Photo eye sensors to be mounted with heavy gauge steel brackets that resist bending from incidental contact.
- 2.4.6. Operator Controls:
  - 2.4.6.1. Type: Push-button.
  - 2.4.6.2. Function: operated control stations with open, close, and stop buttons for surface mounting, for interior location.
  - 2.4.6.3. Door controls shall be provided that are properly interfaced with the site's access control system to monitor status of each door and provide interface for exterior card readers on entry doors
- 2.4.7. Special Operation:
  - 2.4.7.1. Provide radio controlled operators, including remote operators for exterior operation of doors, as follows:
    - (1) Receiver to be Chamberlain Model 412 HMC or equivalent.
    - (2) Remote to be Chamberlain Model 972 LMC or equivalent.

### **2.5. FABRICATION**

- 2.5.1. Fabricate work of this section with materials, and with component dimensions and gauges, reinforcing, attached anchors and fastenings of adequate strength to prevent warping, buckling, opening of joints and seams, loosening of hardware, distortion, and displacement within limits of intended and specified use.
- 2.5.2. Conceal and weld connections wherever possible.
- 2.5.3. Fabricate Work free from defects impairing function, appearance, strength, and durability.
- 2.5.4. Fabricate panel frames in a continuous box frame with vertical stiffeners at 600 mm centres.
- 2.5.5. Fabricate doors from prefinished stock
- 2.5.6. Fit joints and junctions between components tightly and in true planes.

- 2.5.7. Isolate from each other dissimilar metals, and metal from concrete or masonry to prevent electrolysis. On aluminum, use bituminous paint in concealed locations and lacquer where exposed to view.
- 2.5.8. Finishing:
  - 2.5.8.1. File and grind exposed welds smooth.
  - 2.5.8.2. Zinc coating: clean and smooth ground surfaces at welds, fill if necessary, and prime all areas from which zinc coating has been removed with zinc rich paint applied in a minimum thickness of 0.102 mm (0.004").

## **2.6. FINISHES**

- 2.6.1. Exposed aluminum surfaces; anodized to AAMA 611:
  - 2.6.1.1. Clear anodized to AA Designation AA-M12C22A41

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine building structure, finishes and conditions at the Place of the Work.
- 3.1.2. Notify the Consultant of any adverse conditions which could jeopardize system installation or system operation. Do not proceed until such conditions have been documented, assessed, rectified and approved for installation. Starting work indicates acceptance of conditions unless the Consultant is notified otherwise in writing.

### **3.2. ELECTRICAL WIRING**

- 3.2.1. Power shall be brought up to circuit breaker/disconnect switch adjacent to controller under the work of Divisions 26, 27 and 28 and in conformance with requirements specified therein.
- 3.2.2. Wiring from motor to switches, controls, starters, safety devices and other items requiring power shall be carried out under this Section.
- 3.2.3. Use EMT conduit for fixed wiring. Use purpose-made and approved type flexible cables or cords at applicable locations; adequately support so as not to impede access or foul moving parts of equipment.

### **3.3. INSTALLATION – GENERAL**

- 3.3.1. Install sectional overhead doors and operators in accordance with door manufacturer's printed instructions.
- 3.3.2. Work shall be performed by qualified personnel approved by door manufacturer.
- 3.3.3. Secure guides to steel framing members, header box to side guides and the motor to header box.
- 3.3.4. Drill and tap door frames to receive hardware. Fasten door tracks and stops to door frame by means of machine bolts; welding will not be permitted.
- 3.3.5. Fit doors snugly to edges of jambs and heads of frames. Doors shall operate smoothly and freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward.
- 3.3.6. Furnish necessary appurtenances relating to door installation, including those required on door frames.
- 3.3.7. Upon completion of installation of doors and operating equipment, lubricate moving parts prior to putting into operation. Supply oil to gear reduction units and grease sprockets, bearings, cables, link chains and door guides. Check and re-adjust as required, items of operating hardware, including weather stripping.
- 3.3.8. Install doors to operate freely and to close tight.
- 3.3.9. Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation in accordance with CSA C22.1 and Ontario Hydro electrical safety code.
- 3.3.10. Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

- 3.3.11. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 10.
- 3.3.12. Touch-up steel doors with primer where galvanized finish damaged during fabrication.
- 3.3.13. Adjust weatherstripping to form a weathertight seal.

**3.4. ERECTION TOLERANCES**

- 3.4.1. Maintain dimensional tolerances and alignment with adjacent work.
- 3.4.2. Maximum variation and alignment from plum: 1.5 mm
- 3.4.3. Maximum variation from level: 1.5 mm
- 3.4.4. Longitudinal or diagonal warp: Plus or minus 3 mm per 3 m straight edge.

**3.5. FIELD QUALITY CONTROL**

- 3.5.1. Testing: Test operate door and demonstrate the operation of same to the satisfaction of the Consultant.

**3.6. ADJUSTING AND CLEANING**

- 3.6.1. Adjust work of this section to ensure free-running, tightly closing and properly counterbalanced operation. Ensure that installation is free from warp, twist or other distortion. Lubricate operating hardware.
- 3.6.2. Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at the Site only if approved.
- 3.6.3. Clean work on completion of installation.
- 3.6.4. Adjust weather-stripping to form a weathertight seal.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage And Handling
- .9 1.9. Project Conditions
- .10 1.10. Warranty
- .11 2.1. Manufacturers - Fire Rated Door Assembly & Window
- .12 2.2. Performance Requirements
- .13 2.3. Materials - Glass
- .14 2.4. Materials – Steel Frames And Doors
- .15 2.5. Fabrication
- .16 2.6. Finishes, General
- .17 2.7. Powdercoat Finishes
- .18 2.8. Door Hardware
- .19 2.9. Accessory Materials
- .20 3.1. Examination
- .21 3.2. Installation
- .22 3.3. Repair And Touch Up
- .23 3.4. Adjusting
- .24 3.5. Protection And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes:
- 1.3.1.1. Fire rated door and framing systems for installation as full vision fire rated doors, sidelights, transoms in interior openings.
- 1.3.2. Related Sections:
- 1.3.2.1. Section 05 50 00 "Metal Fabrications:" Steel attachment members inserts and anchors
  - 1.3.2.2. Section 07 62 00 "Sheet Metal Flashing and Trim" Flashing between this work and other work
  - 1.3.2.3. Section 07 84 00 "Firestopping:" Firestops between work of this section and other fire resistive assemblies.
  - 1.3.2.4. Section 08 11 13 "Hollow Metal Doors and Frames." Hollow Metal doors prepped for the work of this section.
  - 1.3.2.5. Section 08 71 00 "Door Hardware:" Door hardware other than that provided by the work of this section
  - 1.3.2.6. Section 08 71 13 "Automatic Door Operators" opener for door to comply with ADA and Local Authority opening force requirements.

### **1.4. REFERENCES**

- 1.4.1. American Architectural Manufacturers Association (AAMA)
- 1.4.1.1. AAMA 1503-1998: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

- 1.4.1.2. AAMA 2603-2002 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- 1.4.1.3. AAMA 2604-2005 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- 1.4.2. American Society for Testing and Materials (ASTM):
  - 1.4.2.1. Material related
    - (1) ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.
  - 1.4.2.2. Exterior related
    - (1) ASTM E 283-04: Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen
    - (2) ASTM E 330-02: Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference Procedure A
    - (3) ASTM E 331-04: Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
    - (4) ASTM E 783-02: Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors
    - (5) ASTM E 1105-00: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
  - 1.4.2.3. Sound related:
    - (1) ASTM E 90-04: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
    - (2) ASTM E 413-04: Standard Classification for Rating Sound Insulation
- 1.4.3. American Welding Society (AWS)
  - 1.4.3.1. AWS D1.3 - Structural Welding Code - Sheet Steel; 2007
- 1.4.4. Builders Hardware Manufacturers Association, Inc.
  - 1.4.4.1. BHMA A156 - American National Standards for door hardware; 2006 (ANSI/BHMA A156).
- 1.4.5. Canadian Standards
  - 1.4.5.1. CAN/ULC-S104 Standard Method of Fire Tests of Door Assemblies
- 1.4.6. National Fire Protection Association (NFPA):
  - 1.4.6.1. NFPA 80: Standard for Fire Doors and Fire Windows.
  - 1.4.6.2. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.
- 1.4.7. Underwriters Laboratories, Inc. (UL):
  - 1.4.7.1. UL 9: Fire Tests of Window Assemblies.
  - 1.4.7.2. UL 10B: Fire Tests of Door Assemblies.
  - 1.4.7.3. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
- 1.4.8. American National Standards Institute (ANSI):
  - 1.4.8.1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.
- 1.4.9. Consumer Product Safety Commission (CPSC):
  - 1.4.9.1. CPSC 16 CFR 1201 Categories I and II: Safety Standard for Architectural Glazing Materials.

## 1.5. SUBMITTALS

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product Data Sheets:

- 1.5.2.1. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.
- 1.5.3. Shop Drawings:
  - 1.5.3.1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure
- 1.5.4. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 08 71 00
- 1.5.5. Samples: For following products:
  - 1.5.5.1. Glass sample-as provided by manufacturer
  - 1.5.5.2. Sample of frame
  - 1.5.5.3. Verification of sample of selected finish
- 1.5.6. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- 1.5.7. Warranties: Submit manufacturer's warranty.
- 1.5.8. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
  - 1.5.8.1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

#### **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Operation and maintenance data:
  - 1.6.1.1. Submit manufacturer's operation and maintenance instructions for incorporation into the operation and maintenance manuals in accordance with Section 01 77 00.

#### **1.7. QUALITY ASSURANCE**

- 1.7.1. Testing Agency Qualifications: Qualified according to
  - 1.7.1.1. International Accreditation Service for a Type A Third-Party Inspection Body
  - 1.7.1.2. International Accreditation Service for Testing Body-Building Materials and Systems
    - (1) Fire Testing
      - (A) ASTM Standard E 119
      - (B) CPSC Standard 16 CFR 1201
      - (C) NFPA Standards 251, 252, 257
      - (D) UL Standards 9, 10B, 10C, 1784, UL Subject 63
      - (E) BS 476; Part 22: 1987
      - (F) EN 1634-1
      - (G) CAN/ULC Standards S101, S104, S106
- 1.7.2. Installer Qualifications:
  - 1.7.2.1. An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- 1.7.3. Source Limitations for Glazing Accessories:
  - 1.7.3.1. Obtain framing system, glazing and glazing accessories from one source for each product and installation method indicated.
- 1.7.4. Fire-Rated Door Assemblies:
  - 1.7.4.1. Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252. Assemblies

- must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.
- 1.7.5. Fire-Rated Window Assemblies:  
1.7.5.1. Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.
- 1.7.6. Listings and Labels - Fire Rated Assemblies:  
1.7.6.1. Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.
- 1.7.7. Regulatory Requirements:  
1.7.7.1. Comply with provisions of the following:  
(1) Where indicated to comply with accessibility requirements, comply with Ontario Building Code, Americans with Disabilities Act (ADA), and ANSI A117.1 as follows:  
(H) Handles, Pulls, Latches, Locks, and other Operating Devices:  
(a) Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.  
(I) Door Closers: Comply with the following maximum opening-force requirements indicated:  
(a) Accessible doors no more than 5 lbf (22.2 N) push or pull force  
(b) Fire Doors:  
.1 Minimum opening force allowable by authorities having jurisdiction  
(J) Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.  
(K) Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.  
(L) Comply with the following for means of egress doors:  
(a) Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.  
(b) Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

## **1.8. DELIVERY, STORAGE AND HANDLING**

- 1.8.1. Store parts in a dry place and permit natural ventilation over their finished surfaces.
- 1.8.2. Store materials in locations protected from damage of other trades.
- 1.8.3. Under conditions of high humidity or cold temperatures, supply heating or forced air ventilation to prevent accumulation of surface moisture.
- 1.8.4. Mark components to show location on building and on the Drawings.
- 1.8.5. Protect finishes with strippable coating that will not mar, nor deface finish on removal, or a similar method designed to afford an equivalent amount of protection. Leave protected coating intact until damage risk is past or immediately prior to final cleaning.
- 1.8.6. Stacking should be done to prevent bending pressure or abrasion of finished surfaces.
- 1.8.7. Brace and protect frame units to prevent distortion and damage in shipment and handling.
- 1.8.8. Provide methods for lifting or hoisting units into place without causing damage.



## **1.9. PROJECT CONDITIONS**

- 1.9.1. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
  - 1.9.1.1. Note whether field or planned dimensions were used in the creation of the shop drawings.
- 1.9.2. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section

## **1.10. WARRANTY**

- 1.10.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.10.2. Extended warranties:
  - 1.10.2.1. Labour, materials, and workmanship for work of this section.
  - 1.10.2.2. Repair or replace steel doors and frames that fail within the specified warranty period.
  - 1.10.2.3. Re-install hardware and re-hang repaired or replaced doors.
  - 1.10.2.4. Duration: 5 years.

## **2 PRODUCTS**

### **2.1. MANUFACTURERS - FIRE RATED DOOR ASSEMBLY & WINDOW**

- 2.1.1. Glass Material:
  - 2.1.1.1. FireLite Plus® fire-rated glazing as fabricated and distributed by
    - (1) Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065
    - (2) Phone (800.426.0279)
    - (3) Fax (425.396.8300)
    - (4) e-mail [tgp.sales@allegion.com](mailto:tgp.sales@allegion.com),
    - (5) web site <http://www.fireglass.com>.
- 2.1.2. Frame System:
  - 2.1.2.1. Fireframes® Designer Series by TGP® fire-rated steel frame system as manufactured and supplied by
    - (1) Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065
    - (2) phone (800.426.0279)
    - (3) fax (425.396.8300)
    - (4) e-mail [tgp.sales@allegion.com](mailto:tgp.sales@allegion.com),
    - (5) web site <http://www.fireglass.com>.
- 2.1.3. Substitutions: in accordance with section 01 25 13.

### **2.2. PERFORMANCE requirements**

- 2.2.1. Fire Rating Requirements
  - 2.2.1.1. Duration – Doors:
    - (1) Capable of providing a fire rating for 60 minutes.
  - 2.2.1.2. Duration - Window Assembly:
    - (1) Capable of providing a fire rating for 90 minutes.
  - 2.2.1.3. Duration - Opening Applications in fire partitions or area separation walls and corridors where opening protection is specified: Capable of providing 90 minute rating.
- 2.2.2. Design Requirements:
  - 2.2.2.1. Dimensions – Door and Framing:
    - (1) Door framing face dimension: 1 15/16-inch.
    - (2) Depth of door framing: 1 15/16-inch.
    - (3) Door style face dimension: 3 1/8-inch.

- (4) Door cross rail (if applicable) face: 3 9/16-inch.
- (5) Depth of stile, header, sill and cross rail: 1 15/16-inch
- 2.2.2.2. Dimensions -- Window Assembly:
  - (1) Perimeter framing face dimension: 2 3/4-inch at head, sill and jamb.
  - (2) Horizontal and/or vertical mullions: 3 9/16-inch on the face.
  - (3) Depth of perimeter and mullion: 1 15/16-inch.
- 2.2.2.3. Construction:
  - (1) Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the Fireframes Designer Series doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.
  - (2) Knock down frames are not permitted.

### **2.3. MATERIALS - GLASS**

- 2.3.1. Fire Rated Glazing:
  - 2.3.1.1. ASTM C 1036 and ASTM C 1048; composed of ceramic glazing material.
- 2.3.2. Thickness of Glazing Material:
  - 2.3.2.1. 3/16" FireLite
- 2.3.3. Approximate Visible Transmission: Clear
  - 2.3.3.1. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory (UL® only), fire rating period, safety glazing standards, and date of manufacture.
  - 2.3.3.2. Performance: Glass must be rated to stop fire from either direction and must meet all testing requirements including the required hose-stream test (where fire-rating exceeds 20 minutes).

### **2.4. MATERIALS – STEEL FRAMES AND DOORS**

- 2.4.1. Steel Framing System including 60 -minute rated doors, 90-minute rated windows.
  - 2.4.1.1. Frame: Steel profiled formed tubing.
  - 2.4.1.2. Fasteners: As recommended by manufacturer
  - 2.4.1.3. Glazing Accessories: calcium silicate setting blocks.
  - 2.4.1.4. Glazing Compounds:
    - (1) FireLite®:
      - (A) Approved Fibrefrax
      - (B) Glaze FireLite® panels that exceed 1,393 sq. inches for 90-minute ratings with "Kerafix 2000" glazing tape supplied by manufacturer.

### **2.5. FABRICATION**

- 2.5.1. Furnish frame assemblies pre-welded.
  - 2.5.1.1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
  - 2.5.1.2. Fit with suitable fasteners.
  - 2.5.1.3. Knock-down frames are not permitted
- 2.5.2. Furnish interior frame assemblies "K-D"
  - 2.5.2.1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
  - 2.5.2.2. Fit with suitable fasteners.
  - 2.5.2.3. Knock-down door perimeter frames are not permitted
- 2.5.3. Field glaze door and frame assemblies.
- 2.5.4. Factory prepare steel door assemblies and install all hardware.
- 2.5.5. Fabrication Dimensions: Fabricate to fire-rated field dimensions.
- 2.5.6. Obtain reviewed shop drawings prior to fabrication.

## 2.6. FINISHES, GENERAL

- 2.6.1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- 2.6.2. Finish frames after assembly.
- 2.6.3. Appearance of Finished Work:
  - 2.6.3.1. Variations in appearance of abutting or adjacent pieces are acceptable.
  - 2.6.3.2. Noticeable variations in the same piece are not acceptable.

## 2.7. POWDERCOAT FINISHES

- 2.7.1. Finish after fabrication.
- 2.7.2. Appearance of Finished Work:
  - 2.7.2.1. Variations in appearance of abutting or adjacent pieces are acceptable.
  - 2.7.2.2. Noticeable variations in the same piece are not acceptable.
- 2.7.3. Interior and Exterior Steel Finishes
  - 2.7.3.1. Powder-Coat Finish:
    - (1) Polyester Super Durable powder coating which meets AAMA 2604 for chalking and fading. Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's recommended instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
  - 2.7.3.2. Color and Gloss:
    - (1) As selected by Architect from manufacturer's full range.
  - 2.7.3.3. Acceptable Manufacturers:
    - (1) Tiger Drylac

## 2.8. DOOR HARDWARE

- 2.8.1. Furnish hardware with 60 minute fire door by the manufacturer.
- 2.8.2. Select hardware from door manufacturer's standard recommended and approved hardware groups as specified in Division 8 Section – Door Hardware.
- 2.8.3. Provide power assisted hardware for use at any door that cannot meet the opening force(s) required by code noted in Part I above.
  - 2.8.3.1. High energy, power-operated doors must meet the requirements of ANSI/BHMA A156.10 and power-assisted low energy doors must comply with ANSI/BHMA A156.19
- 2.8.4. Operating hardware for Fireframes® Designer Series Single Outswing Doors with Exit Device. Each to have the following.

	Item	Description	Manufacturer	Finish*
3	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
1	Exit Device	35A-F Rim	Von Duprin	626
1	Lever Trim	360L	Von Duprin	626
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	626
1	Closer	4040XP Surface Mounted	LCN	689
1	Auto door Bottom	420APKL Smoke Seal	Pemko	MA
1	Weather Seal	Perimeter Gasket	Technical Glass Products	

Balance of hardware shall be provided by General Contractor

### \* FINISH LEGEND:

PTM	Painted to match frame
MA	Mill Finish Aluminum
689	Aluminum Paint
630	Satin Stainless Steel
626	Satin Chrome Plated

## **2.9. ACCESSORY MATERIALS**

- 2.9.1.1. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.
- 3.1.2. Provide openings plumb, square and within allowable tolerances.
  - 3.1.2.1. Provide 3/8 inch shim space at all walls
- 3.1.3. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.
- 3.1.4. Do not proceed until such conditions are corrected.

### **3.2. INSTALLATION**

- 3.2.1. Refer to manufactures Installation Manual

### **3.3. REPAIR AND TOUCH UP**

- 3.3.1. Limited to minor repair of small scratches. Use only manufacturer's recommended products.
  - 3.3.1.1. Such repairs shall match original finish for quality or material and view.
- 3.3.2. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

### **3.4. ADJUSTING**

- 3.4.1. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

### **3.5. PROTECTION AND CLEANING**

- 3.5.1. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
  - 3.5.1.1. Do not clean with astringent cleaners. Use a clean "grit free" cloth and a small amount of mild soap and water or mild detergent.
  - 3.5.1.2. Do not use any of the following:
    - (1) Steam jets
    - (2) Abrasives
    - (3) Strong acidic or alkaline detergents, or surface-reactive agents
    - (4) Detergents not recommended in writing by the manufacturer
    - (5) Do not use any detergent above 77 degrees F
    - (6) Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.
    - (7) Metal or hard parts of cleaning equipment must not touch the glass surface
- 3.5.2. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- 3.5.3. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Related Documents
- .4 1.4. Section Includes
- .5 1.5. Related Sections
- .6 1.6. References
- .7 1.7. Submittals
- .8 1.8. Quality Assurance
- .9 1.9. Delivery, Storage And Handling
- .10 1.10. Coordination
- .11 1.11. Warranty
- .12 2.1. Manufacturers
- .13 2.2. Materials
- .14 2.3. Hanging Devices
- .15 2.4. Flush Bolts And Accessories
- .16 2.5. Cylinders And Keying
- .17 2.6. Locking Devices
- .18 2.7. Electric Strikes
- .19 2.8. Exit Devices
- .20 2.9. Automatic Door Operators
- .21 2.10. Door Closers
- .22 2.11. Door Trim And Protective Plates
- .23 2.12. Door Stops And Holders
- .24 2.13. Gasketing And Thresholds
- .25 2.14. Silencers
- .26 2.15. Sliding Door Track
- .27 2.16. Electronic Products And Accessories
- .28 2.17. In-Line Power Controller
- .29 2.18. Power Supplies
- .30 2.19. Elynx Cables
- .31 2.20. Finishes
- .32 3.1. Examination
- .33 3.2. Preparation
- .34 3.3. Installation
- .35 3.4. Field Quality Control
- .36 3.5. Adjusting
- .37 3.6. Cleaning And Protection
- .38 3.7. Demonstration

### **1.3. RELATED DOCUMENTS**

- 1.3.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### **1.4. SECTION INCLUDES**

- 1.4.1. Furnishing of all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors as indicated. Except, items which are

specifically excluded from this section of the specification or are of unique hardware specified in the same sections as the doors and frames on which they are installed.

## **1.5. RELATED SECTIONS**

- 1.5.1. 06 20 00 – Finish Carpentry
- 1.5.2. 06 40 00 – Architectural Woodwork
- 1.5.3. 08 01 00 – Operation and Maintenance of Openings
- 1.5.4. 08 06 00 – Schedules for Openings
- 1.5.5. 08 08 00 – Commissioning of Openings
- 1.5.6. 08 10 00 – Doors and Frames
- 1.5.7. 08 30 00 – Specialty Doors and Frames
- 1.5.8. 08 40 00 – Entrances, Storefronts, and Curtain Walls
- 1.5.9. 08 71 13 – Automatic Door Operators
- 1.5.10. 08 74 00 – Access Control Hardware
- 1.5.11. 08 78 00 – Special Function Hardware
- 1.5.12. 08 79 00 – Hardware Accessories
- 1.5.13. 10 20 00 – Interior Specialties
- 1.5.14. 10 50 00 – Storage Specialties
- 1.5.15. 26 05 00 – Common Work Results for Electrical
- 1.5.16. 26 06 00 – Schedules for Electrical
- 1.5.17. 26 08 00 – Commissioning of Electrical Systems
- 1.5.18. 27 05 00 – Common Work Results for Communications
- 1.5.19. 27 06 00 – Schedules for Communications
- 1.5.20. 27 21 00 – Data Communications Network Equipment
- 1.5.21. 28 00 00 – Electronic Safety and Security

## **1.6. REFERENCES**

- 1.6.1. Codes And Standards
  - 1.6.1.1. ANSI A117.1 – Accessible and Usable Buildings and Facilities
  - 1.6.1.2. ANSI A156.1 – Butts and Hinges
  - 1.6.1.3. ANSI A156.3 – Exit Devices
  - 1.6.1.4. ANSI A156.4 – Door Controls – Closers
  - 1.6.1.5. ANSI A156.5 – Cylinders and Input Devices for Locks
  - 1.6.1.6. ANSI A156.6 – Architectural Door Trim
  - 1.6.1.7. ANSI A156.7 – Template Hinge Dimensions
  - 1.6.1.8. ANSI A156.8 – Door Controls – Overhead Stops and Holders
  - 1.6.1.9. ANSI A156.9 – Cabinet Hardware
  - 1.6.1.10. ANSI A156-10 – Power Operated Pedestrian Doors
  - 1.6.1.11. ANSI A156.11 – Cabinet Locks
  - 1.6.1.12. ANSI A156.12 – Interconnected Locks
  - 1.6.1.13. ANSI A156.13 – Mortise Locks and Latches Series 1000
  - 1.6.1.14. ANSI A156.16 – Auxiliary Hardware
  - 1.6.1.15. ANSI A156.18 – Materials and Finishes
  - 1.6.1.16. ANSI A156.19 – Power Assist and Low Energy Power Operated Doors
  - 1.6.1.17. ANSI A156.21 – Thresholds
  - 1.6.1.18. ANSI A156.22 – Door Gasketing and Edge Sealing Systems
  - 1.6.1.19. ANSI A156.25 – Electrified Locking Devices
  - 1.6.1.20. ANSI A156.26 – Continuous Hinges
  - 1.6.1.21. ANSI A156.28 – Recommended Practices for Mechanical Keying Systems
  - 1.6.1.22. ANSI A156.29 – Exit Locks, Exit Alarms, Alarms for Exit Devices
  - 1.6.1.23. ANSI A156.30 – High Security Cylinders
  - 1.6.1.24. ANSI A156.31 – Electric Strikes and Frame Mounted Actuators
  - 1.6.1.25. ANSI A156.32 – Integrated Door Opening Assemblies
  - 1.6.1.26. ANSI A156.36 – Auxiliary Locks
  - 1.6.1.27. ANSI A250.4 – Steel Doors and Frames Physical Endurance

- 1.6.1.28. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
- 1.6.1.29. NFPA 101 – Life Safety Code
- 1.6.1.30. OBC 2006 – Ontario Building Code
- 1.6.1.31. SDI 122-07 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames
- 1.6.1.32. Door and Hardware Institute Publication – Sequence and Format for the Hardware Schedule (1996)
- 1.6.1.33. Door and Hardware Institute Publication – Keying Systems and Nomenclature (1989)

## **1.7. SUBMITTALS**

- 1.7.1. General Requirements
  - 1.7.1.1. Submit all documentation and samples in accordance with division 1, general requirements.
- 1.7.2. Schedules And Data
  - 1.7.2.1. Product data: manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
  - 1.7.2.2. Door hardware schedule: prepared and submitted within 2 weeks of receipt of purchase order by or under the supervision of supplier and coordinated with all drawings and related documents to ensure; size, thickness, hand, function, finish and application of hardware. All approved hardware changes shall be incorporated in the hardware schedule and kept current throughout the duration of the project.
    - .1 Format: vertical format and sequence as detailed in the door and hardware institute (dhi) publication "sequence and format for the hardware schedule".
    - .2 Content: include the following information for each opening:
      - 1. Location of each hardware set cross-referenced to indentifying mark(s) on architectural floor plans and in door and frame schedule.
      - 2. Handing and degree of swing of each door.
      - 3. Keying information.
      - 4. Quantity, type, style, function, size and finish of each hardware item.
      - 5. Complete methods of operation for all openings containing electronic components with detailed operational descriptions of each item's function(s) during all typical conditions and ingress/egress situations.
      - 6. Elevation drawings of all openings with electronic hardware systems identifying locations of components, conduit, back boxes, junction boxes and miscellaneous system requirements.
      - 7. Name and manufacturer of each hardware item.
      - 8. Fastenings and other pertinent installation information.
      - 9. Hardware mounting locations when different from standard.
- 1.7.3. Samples: Provide each type of hardware in finish indicated as requested. Items will be returned in original packaging and working order to the supplier to be incorporated into the project scope of work.
- 1.7.4. Templates: Furnish a complete, indexed list with templates and finish hardware schedule to the Contractor for each trade supplying materials requiring hardware preparations.
- 1.7.5. Electronic Hardware Systems:
  - 1.7.5.1. Wiring Diagrams: Prepared and submitted within 2 weeks of receipt of purchase order by or under the supervision of supplier and coordinated with all drawings and related documents to ensure accurate function and coordination.
  - 10. Elevations: Provide diagrams for each unique opening with electronic hardware components indentifying individual item locations, conduits,

back boxes, junction boxes and miscellaneous system requirements and devices.

11. Risers: Provide diagrams detailing locations and infrastructure between door openings, power supplies, access control panels and system components.
  12. Point to Points: Provide diagrams detailing wiring terminations at all electrified devices as applicable to function of all openings. (inclusion depending on installation)
  13. Responsibility matrix: Provide documentation for approval detailing basic responsibilities inclusive of all related sections involved in the preparation for, installation and commissioning of electrified systems.
- 1.7.6. Keying Schedule: Prepare a separate schedule, in accordance with DHI publication "Keying Systems and Nomenclature", detailing final keying instructions for all locksets and cylinders. Include; keying system explanation, door numbers, keyset symbols, hardware set numbers, and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- 1.7.7. Operations and Maintenance Manuals: Provide operating and maintenance manuals in accordance with Division 01, Section 01 78 00, Closeout Submittals. Manuals to include; complete manufacturer and distributor contact information, manufacturers documentation for care and maintenance of all products and finishes, manufacturers product parts lists, manufacturers installation and adjustment instructions, manufacturers/service representatives warranty documentation, and 'as built' copies of all submittal documentation.
- 1.7.8. Warranties and Maintenance Agreements; Provide manufacturers/service representatives special warranties and maintenance agreements specified in this Section.

## **1.8. QUALITY ASSURANCE**

- 1.8.1. Substitutions
- 1.8.1.1. All requests for approved alternates must be submitted in writing 10 working days prior to closing date. Approval of products is at the discretion of the Architect, owner and hardware consultant.
- 1.8.2. Supplier Qualifications
- 1.8.2.1. A recognized Architectural door hardware supplier who has maintained an office and has minimum of five (5) years documented experience in providing consulting services and supplying mechanical and electromechanical hardware comparable in material, design and extent to that required for this project.
- 1.8.2.2. Have an office and warehouse facilities to accommodate this project.
- 1.8.2.3. Authorized factory distributor in good standing of all products herein specified.
- 1.8.2.4. Have in their employment a minimum of one (1) Architectural Hardware Consultant (AHC) as administered and certified by The Door and Hardware Institute, Chantilly VA. AHC shall be responsible for preparation of finish hardware/keying schedules.
- 1.8.3. Installer Qualifications
- 1.8.3.1. Trained by the primary product manufacturers with a minimum of five (5) years documented experience in the installation of both mechanical and electromechanical hardware comparable in material, design and extent to that required for this project.
- 1.8.4. Source Limitations
- 1.8.4.1. Electrified modifications and enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- 1.8.4.2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.



- 1.8.5. Fire-Rated Openings
  - 1.8.5.1. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of Authorities Having Jurisdiction (AHJ). Provide only items that are listed/labelled by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.
- 1.8.6. Keying Conference
  - 1.8.6.1. Conduct conference to comply with requirements in Division 01, Section 01 31 19, Project Meetings. Keying conference to incorporate the following criteria into the final keying schedule document:
    - .1 Function of building, purpose of each area and degree of security required.
    - .2 Plans for existing and future key system expansion.
    - .3 Requirements for key control storage and software.
    - .4 Installation of permanent keys, cylinder cores and software.
    - .5 Address and requirements for delivery of keys.
- 1.8.7. Pre-Submittal Conference
  - 1.8.7.1. Conduct conference to comply with requirements in Division 01, Section 01 31 19, Project Meetings, with attendance by representatives of Supplier(s), Installer(s) and Contractor(s) to review proper methods and the procedures for receiving, handling and installing door hardware.

## **1.9. DELIVERY, STORAGE AND HANDLING**

- 1.9.1. Marking And Packaging
  - 1.9.1.1. Mark items according to the approved hardware schedule indicating hardware set and door number.
  - 1.9.1.2. Items to be sorted, verified and repackaged in manufacturer's original packaging complete with necessary screws, accessories, templates, installation instructions and any specialized tools required for installation
- 1.9.2. Delivery
  - 1.9.2.1. Schedule delivery times for receipt of door hardware with Contractor. Contractor to check deliveries against accepted list and provide written acceptance assuming responsibility for storage and care. Immediately identify any shortages or damaged items in writing.
  - 1.9.2.2. Hardware items to be jointly inventoried on site by representatives from hardware supplier, installer and Contractor.
  - 1.9.2.3. Deliver permanent keys, cylinders, cores, access control credentials, software and related accessories directly to the Owner via registered mail or as established at the 'Keying Conference'.
  - 1.9.2.4. Do not store electronic access control hardware, software or accessories at project site without prior authorization.
  - 1.9.2.5. Construction master keys to be separately packaged from all other items and delivered to Contractor as previously coordinated.
- 1.9.3. Storage
  - 1.9.3.1. Contractor to provide a clean, dry and secure hardware storage room with adequate shelving to layout each item by door number and hardware set number. Room size, location and layout to be jointly coordinated with hardware supplier, installer and Contractor.

## **1.10. COORDINATION**

- 1.10.1. Obtain and distribute templates for doors, frames and other work specified to be factory prepared for installing standard and electrified hardware. Review shop drawings of related sections to ensure that adequate provisions and modifications are made for locating and installing hardware.
- 1.10.2. Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required power connections, conduit, fire alarm connections, junction boxes, back boxes, reinforcing and mounting locations for low

voltage power supplies, detection/monitoring hardware, power transfer devices and all other listed components.

1.10.3. Coordination meetings:

- 1.10.3.1. Hardware supplier to meet with Owner, Architect, Electrical Sub Contractor, Security Consultant and Access Control Sub Contractor to review, coordinate and implement all details relating to the proper operation and location of all electronic hardware prior to start of construction. Review methods of operation for each unique opening with electrified components.
- 1.10.3.2. Conduct a project specific training meeting to instruct the installation Contractor's personnel on the proper installation and adjustment of all products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates, physical product samples as required and review of method of operation for electrified openings.
- 1.10.3.3. Inspect and review electrical rough-ins, power supply connections and all other applicable work by related trades.
- 1.10.3.4. Review and finalize construction schedule and verify material availability.
- 1.10.3.5. Review the required inspection, testing, commissioning and demonstration procedures.

1.10.4. Upon completion of installation, provide written documentation that components were applied as per manufacturer's instructions and recommendations according to the approved hardware schedule. Identify any defective or damaged materials.

## **1.11. WARRANTY**

- 1.11.1. General Warranty in accordance with Division 01, General Requirements. Special warranties specified in this article shall not deprive the Owner of other rights under other provisions of the Contract Documents and shall be in addition to, and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.
- 1.11.2. Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period of one (1) year from date of Substantial Completion, unless otherwise indicated. Failures include, but are not limited to:
  - 1.11.2.1. Structural failures including excessive deflection, cracking, or breakage.
  - 1.11.2.2. Faulty operation of hardware.
  - 1.11.2.3. Deterioration of metals, finishes and other materials beyond normal weathering.
  - 1.11.2.4. Electrical component defects and failures within system operation.
- 1.11.3. Special Warranty Periods:
  - 1.11.3.1. Hinges - Lifetime
  - 1.11.3.2. Mortise Locksets – Seven (7) years
  - 1.11.3.3. Exit Devices – Five (5) years
  - 1.11.3.4. Door Closers – Ten (10) years
  - 1.11.3.5. Electric Strikes – Five (5) years
  - 1.11.3.6. Electromechanical Locksets – Two (2) years
  - 1.11.3.7. Electromagnetic Locks – Lifetime
  - 1.11.3.8. Power Supplies - Lifetime

## **2 PRODUCTS**

### **2.1. MANUFACTURERS**

- 2.1.1. Manufacturers as listed below have been determined as the approved products. Obtain each type of finish hardware (hinges, latch and locksets, exit devices, door closers, etc.) from a single manufacturer.

### **2.2. MATERIALS**

- 2.2.1. Screws And Fasteners

- 2.2.1.1. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and the appropriate blocking or reinforcing is not present in the door to preclude their use.

## **2.3. HANGING DEVICES**

### **2.3.1. Hinges**

- 2.3.1.1. Hinges shall conform to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all exterior and interior locked reverse bevel doors. Unless otherwise scheduled, supply 2 hinges for doors up to 60"(1520mm) in height and supply one (1) additional hinge for every 30"(760mm) of door height or part thereof. Hinges shall be sized per the manufacturer's recommendations. Hinges shall be a minimum of 4 1/2" high and 4" wide; heavy weight hinges (.180) shall be supplied at all doors where specified.

Provide hinge size to comply with the following:

<u>Door Width</u>	<u>Hinge Height</u>	<u>Hinge Width</u>
Up to 36"	4-1/2"	4"
Over 36"	5"	4-1/2"
Up to 48"	5"	5"
Over 48"	6"	6"

1. Specified Manufacturer: McKinney TA/T4A Series

### **2.3.2. Electric Hinges**

- 2.3.2.1. Electric hinges shall be provided with Molex standardized plug connectors to accommodate up to twelve (12) wires. Plug connectors shall plug directly into Molex through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a mortar guard for each electric hinge specified.

- .1 Specified Manufacturer: McKinney/Markar - QC Series

### **2.3.3. Continuous Geared Hinges**

- 2.3.3.1. All hinges to be non-handed and completely reversible. Hinge line to be available in concealed flush mount with or without inset, full surface and half surface types as specified in the hardware sets. All hinges to be made of extruded 6060 T6 aluminum alloy with polyacetal thrust bearings, anodized after cutouts are made for bearings. All concealed hinges to be fire-rated for 20, 45 and 90 minutes when incorporated into proper door and frame labeled installations, without necessitating the use of fusible-link pins. All concealed hinges to be available in standard, heavy, and extra heavy duty weights; all full surface and half surface hinges in standard and heavy duty weights as specified in the hardware sets. All hinges to be factory cut for door size.

- .1 Specified Manufacturers: McKinney

## **2.4. FLUSH BOLTS AND ACCESSORIES**

- 2.4.1. All manual and automatic flush bolts to be furnished as specified.

- 2.4.1.1. Specified Manufacturer:

- .1 Rockwood

## **2.5. CYLINDERS AND KEYING**

### **2.5.1. Cylinders**

- 2.5.1.1. All cylinders shall meet the requirements of UL437 including those for pick and drill resistance. Pick resistance shall incorporate two or more independent locking mechanisms including a pin tumbler device with six top pin chambers

with mushroom shaped driver pins and a coded sidebar locking mechanism operated independently from the six top pin tumbler device. Drill resistance shall incorporate cylinder housing with fixed in-place case-hardened inserts to protect the pin tumbler shear line, cylinder plugs with case-hardened inserts to protect the pin tumbler shear line and the side bar, mushroom shaped stainless steel driver pins and stainless steel sidepins. All cylinders shall be factory master keyed.

.1 Specified Manufacturer: Medeco M3/M4 TBC BY OWNER

2.5.2. Keying

2.5.2.1. Keying: All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the owner To the owners existing Master key system.

2.5.2.2. Furnish directly to the owner, via registered mail, one copy of the bitting list. Include for ten new changes orders each master key.

2.5.2.3. The contractor shall be responsible to remove all construction cores and install all permanent cores. Unless otherwise directed by the owner.

2.5.2.4. Pack all permanent cylinders and keys separately from locksets. Identify door number and keyset symbol on each envelope.

2.5.2.5. Ship the control keys directly to the owner unless directed otherwise.

2.5.2.6. Furnish the following:

.1 Two (2) change keys per lock. Determine final quantities during keying meeting.

.2 Allow for 150 extra cut keys. Determine quantity per key set during keying meeting.

.3 All cylinders and keys are to be provided with visual, keyset symbol, key control.

.4 Twenty (20) cut master keys – divide between MK groups.

.5 I/C Core – four (4) construction control keys and four (4) permanent control keys.

.6 Fifteen (15) construction keys.

.7 Twenty (20) Extra combined cores.

.8 100 Key Blanks with milled side bar.

.9 Complete bitting list.

.10 1 only RP2 LX RX Power Tester.

.11 WT1, lock tester.(ship direct to owner)

.12 1 only Molex Service Kit QCR-001.(ship direct to owner)

.13 Confirm local locksmith for services and availability. Review with owners locksmith.

.14 Master keys and all high-security or patented keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging. Deliver all keys and key blanks directly to owner's representative as directed.

.15 The construction keys are to be shipped separate from the locksets, directly to the contractor.

2.5.3. Key Cabinet

2.5.3.1. Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project. Hardware Supplier shall assist owner with the set up of the key cabinet.

.1 Specified Manufacturer: Telkee AWC Series

**2.6. LOCKING DEVICES**

2.6.1. Mortise Locksets

- 2.6.1.1. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2 3/4" backset with a two-piece 3/4" anti-friction stainless steel latchbolt. The deadbolt shall be a full 1" throw made of stainless steel and have 2 hardened steel roller inserts. All strikes shall be non-handed with a straight lip. To insure proper alignment, all trim, shall be thru-bolted and fully interchangeable between rose and escutcheon designs and shall be the product of one manufacturer.
  - .1 Specified Manufacturer: Corbin Russwin ML2000 Series
- 2.6.2. Electrified Locksets
  - 2.6.2.1. Mechanical features of locksets shall conform to standards as specified above. Locksets shall be fail-secure unless otherwise specified. Where specified electrified locksets shall be provided with a switch to monitor inside or outside lever handle or signal remote location. Provide an in-line power controller with all electrified locksets.
    - .1 Specified Manufacturer: Corbin Russwin
- 2.6.3. Lockset Strikes
  - 2.6.3.1. Strikes shall be non-handed and straight lip. Provide strikes with lip-length required to accommodate jamb and/or trim detail and projection.

## **2.7. ELECTRIC STRIKES**

- 2.7.1. Standard Strikes
  - 2.7.1.1. All standard electric strikes shall meet bhma standard 501, grade 1 and be ul listed for burglary resistance, category 1034. Strikes shall be all stainless steel construction for corrosion resistance, strength and durability. Strikes shall have been tested to withstand a forcing strength of a minimum 2400 lbs. Before releasing and perform with a minimum of one million cycles of operation. Strikes shall be 24vdc fail-secure unless otherwise specified. Provide an in-line power controller with all electric strikes.
    - .1 Specified manufacturers: hes 1500 series
- 2.7.2. Surface Mounted Strikes
  - 2.7.2.1. All surface mounted electric strikes shall meet bhma standard 501, grade 1 and be ul listed for burglary resistance, category 1034. Strikes shall have two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Optional latchbolt and latchbolt strike monitoring that indicates position of the latchbolt and locked condition of the strike shall be available. Strikes shall have been tested for a minimum of 500,000 operating cycles. Provide an in-line power controller with all electric strikes.
    - .1 Specified manufacturers: hes 9500(fire rated)hes 9600(non-rated)

## **2.8. EXIT DEVICES**

- 2.8.1. Conventional Devices – Push Rail
  - 2.8.1.1. All exit devices shall be ansi a156.3, grade 1 certified and shall be listed by underwriters laboratories and bear the ul label for life safety in full compliance with nfpa 80 and nfpa 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072" thick. Push rails shall be constructed of 0.062" thick material. Painted or anodized aluminum shall not be considered heavy duty and is not acceptable. Lever trim shall be available in finishes and designs to match that of the specified locksets.
    - .1 Specified manufacturer:
      - (A) Corbin russwin ed4000/ed5000 series
- 2.8.2. Electrified Devices

- 2.8.2.1. Electrified exit devices shall conform to all traditional exit device standards as specified above. All power requirements for exit devices used must utilize a continuous circuit electric hinge for clean design and no visible means of interrupting power to device.
- 2.8.2.2. All exit devices, both fire labeled and non-labeled devices, requiring electric dogging shall be held in the "dogged" or retracted position. All exit devices with electric latch retraction shall provide for a remote means of unlocking for momentary or maintained periods of time.
- 2.8.2.3. Where specified exit devices shall be provided with a switch to monitor push rail or signal remote location and latchbolt monitoring.
- 2.8.2.4. Provide a 782 series controller from corbin russwin with all electric latch retraction devices.
  - .1 Specified manufacturers:
    - (A) Corbin russwin

## **2.9. AUTOMATIC DOOR OPERATORS**

- 2.9.1. All operators shall be ANSI 156.19, Grade 1 Certified. Units shall have adjustments for door closing force and backcheck, motor assist from 0 to 30 seconds, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay up to 30 seconds. Operator units shall provide conventional door closer opening and closing forces unless the power operator motor is activated by an initiating device with door closer assembly having adjustable spring size, backcheck valve, sweep valve, latch valve, speed control valve, and pressure adjustment valve to control door closing. Operators shall have push and go function to activate power operator or power assist functions. Units shall have a presence detector input to prevent a closed door from opening or a door that is fully opened from closing and shall have a hold open toggle input to allow remote activation for indefinite hold open; door shall close the second time the input is activated. Operators shall have a SPDT relay for interfacing with latching or locking devices. All controlling operator switches shall be of radio-frequency design and not hard-wired.
  - 2.9.1.1. Specified Manufacturer:
    - .1 DORMA ED250(exterior)
    - .2 DORMA ED100(interior)

## **2.10. DOOR CLOSERS**

- 2.10.1. Surface Mounted Closers – Heavy Duty
  - 2.10.1.1. All Door Closers Shall Be Ansi 156.4, Grade 1 Certified. All Closers Shall Have Aluminum Alloy Bodies, Forged Steel Arms, And Separate Valves For Adjusting Backcheck, Closing And Latching Cycles And Adjustable Spring To Provide Up To 50% Increase In Spring Power. Closers Shall Be Furnished With Parallel Arms Mounting On All Doors Opening Into Corridors Or Other Public Spaces And Shall Be Mounted To Permit 180 Degrees Door Swing Wherever Wall Conditions Permit. Closers Shall Not Be Installed On Exterior Or Corridor Side Of Doors; Where Possible Install Closers On Door For Optimum Aesthetics.
    - .1 Specified Manufacturer:
      - (A) Norton 7500 Series
- 2.10.2. Surface Mounted Closers – Standard Duty
  - 2.10.2.1. All Door Closers Shall Be Ansi 156.4, Grade 1 Certified. All Closers Shall Have Aluminum Alloy Bodies, Forged Steel Arms, And Separate Valves For Adjusting Backcheck, Closing And Latching Cycles And Adjustable Spring To Provide Up To 50% Increase In Spring Power. Closers Shall Be Furnished With Parallel Arms Mounting On All Doors Opening Into Corridors Or Other Public Spaces And Shall Be Mounted To Permit 180 Degrees Door Swing Wherever Wall Conditions Permit. Closers Shall Not Be Installed On Exterior Or Corridor Side Of Doors; Where Possible Install Closers On Door For Optimum Aesthetics.

- .1 Specified Manufacturer:  
(A) Norton 8500 Series

## **2.11. DOOR TRIM AND PROTECTIVE PLATES**

- 2.11.1. Door Pulls/Push/Kick/Armour Plates: to be 0.050 inches thick and 1.5 inches less full width of door, or as specified. Furnish all push/kick and armor plates with 'B4E' beveled edges. Where door pulls and push plates are specified countersink door pull through bolts in door for flush fit and apply push plates over top of through bolts. Follow specific mounting instructions where push plate, door pull and deadlock applications occur. Fasteners for push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule. Where full height door pulls are specified supply units less 150mm from the top of door and 300mm from bottom of door. Submit shop drawing of pulls for review.
  - 2.11.1.1. Specified Manufacturer:
    - .1 Rockwood

## **2.12. DOOR STOPS AND HOLDERS**

- 2.12.1. Wall Mounted Door Stops
  - 2.12.1.1. Where A Door Is Indicated On The Plans To Strike Flush Against A Wall, Wall Bumpers Shall Be Provided. Provide Convex Or Concave Design As Indicated.
    - .1 Specified Manufacturers:
      - (A) Rockwood
- 2.12.2. Overhead Stops/Holders
  - 2.12.2.1. Where Specified, Overhead Stops/Holders As Shown In The Hardware Sets Are To Be Provided. Track, Slide, Arm And Jamb Bracket Shall Be Constructed Of Extruded Bronze And Shock Absorber Spring Shall Be Of Heavy Tempered Steel. Overhead Stops Shall Be Of Non-Handed Design.
    - .1 Specified Manufacturers:
      - (A) Rixson 1/2/9/10 Series

## **2.13. GASKETING AND THRESHOLDS**

- 2.13.1. On exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide seals as required to meet UL10C. Provide only those units where silicon seal strip is easily replaceable and readily available from stocks maintained by manufacturer. Provide head seal as solid aluminum extrusion suitable for stop applied hardware ie P/A closers or surface overhead door stops.
- 2.13.2. Door Sweeps: House nylon brush seal in extruded aluminum case. Surface applied and adjusted to suit gap at bottom of door, complete with snap cover.
- 2.13.3. Auto Door Bottoms: Surface or semi mortise automatic door bottoms housed in aluminum case and equipped with nylon brush inserts. Each unit sized to suit the door width and meets the requirements of ANSI/BHMA 156.22-2003 for latching force and air infiltration.
- 2.13.4. Astragal Seal: House nylon brush seal in extruded aluminum case. Surface applied, meeting stile astragal, consisting of two pieces attached to pull side face of door. Adjust during installation for proper seal prior to attaching snap cover.
- 2.13.5. Provide threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA).
  - 2.13.5.1. Specified Manufacturers:
    - .1 Pemko

## **2.14. SILENCERS**

- 2.14.1. Furnish rubber door silencers all hollow metal frames; two (2) per pair and three (3) per single door frame.

## **2.15. SLIDING DOOR TRACK**

- 2.15.1. Supply sliding door track and hardware for doors weighing up to 200lbs for standard applications. Provide needle bearing rollers and aluminum track. Where noted provide sliding door hardware in kit form consisting of hangers, nylon guide, stops and adjustable wrench and mounting hardware. For applications of heavy sliding doors use individual components designed to carry required load capacities, as noted in the hardware schedule.
  - 2.15.1.1. Specified Manufacturer:
    - .1 Pemko

## **2.16. ELECTRONIC PRODUCTS AND ACCESSORIES**

- 2.16.1. Keypads
  - 2.16.1.1. Keypads shall be 24vdc and operate a 5-amp dpdt relay to switch any type of fail-safe or fail-secure electric lock or strike and be weather proof, vandal resistant and suitable for mounting on a narrow mullion. The keypad system circuit board shall be a remote unit to allow for increased security. Release time shall be programmable from 1 to 99 seconds. Keypads shall support 2 to 7 digit codes for a minimum of 59 users and shall be locked out for 30 seconds when 16 wrong digits are entered. System shall have user/installer programmable options such as anti-tailgate, anti-door prop, and duress code alarm.
    - .1 Specified manufacturer:
      - .1 Securitron dk26 series
- 2.16.2. Keyswitches
  - 2.16.2.1. Keyswitches shall be furnished on a stainless steel single gang face plate with a 12/24vdc bi-color led and an integral backing bracket that shall permit integration with any 1.25" or 1.125" mortise cylinder. Keyswitches shall be available for momentary or maintained action and in narrow stile designs.
    - .1 Specified manufacturers:
      - (A) Securitron mk series

## **2.17. IN-LINE POWER CONTROLLER**

- 2.17.1. Where specified, electrified products shall be supplied with an in-line power controller that enables the hardware to operate from 12 to 32 volts. On board safety features shall include an in-line fuse to protect the hardware and host system from any possible reverse current surges. The controller shall regulate current to provide continuous duty operation without the typical head build up.
  - 2.17.1.1. Specified Manufacturers: HES 2005 Smart-Pac III

## **2.18. POWER SUPPLIES**

- 2.18.1. Power supplies shall furnish regulated 24VDC and shall be UL class 2 listed. LED's shall monitor zone status (voltage/no voltage) and slide switches shall be provided to connect or disconnect the load from power; 1, 4 or 8 separate output circuit breakers shall be provided to divide the load. Power supplies shall have the internal capability of charging optional 24VDC sealed lead acid batteries in addition to operating the DC load. Power supplies shall be supplied complete requiring only 120VAC to the fused input and shall be supplied in an enclosure. Power supplies shall be provided with emergency release terminals that allow the release of all devices upon activation of the fire alarm system.
  - 2.18.1.1. Specified Manufacturer: Securitron BPS

## **2.19. ELYNX CABLES**

- 2.19.1. All power transfer hinges, electrified locksets, electric exit device trim and electric exit devices are to be equipped with Molex plug connectors. Door and Frame Elynx cables have been specified at a provisional length at each of these locations. It is the responsibility of the finishing hardware supplier to supply these cables, prior to door/frame manufacture, in appropriate lengths required by the various manufacturers.



The hardware supplier is responsible to contact the door manufacturers to determine the cabling route and supply the correct length. Where the door manufacturer requires flying ends on Elynx cables the hardware installer will be responsible to map and pin Molex connectors.

2.19.1.1. Specified Manufacturer: McKinney

## **2.20. FINISHES**

- 2.20.1. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S. finishes shown by certain manufacturers for their products.
- 2.20.2. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine scheduled openings, with installer present, for compliance with requirements for; installation tolerances, labelled fire door assembly construction, wall and floor conditions, and other site conditions affecting performance. Notify Architect in writing of any discrepancies or conflicts between the door schedule, door types, drawings or scheduled hardware. Discrepancies and conflicts to be resolved in writing prior to installation of hardware.
- 3.1.2. Examine hardware to ensure it is free from defects prior to installation.
- 3.1.3. Ensure that building is secured and free from weather elements prior to installation of interior door hardware.

### **3.2. PREPARATION**

- 3.2.1. Door and Frame Preparation:
  - 3.2.1.1. Field prepare doors and frames for all function holes and fasteners under 25.4mm (1") as per the manufacturer(s) templates and installation instructions provided. Drill and tap as required.

### **3.3. INSTALLATION**

- 3.3.1. Install each item of mechanical and electromechanical hardware and access control equipment to comply with the manufacturer's written instructions and according to specifications. All items to be installed with fasteners identified by manufacturer's installation instructions unless otherwise noted.
- 3.3.2. Mounting Heights:
  - 3.3.2.1. Install door hardware at heights indicated in the following applicable publications unless; specifically indicated or required by local governing regulations, requirements to match existing conditions, special templates, necessary coordination with door elevations, and or to ensure consistency with pairs of doors.
- 3.3.3. DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames" DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors" ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities" NWWDA
- 3.3.4. Power door operator products and accessories are required to be installed by an AAADM certified technician as approved by the manufacturer. Adjust for proper opening and closing operation after final balancing of HVAC system.
- 3.3.5. Wall stops:
  - 3.3.5.1. Locate wall stops to contact door pulls/levers at mounting post connecting to door. Ensure existence of necessary wall reinforcing where specified for installation on drywall, plaster or clad wall conditions prior to installation.
- 3.3.6. Closers:

- 3.3.6.1. Size closers as per manufacturer's installation instructions. Adjust all closers after final balancing of HVAC system to ensure; proper latching of doors, proper closing/latch speed, adequate backcheck and opening force in accordance with referenced accessibility requirements.
- 3.3.7. Protection plates:
  - 3.3.7.1. Install on clean surface, and in temperature range of 5-25 degrees Celsius where tape applied. Pre-drill pilot holes doors when using mechanical fasteners.
- 3.3.8. Thresholds:
  - 3.3.8.1. Set thresholds in full bed of sealant complying with requirements specified in Division 7, Section 07 92 00, Joint Sealants.
- 3.3.9. Architectural Seals
  - 3.3.9.1. Install prior to other soffit mounted door hardware as indicated in hardware schedule. Ensure continuous seal of gasketing to door without impeding latching.
- 3.3.10. Door Bottoms
  - 3.3.10.1. Ensure continuous seal to threshold or finished floor.
- 3.3.11. Electronic hardware systems:
  - 3.3.11.1. Install all electronic hardware as per electrical elevations and point-to-point drawings furnished under Submittals.

#### **3.4. FIELD QUALITY CONTROL**

- 3.4.1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures for coordinating all portions of work under the Contract, unless the Contract Documents give other specific instructions.
- 3.4.2. The Contractor will conduct periodic inspections to ensure that door frames are installed plumb, level and square with verification by installer prior to installation of doors and door hardware.
- 3.4.3. Hardware supplier to attend site meetings as required to ensure proper execution of the guidelines set forth herein.
- 3.4.4. Hardware supplier will perform final field inspection of installed door hardware after final adjustment of all products and will document and report any deficiencies or omissions for correction and written acceptance by the Contractor.

#### **3.5. ADJUSTING**

- 3.5.1. Adjust and verify proper operation and function of each operating item of hardware (including electromechanical) on all doors prior to acceptance and occupancy. Replace units that cannot be adjusted to operate freely and as intended for the application made.

#### **3.6. CLEANING AND PROTECTION**

- 3.6.1. Contractor to protect all hardware, as it is stored on construction site in a covered, dry and secure place. Protect exposed hardware installed on doors and frames during the construction phase. Install all hardware at the latest possible time frame.
- 3.6.2. Remove manufacturer's protective coating from items after written acceptance of installation by Contractor.
- 3.6.3. Clean operating items as necessary to restore to proper function and finish of hardware and doors.
- 3.6.4. Clean adjacent surfaces soiled by door hardware installation.

#### **3.7. DEMONSTRATION**

- 3.7.1. Instruct Owner's maintenance personnel in the proper adjustment, operation and maintenance of mechanical and electromechanical door hardware, electronic devices and maintenance of finishes.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Warranty
- .10 2.1. Performance/Design Requirements
- .11 2.2. Automatic Door Operators - General
- .12 2.3. Automatic Door Operators - Door Frame / Wall Mounted
- .13 2.4. Electrical Characteristics
- .14 2.5. Finishes
- .15 2.6. Fabrication
- .16 3.1. Examination
- .17 3.2. Preparation
- .18 3.3. Installation
- .19 3.4. Sealant Application
- .20 3.5. Adjusting
- .21 3.6. Protection Of Finished Work
- .22 3.7. Final Cleaning
- .23 3.8. Demonstration

### **1.3. SUMMARY**

- 1.3.1. Section includes provision of all labour, materials, equipment and incidental services necessary to provide automatic power door operator systems including the following:
- 1.3.1.1. Automatic door operators.
  - 1.3.1.2. Control System
  - 1.3.1.3. Activation Devices

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination:
- 1.4.1.1. Check dimensions at the *Place of the Work* before fabrication commences, and report to the *Consultant* in writing all discrepancies.
  - 1.4.1.2. Where dimensions are not available before fabrication commences, the dimension required shall be agreed upon between the various sections concerned.
- 1.4.2. Templates:
- 1.4.2.1. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- 1.4.3. Electrical System Roughing-in:
- 1.4.3.1. Coordinate layout and installation of automatic door operators with connections to, power supplies and electrical door latching hardware.
- 1.4.4. System Integration:
- 1.4.4.1. Integrate automatic door operators with other systems as required for a complete working installation.

## **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Shop drawings to be prepared specifically for this *Contract* and to indicate location of components, anchorage details, adjacent construction interface, and dimensions as well as all necessary wiring and electrical requirements.
- 1.5.4. Samples:
  - 1.5.4.1. Submit samples of each finish material proposed for use in the *Work*.
- 1.5.5. Certificates:
  - 1.5.5.1. Submit certificate of conformance to specified standards following procedures for submittal of *Product* data.
- 1.5.6. Templates:
  - 1.5.6.1. Submit templates during construction for use by installers and fabricators as required for proper location and installation of hardware.

## **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Operation and maintenance data:
  - 1.6.1.1. Demonstrate, and Provide instruction in, the proper operation and maintenance of the Products Provided as part of the work of this section to the Owner in accordance with Section 01 77 00.
  - 1.6.1.2. Submit operation data and maintenance data for cleaning and maintenance of hardware for incorporation into the operation and maintenance manual specified in Section 01 77 00.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Installers / applicators / erectors:
    - (1) Execute the work of this section only by a certified Subcontractor who has adequate plant, equipment, and skilled workers to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to that specified during a period of at least the immediate past 5 years, and with 10 years' satisfactory experience.
    - (2) Installer shall be approved in writing by the manufacturer of the operators for installation of their *Product*.
- 1.7.2. Barrier free door operators shall be certified by the manufacturer to performance design criteria in accordance with CAN/CSA C22.2 No. 247-92(R2014), and ANSI/BHMA A156.19-2013.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Store finishing hardware in locked, clean dry area.
- 1.8.2. Package each item of hardware, including fastenings, separately or in like groups of hardware, and label each package as to item definition and location.
- 1.8.3. Submit hardware with an easily removable covering to protect against scratches, abrasions, coating with dissimilar finish materials on adjacent surfaces, and tarnishing.

## **1.9. WARRANTY**

- 1.9.1. Automatic door operators shall be free of defects in material and workmanship for a period of one (1) year from the date of Substantial Performance.
- 1.9.2. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- 1.9.3. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

## 2 PRODUCTS

### 2.1. PERFORMANCE/DESIGN REQUIREMENTS

- 2.1.1. Use ULC or ULI listed and labelled hardware in fire separations and exit doors.
- 2.1.2. Be responsible for, and abide by, all requirements and regulations of the Ontario Building Code. Conduct tests and inspections required and pay all charges incidental thereto.

### 2.2. AUTOMATIC DOOR OPERATORS - GENERAL

- 2.2.1. Operation:
  - 2.2.1.1. Activation type:
    - (1) Push-plate.
  - 2.2.1.2. Door to safely stop and reverse if an object is encountered in the opening or closing cycle.
  - 2.2.1.3. Manual opening force: 62 N.
  - 2.2.1.4. Closing force: 26.6 N.
  - 2.2.1.5. Factory-set door hold open voltage.
  - 2.2.1.6. Fail safe: In the event of power failure, door shall operate manually, without damage to operator components.
- 2.2.2. Activators; wall-mounted:
  - 2.2.2.1. Push-plate:
    - (1) Formed stainless steel plate, satin finish, approximately 127 mm (5") square, with depressed wheelchair logo marking, 2 required per opening.
  - 2.2.2.2. Electrical supply: 120 Volt.

### 2.3. AUTOMATIC DOOR OPERATORS - DOOR FRAME / WALL MOUNTED

- 2.3.1. Provide low *energy* operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
  - 2.3.1.1. Fire-Rated Doors:
    - (1) Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- 2.3.2. Standard:
  - 2.3.2.1. Certified ANSI/BHMA A156.19.
- 2.3.3. Configuration:
  - 2.3.3.1. Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- 2.3.4. Operation:
  - 2.3.4.1. Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.
- 2.3.5. Features:
  - 2.3.5.1. Opening speed.
  - 2.3.5.2. Back-check.
  - 2.3.5.3. Hold-open, from 5 seconds to 30 seconds.
  - 2.3.5.4. Closing speed.
  - 2.3.5.5. Opening force.
  - 2.3.5.6. Acceleration during opening and recycling, for soft start.
- 2.3.6. Controller:
  - 2.3.6.1. Completely electromechanical capable of the following functions:
    - (1) Obstruction detection.
    - (2) Initialization and power on.
    - (3) Door motion learn cycle.
    - (4) Manual mode, without spring closer.
    - (5) Power open/power close logic.

- 2.3.6.2. Control box and motor/gear box to be contained in aluminum housing finished to match aluminum entrances, precision-machined gears and bearing seats and all- weather lubricant, mounted on vibration isolators.
  - (1) Design for surface-mounted application on surface of door frame/wall, maximum 3 mm (1/8") above top of door.
  - (2) Design for interior application.
- 2.3.6.3. Gears: manufactured by operator manufacturer specifically for operators being provided.
- 2.3.6.4. Motor: DC permanent magnet motor with shielded ball bearings. Stop motor when door stops or is fully open and when breakaway is operated.
- 2.3.6.5. Door operating arm: forged steel, attached at natural pivot point of door. Do not use side block in top of door. Exposed arms to be factory polished and finished to match operator enclosure.
- 2.3.6.6. Control circuits for actuators and safeties: low-voltage, NEC Class II.
- 2.3.6.7. Service conditions: satisfactory operation between -34°C and 71°C.
- 2.3.7. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- 2.3.8. Brackets and Reinforcements:
  - 2.3.8.1. Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- 2.3.9. Wireless Interface:
  - 2.3.9.1. Operator units shall have a wireless interface via a mobile device for ease of installation and setup. Anti-ligature, digitally controlled and intelligent complete swing door system. Includes built-in anti-finger trap door leaves mounted into a tight sealed frame. Complete with an overhead concealed swing door operator and ball-raced heavy duty bottom pivot.
- 2.3.10. Acceptable Products:
  - 2.3.10.1. Assa Abloy SW200 I (Integra) by Assa Abloy.

## **2.4. ELECTRICAL CHARACTERISTICS**

- 2.4.1. Nominal current draw 222 watts (1.85 amps at 120V AC). Motor shall draw 672 watts maximum. Electric motor shall be equipped with a built-in thermal overload protection, and shall not exceed 10 amps current draw.
- 2.4.2. Provide two low-voltage 18 gauge stranded wires (per operator) from each automatic operator to remote activation devices.

## **2.5. FINISHES**

- 2.5.1. Finish components to match aluminum framed glazing systems in conjunction with which they are to be provided, in accordance with Section 08 41 00 and 08 41 23.
- 2.5.2. Anodized: Class 1 anodic colour coating to AA-M12C22A42/44; #29 Black.

## **2.6. FABRICATION**

- 2.6.1. Fit intersecting members to flush hairline weathertight joints and mechanically fasten together, except where indicated otherwise.
- 2.6.2. Conceal fastenings from view, except where indicated otherwise.
- 2.6.3. Form cut-outs, recesses, mortising or milling for finishing hardware to templates supplied. Reinforce with aluminum or galvanized steel plates.
- 2.6.4. Field apply isolation coating to aluminum in contact with dissimilar metals or cementitious materials.
- 2.6.5. Fabricate units square and true with maximum tolerance of plus or minus 1.5mm for units with a diagonal measurement of 1800mm or less and plus or minus 3mm for units with a diagonal measurement over 1800mm.
- 2.6.6. Provide all internal reinforcing as required for the proper structural design and support of the framing system.
- 2.6.7. All joints shall be accurately machined and assembled to provide neat joints.

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Verify that door openings are properly installed and ready to receive the work of this section.
- 3.1.2. Verify that electrical service is available, properly located, and of proper type.

#### **3.2. PREPARATION**

- 3.2.1. Before furnishing any hardware, carefully check the *Contract Documents*, verify door swings, door and frame materials and operating conditions, and assure that hardware will fit work to be attached.
- 3.2.2. Check shop drawings and frame and door lists affecting hardware type and installation, and verify to correctness thereof, or advise of required revisions. Check that doors, frames and panels requiring additional support are reinforced.
- 3.2.3. Point out special requirements to installer. Make final adjustment of hardware, in particular closer arms, valves and locksets, to work properly.

#### **3.3. INSTALLATION**

- 3.3.1. Install in accordance with manufacturer's instructions and in accordance with CAN/CSA C22.2 No. 247-92(R2014).
- 3.3.2. Provide operator system complete in all its parts and connected to electrical service provided as part of the work of Divisions 26, 27 and 28. Secure all wiring such that it is concealed from view.
- 3.3.3.
- 3.3.4. Install power door operators in accordance with reviewed shop drawings and manufacturer's printed instructions, including controls, wiring, and all activation devices.
- 3.3.5. Coordinate installation of components with related and adjacent work.
- 3.3.6. Set work plumb, square, level, free from warp, twist and superimposed loads.
- 3.3.7. Securely anchor work in required position.
- 3.3.8. Apply isolation coating to separate aluminum and primed or galvanized steel surfaces at points of contact with cementitious materials.

#### **3.4. SEALANT APPLICATION**

- 3.4.1. Comply with requirements of Section 07 90 00 for sealants, fillers and gaskets to be installed during installation of doors and frames.
- 3.4.2. Conceal sealant within aluminum work.
- 3.4.3. Set sill members in bed of sealant.

#### **3.5. ADJUSTING**

- 3.5.1. Verify that installed hardware and operators function properly and instruct installers accordingly of requirements and procedures for adjustments for operation without binding or scraping, and without excessive noise.
- 3.5.2. After repeated operation of completed installation equivalent to three days of use by normal traffic (100 to 300 cycles), re-adjust door operators and controls for optimum, smooth operating condition and safety and for weather tight closure. Lubricate hardware, operating equipment and other moving parts.
- 3.5.3. Adjust doors to provide tight fit at contact points with enclosure.

#### **3.6. PROTECTION OF FINISHED WORK**

- 3.6.1. Protect finished installation until time of final cleaning and inspection.
- 3.6.2. Leave all factory installed protective films in place until time of final cleaning.

#### **3.7. FINAL CLEANING**

- 3.7.1. Clean aluminum surfaces promptly after installation. Exercise care to avoid damage to coatings.
- 3.7.2. Remove protective material from prefinished aluminum surfaces.

- 3.7.3. Wash exposed surfaces with mild solution of detergent and warm water, using soft, clean wiping cloths. Remove dirt from corners. Wipe surfaces clean.
- 3.7.4. Remove excess sealant by moderate use of solvent, of type acceptable to sealant manufacturer

**3.8. DEMONSTRATION**

- 3.8.1. Demonstrate operation, operating components, adjustment features, and lubrication requirements to Owner.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.2 Summary
- .4 1.3. References
- .5 1.4. Submittals
- .6 1.5. Closeout Submittals
- .7 1.6. Quality Assurance
- .8 1.7. Delivery, Storage, And Handling
- .9 1.8. Field Conditions
- .10 1.9. Extended Warranty
- .11 2.1. Regulatory Requirements
- .12 2.2. Performance/Design Requirements
- .13 2.3. Glass Materials
- .14 2.4. Fire Protection Rated Glass
- .15 2.5. Glazing Materials (Non-Fire Rated)
- .16 2.6. Glazing Accessories (Fire Rated)
- .17 2.7. Glazing Films
- .18 2.8. Fabrication
- .19 3.1. Examination
- .20 3.2. Preparation
- .21 3.3. Glazing - General
- .22 3.4. Tape Glazing
- .23 3.5. Gasket Glazing (Dry)
- .24 3.6. Sealant Glazing (Wet)
- .25 3.7. Installation – Mirrors
- .26 3.8. Installation – Glass Film
- .27 3.9. Field Quality Control
- .28 3.10. Protection
- .29 3.11. Finishing

### **1.2 SUMMARY**

- 1.2.1. Section includes:  
1.2.1.1. Glass and glazing.

### **1.3. REFERENCES**

- 1.3.1. Definitions:
- 1.3.1.1. Deterioration of coated glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
  - 1.3.1.2. Deterioration of insulating glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.
  - 1.3.1.3. Deterioration of laminated glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass

breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delaminating material obstructing vision through glass and blemishes exceeding those allowed by referenced laminated glass standards.

- 1.3.1.4. Interspace or airspace: The space between lites of any insulating glass unit that contains dehydrated air or a specified gas.
- 1.3.1.5. Manufacturer: A firm that produces primary glass or fabricated glass products as defined in referenced glazing publications.

#### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Show details of each type of glazing system in conjunction with the framing system indicating type of glass, sizes, shapes, glazing material and quantity. Show details indicating glazing material, glazing thickness, bite on the glass and glass edge clearance.
  - 1.4.3.2. For glass scheduled or indicated as engineered and glass to serve as guards in accordance with the Ontario Building Code, shop drawings to be engineered shop drawings.
  - 1.4.3.3. Indicate analysis of glass including maximum deflection and allowable stresses (from imposed dead/live loads and thermal loads).
- 1.4.4. Samples:
  - 1.4.4.1. Submit 305 mm (12") square samples of each type of glass indicated except for clear monolithic glass products, and 305 mm (12") long samples of each color required, except black, for each type of sealant or gasket exposed to view.
    - (1) Submit 3 control samples for each glass type showing maximum range of visible difference between units for the project.
- 1.4.5. Test and evaluation reports:
  - 1.4.5.1. Obtain compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealant as well as other glazing materials including insulating units.
- 1.4.6. Manufacturer reports:
  - 1.4.6.1. Submit glass fabricator's product information and structural calculations indicating compliance with glazing standards established by the Glass Association of North America (GANA). Submittal to include thermal stress and structural load analysis of the proposed glass types, configuration and sizes.
- 1.4.7. Submit sample glazing warranty.
- 1.4.8. Submit letter from IGMAC or IGMA/IGCC, or a test report prepared by independent testing company confirming insulating glass units of the types required have been successfully tested in accordance with CAN/CGSB 12.8-97 or ASTM E2190-10 and will withstand design loads specified in the *Contract Documents*.

#### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit maintenance and cleaning instructions for glass and glazing for incorporation into the operating and maintenance manuals.

#### **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be

manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.

- 1.6.1.2. Installers / applicators / erectors: *Provide* the work of this section executed by specialist *Subcontractor* who shall be thoroughly trained and experienced in skills required, be completely familiar with referenced standards and requirements of the work of this section, and personally direct installation performed under this section.
  - (1) Foreperson experience: a minimum of 10 years' experience as glazing mechanic.
  - (2) Typical glazing mechanic experience: a minimum of 3 years' experience as glazers.
  - (3) Mirror installations: Installation only by applicator trained and approved by adhesive manufacturer for application of its products.
- 1.6.1.3. Licensed professionals: Retain a Professional Engineer to design the work of this section; to prepare, seal and sign shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.
- 1.6.2. Mock-ups:
  - 1.6.2.1. Provide mock-up of mirror installation, including minimum of 4 full size mirrors.
  - 1.6.2.2. Locate mirror mock-up where approved by the *Consultant*.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Protect glass from edge damage, dust, and contaminants during handling and storage. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.
- 1.7.2. Storage and protection: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

## **1.8. FIELD CONDITIONS**

- 1.8.1. Ambient Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.
- 1.8.2. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 4.4°C.

## **1.9. EXTENDED WARRANTY**

- 1.9.1. The glazing systems shall perform properly to the extent that the design and the *Contract Documents* permit such performance for the duration of the warranty period.
- 1.9.2. Special product warranty for insulating glass unit products:
  - 1.9.2.1. *Provide* a written warranty from date of manufacture for sealed insulating glass units. Warranty shall cover the following:
    - (1) Deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
    - (2) Replacement of sealed insulating glass units.
    - (3) No dollar limit.
    - (4) Non-prorated.
    - (5) 10-year warranty duration.
- 1.9.3. Special product warranty for mirror glass products:
  - 1.9.3.1. Provide a written warranty from date of manufacture for mirror silvering. Warranty shall cover the following:
    - (1) Deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.

- (2) Replacement of mirror glass units.
- (3) 10 year warranty duration.

## **2 PRODUCTS**

### **2.1. REGULATORY REQUIREMENTS**

- 2.1.1. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with building code, ANSI Z97.1, and requirements of CPSC 16 CFR Part 1201 for category II materials.
- 2.1.2. Barrier-Free Strips: Comply with the Ontario Building Code Requirements for a barrier-free path of travel and Facility Accessibility Design Standards.
  - 2.1.2.1. Where a vision panel is provided in a door in a barrier-free path of travel, such panel shall be at least 75 mm in width and be located so that:
  - 2.1.2.2. The bottom of the panel is not more than 900 mm above the finished floor,
  - 2.1.2.3. The edge of the panel closest to the latch is not more than 250 mm from the latch side of the door.
- 2.1.3. Fully-glazed interior doors, screens and sidelights shall be marked with continuous opaque strip that is colour and brightness contrasted to background of door:
  - 2.1.3.1. Shall be at least 50 mm wide.
  - 2.1.3.2. Located across width of door at height of 1350 mm to 1500 mm above finished floor.
  - 2.1.3.3. May incorporate a logo or symbol provided such logo or symbol does not diminish opacity of strip, width of the strip, colour and brightness contrast of strip to background of door, and continuity of strip across width of the door.

### **2.2. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.2.1. General:
  - 2.2.1.1. Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section.
    - (1) GANA Glazing Manual.
    - (2) GANA Engineering Standards Manual.
    - (3) GANA Laminated Glazing Reference Manual.
    - (4) GANA Sealant Manual.
- 2.2.2. Regulatory requirements:
  - 2.2.2.1. Fire rated glass:
    - (1) Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
- 2.2.3. Glass strength:
  - 2.2.3.1. Provide glass products in the thickness and strengths required to meet or exceed the following criteria based on project loads and in-service conditions.
    - (1) Analysis shall comply with CAN/CGSB 12.20-M89.
    - (2) Minimum thickness of annealed or heat-treated glass products to be selected so the worst case probability of failure does not exceed the following:
      - (A) 8 breaks per 1000 for glass installed vertically less than 15 degrees from the vertical plane and under wind action.
      - (B) 5 breaks per 1000 for heat soaked tempered glass as a result of verifiable NiS inclusion.
      - (C) 1 break per 1000 for glass installed 15 degrees or more from the vertical plane and under action of wind and/or snow.
    - (3) Maximum lateral deflection; insulating glass units:
      - (D) For insulating glass units supported on four edges, limit centre-of-glass deflection at design wind pressure to not more than 1/175 times the long- side length or 19 mm (3/4") maximum.
    - (4) Glass at guards, balustrades, and where glass is likely to be subjected to human impact shall comply with safety glass requirements of CAN/CGSB

- 12.20-M89 and CAN/CGSB 12.1-M90, where applicable, and the Ontario Building Code.
- (5) Provide annealed, heat strengthened, and tempered lights where required by the Ontario Building Code, and where required for the various solar exposures on the building.
  - (6) Glass thicknesses and glass types specified, indicated, or scheduled in the Contract Documents are minimums required. Glass designer/engineer to modify as required to satisfy design and Ontario Building Code requirements, and requirements of authorities having jurisdiction, and any such modifications shall be clearly indicated on shop drawings.
- 2.2.4. Thermal and optical performance: *Provide* glass products with performance properties specified or published by glass manufacturer where not specified. Performance properties to be manufacturer's published data as determined according to the following procedures:
- 2.2.4.1. Centre of glass U-Value: National Fenestration Rating Council (NFRC) 100 methodology using LBNL WINDOW 5.2 computer program.
  - 2.2.4.2. Centre of glass solar heat gain coefficient: NFRC 200 methodology using LBNL- 35298 WINDOW 5.2 computer program.
  - 2.2.4.3. Visible light transmittance: NFRC 200 methodology.
  - 2.2.4.4. Solar optical properties: NFRC 300 or LBNL Optics.
- 2.2.5. Glazing systems shall be capable of withstanding normal thermal movements, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
- 2.2.6. Protect laminated glass interlayer from damage or discolouration resulting from contact with deleterious and incompatible sealants, substances, and materials. Comply with manufacturer's recommended installation instructions.

### 2.3. GLASS MATERIALS

- 2.3.1. General:
- 2.3.1.1. Single source responsibility:
    - (1) *Provide* materials from a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source and manufacturing plant for each type and class required.
- 2.3.2. Insulating glass units:
- 2.3.2.1. Triple Glazed Clear Solar Control Insulating Glass Unit
    - (1) Conformance: ASTM E 2190
    - (2) Outdoor Lite: Clear float glass
      - (A) Conformance: ASTM C 1036, Type 1, Class 1, Quality q3.
      - (B) Glass Thickness: 6mm (1/4")
      - (C) Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C 1376.
      - (D) Coating: Solarban® 90 on Surface # 2
      - (E) Heat-Treatment: Heat-strengthened, ASTM C 1048, Kind HS
    - (3) Interspace Content: Air 1/2" (12.7mm)
    - (4) Middle Lite: Clear float glass
      - (A) Conformance: ASTM C 1036, Type 1, Class 1, Quality q3.
      - (B) Heat-Treatment: Heat-strengthened, ASTM C 1048, Kind
      - (C) Glass Thickness: 6mm (1/4")
    - (5) Interspace Content: Air 1/2" (12.7mm)
    - (6) Indoor Lite: Clear float glass
      - (A) Conformance: ASTM C 1036, Type 1, Class 1, Quality q3.
      - (B) Heat-Treatment: Heat-strengthened, ASTM C 1048, Kind HS
      - (C) Glass Thickness: 6mm (1/4")

- 2.3.2.2. Hermetically sealed, CAN/CGSB 12.8-97, minimum 12 mm (1/2") air space, air filled, double sealed edges (primary to be polyisobutylene, secondary to be polysulphide/polyurethane, desiccant filled aluminum spacer bar.
  - (1) The minimum thickness of the secondary seal shall be 1.59 mm (1/16").
  - (2) The target width of the primary seal shall be 3.97 mm (5/32").
  - (3) There shall be no voids or skips in the primary seal.
  - (4) Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1.59 mm (1/16") by maximum length of 50 mm (2") with gaps separated by at least 450 mm (18"). Continuous contact between the primary seal and the secondary seal is desired.
  - (5) Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
- 2.3.2.3. Warm edge, hermetically sealed, CAN/CGSB 12.8-97, minimum 12 mm (1/2") air space, air filled, double sealed edges (primary to be polyisobutylene, secondary to be polysulphide, desiccant filled warm edge spacer (splice connectors at corner of each glass unit).
  - (1) The minimum thickness of the secondary seal shall be 1.59 mm (1/16").
  - (2) The target width of the primary seal shall be 3.97 mm (5/32").
  - (3) There shall be no voids or skips in the primary seal.
  - (4) Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1.59 mm (1/16") by maximum length of 50 mm (2") with gaps separated by at least 450 mm (18"). Continuous contact between the primary seal and the secondary seal is desired.
  - (5) Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
  - (6) Warm edge spacer:
    - (E) Vinyl faced, electrolytic tinplated steel: Fenzi 'Warmedge' or equivalent.
    - (F) Spacer bar colour:
    - (G) Black.
- 2.3.2.4. IGMAC or IGMA/IGCC certified.
- 2.3.2.5. Low 'E' coating (double silver):
  - (1) Acceptable Products:
    - (H) Vitro Architectural Glass 'Solarban 90'.
    - (I) Or equivalent.
- 2.3.2.6. Glass thickness: 6 mm (1/4") minimum, and as required to suit design requirements.
- 2.3.2.7. Glass colour: clear, unless otherwise indicated in the Contract Documents.
- 2.3.2.8. Performance Requirements:
  - (1) Visible Light Transmittance: 46 percent minimum
  - (2) Winter Nighttime U-Factor: 0.21 (Btu/hr\*ft2\*°F) maximum
  - (3) Summer daytime U-Factor: 0.21 (Btu/hr\*ft2\*°F) maximum
  - (4) Shading Coefficient: 0.24 maximum
  - (5) Solar Heat Gain Coefficient: 0.21 maximum
  - (6) Outdoor Visible Light Reflectance: 14 percent maximum
- 2.3.3. Annealed (float) glass:
  - 2.3.3.1. Clear, annealed glass, 6 mm (1/4") thick minimum, CAN/CGSB 12.3-M91, Glazing Quality.
- 2.3.4. Heat treated (tempered or heat strengthened) float glass:
  - 2.3.4.1. CAN/CGSB 12.1-M90.
  - 2.3.4.2. Provide thickness as indicated or greater thickness as needed to comply with requirements. Minimum thickness: 6 mm (1/4").
  - 2.3.4.3. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- 2.3.4.4. For uncoated glass, comply with requirements for Condition A in accordance with ASTM C1048-12e1.
- 2.3.4.5. For coated vision glass, comply with requirements for Condition C (other coated glass) in accordance with ASTM C1048-12e1.
- 2.3.4.6. Heat strengthened glass shall have surface compression of 24-52 MPa (3,500-7,500 psi).
- 2.3.5. Mirrors:
  - 2.3.5.1. Annealed glass, to ASTM C1503-08(2013) as follows:
  - 2.3.5.2. Grade: Mirror Cut Size.
  - 2.3.5.3. Quality: Mirror Select Quality, except allowable distortion shall be  $\geq 80^\circ$  vision interference angle to ASTM C1036-11e1 Table 5.
  - 2.3.5.4. Colour: Clear.
  - 2.3.5.5. Thickness: 6 mm (1/4")
  - 2.3.5.6. Exposed edges shall be chamfered, ground, and polished.
- 2.3.6. Ceramic-coated spandrel glass:
  - 2.3.6.1. Glass treatment:
    - (1) Tempered float glass.
  - 2.3.6.2. Thickness: 6 mm (1/4") minimum thickness.
  - 2.3.6.3. Coating Location: Second surface.
  - 2.3.6.4. Fallout Resistance: Passes fallout-resistance test in ASTM C1048-12e1 for an assembly of glass and adhered reinforcing material.
  - 2.3.6.5. Ceramic enamel coating, baked on.
    - (1) Colour: Custom colour to later selection by the *Consultant*
  - 2.3.6.6. Acceptable ceramic coating manufacturers:
    - (1) Viracon Inc.
    - (2) Prelco Inc.
    - (3) Or equivalent.
- 2.3.7. Frosted glass:
  - 2.3.7.1. Glass type: Tempered or type as required to suit design requirements.
  - 2.3.7.2. Surface treatment: Etching.
  - 2.3.7.3. Level of opacity: As selected by Consultants

## **2.4. FIRE PROTECTION RATED GLASS**

- 2.4.1. Fire rated, impact safety resistant glass, non-wired:
  - 2.4.1.1. Film-faced ceramic glazing:
    - (1) Fire-rated and impact safety-rated, clear ceramic glazing material with surface applied impact safety film, and listed for use in doors, sidelites, transoms, and borrowed lites in both interior and exterior applications, not functioning as a barrier to heat.
    - (2) Fire-ratings: as indicated or scheduled, from 20 minutes to 90 minutes, 3 hours in doors where applicable, with hose stream test.
    - (3) Impact Safety Resistance: ANSI Z97.1-2010 and CPSC 16 CFR 1201 (Cat. I and II).
    - (4) Surface finish:
      - (J) Premium Grade: clear glass, polished for superior optical clarity.
    - (5) Acceptable *Product*:
      - (K) Schott Gemtron (Canada) Corporation 'Pyran Platinum F'.
      - (L) Technical Glass Products Ltd. 'FireLite NT'.
      - (M) Or equivalent.

## **2.5. GLAZING MATERIALS (NON-FIRE RATED)**

- 2.5.1. Glazing materials; general: Select glazing sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

- 2.5.2. Glazing gaskets: Moulded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:
  - 2.5.2.1. Preformed, EPDM to ASTM C864-05(2011).
- 2.5.3. Setting blocks: Moulded or extruded material with Shore, Type A Durometer hardness of 85, plus or minus 5, made from the following:
  - 2.5.3.1. Preformed, EPDM to ASTM C864-05(2011).
- 2.5.4. Spacers: Moulded or extruded blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated made from the following:
  - 2.5.4.1. Preformed, EPDM to ASTM C864-05(2011).
- 2.5.5. Edge blocks: Moulded or extruded material of hardness needed to limit glass lateral movement (side walking) made from the following:
  - 2.5.5.1. Preformed, EPDM to ASTM C864-05(2011).
- 2.5.6. Cleaners, primers and sealers: Type recommended by sealant or gasket manufacturer.
- 2.5.7. Polyurethane foam glazing tape:
  - 2.5.7.1. High density, closed-cell, flexible, non-extruding tape, adhesive backed one side only; recommended by manufacturer for exterior applications with nominal pressure in glazing channel.
  - 2.5.7.2. Acceptable manufacturer: Norton Company or equivalent.
  - 2.5.7.3. Acceptable products: As recommended by manufacturer suitable for conditions of application and use.
- 2.5.8. Silicone glazing (Weatherseal) sealant:
  - 2.5.8.1. Medium-modulus, neutral-curing silicone sealant; complying with ASTM C920-11, Type M or S, Grade NS, Class 25.
  - 2.5.8.2. Acceptable products:
    - (1) Dow Corning '790' or '795'.
    - (2) Pecora Corporation '864' or '890'.
    - (3) Sika Canada Inc. 'Sikasil WS-290' or 'WS-295'.
    - (4) Tremco Inc. 'Spectrum 2'.
    - (5) Momentive Performance Materials Inc. 'SilGlaze II'.
    - (6) Or equivalent.
- 2.5.9. Mirror clips:
  - 2.5.9.1. Nickel plated, CR Laurence 'Vancouver' clips or equivalent.
- 2.5.10. Mirror adhesive: Palmer Mirro-Mastic, complete with sealer as required.

## **2.6. GLAZING ACCESSORIES (FIRE RATED)**

- 2.6.1. Glazing tape; fire-rated glass (non-wired):
  - 2.6.1.1. Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapour seal.
- 2.6.2. Silicone sealant: One-part neutral curing silicone, medium modulus sealant, to ASTM C920-11, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable.
  - 2.6.2.1. Acceptable Products:
    - (1) Dow Corning '795'.
    - (2) Momentive Performance Materials Inc. 'Silglaze-II 2800'.
    - (3) Tremco Inc. 'Spectrum 2'.
    - (4) Or equivalent.
- 2.6.3. Setting blocks: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
- 2.6.4. Cleaners, primers, and sealers: Type recommended by manufacturer of glass and gaskets.



## **2.7. GLAZING FILMS**

- 2.7.1. Glazing Film: Refer to Architectural Drawings.
  - 2.7.1.1. Meets ASTM E84, Class A.
  - 2.7.1.2. Pressure-sensitive adhesive application
- 2.7.2. Provide barrier-free strips to comply with the Ontario Building Code Requirements for a barrier-free path of travel.
  - 2.7.2.1. Provide samples to the Consultant for approval.
  - 2.7.2.2. Basis of Design: Refer to Architectural Drawings

## **2.8. FABRICATION**

- 2.8.1. Factory sealed insulating glass units:
  - 2.8.1.1. Fabricate units to requirements of CAN/CGSB 12.8-97.
  - 2.8.1.2. Spacer core shall be straight and evenly set into glass units.
  - 2.8.1.3. Insulating glass units shall be manufactured to conform to IGMAC recommendations (Insulated Glass Manufacturers Association of Canada) and the manufacturer shall be a member of IGMAC. Sealed units shall bear IGMAC certification markings.
- 2.8.2. Grind, chamfer, and polish exposed glass edges, unless otherwise indicated in the *Contract Documents*.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine framing, glazing channels, and stops, with glazing installer present, for compliance with the following:
  - 3.1.1.1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 3.1.1.2. Inspect butt and mitre joints in framing. Seal joints found to be open with a compatible sealant prior to glazing.
  - 3.1.1.3. Glazing pockets and surfaces are free of dust, construction debris, and contaminants.
  - 3.1.1.4. Presence and functioning of weep systems.
  - 3.1.1.5. Minimum required face and edge clearances as per IGMA and GANA standards.
  - 3.1.1.6. Effective sealing between joints of glass-framing members.
- 3.1.2. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2. PREPARATION**

- 3.2.1. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- 3.2.2. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.
- 3.2.3. Clean contact surfaces with solvent and apply primers to surfaces to receive tapes and sealants in accordance with the manufacturer's instructions. Ensure surfaces are free of moisture and frost.

### **3.3. GLAZING - GENERAL**

- 3.3.1. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- 3.3.2. Adjust glazing channel dimensions as required by conditions during installation to Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 3.3.3. Protect glass edges from damage during handling and installation. Remove damaged glass from the Site and legally dispose of off Site. Damaged glass is glass with edge

- damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- 3.3.4. Clean glazing rebate surfaces of traces of dirt, dust, or other contaminants.
  - 3.3.5. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
  - 3.3.6. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
  - 3.3.7. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
  - 3.3.8. Provide spacers for glass lites where length plus width is greater than 1270 mm (50").
    - 3.3.8.1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
    - 3.3.8.2. Provide 3.2 mm (1/8") minimum bite of spacers on glass and use thickness equal to sealant width.
  - 3.3.9. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel.
  - 3.3.10. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
  - 3.3.11. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
  - 3.3.12. Glaze hollow metal doors and frames specified under work of Section 08 11 13 using tape glazing installation.
  - 3.3.13. Install fire rated glazing in accordance with fire rated glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

### **3.4. TAPE GLAZING**

- 3.4.1. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- 3.4.2. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- 3.4.3. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs.
- 3.4.4. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- 3.4.5. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- 3.4.6. Do not remove release paper from tape until right before each glazing unit is installed.
- 3.4.7. Centre glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings.

### **3.5. GASKET GLAZING (DRY)**

- 3.5.1. Allow gaskets to relax and cut compression gaskets to lengths recommended by gasket manufacturer to fit openings to suit frame dimensions.
- 3.5.2. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- 3.5.3. Installation with drive-in wedge gaskets: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centres of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- 3.5.4. Installation with Pressure-Glazing Stops: Centre glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress

gaskets to produce a weathertight seal without developing bending stresses in glass.  
Seal gasket joints with sealant recommended by gasket manufacturer.

- 3.5.5. Install gaskets so they protrude past face of glazing stops.

### **3.6. SEALANT GLAZING (WET)**

- 3.6.1. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- 3.6.2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- 3.6.3. Tool exposed surfaces of sealants to *Provide* a substantial wash away from glass.

### **3.7. INSTALLATION – MIRRORS**

- 3.7.1. Provide frameless mirrors only. Grind and polish exposed mirror edges.
- 3.7.2. Mount mirrors in true planes, free of distortions. Surfaces of butted mirrors shall be flush to  $\leq 1$  mm (0.04"). Mirror installation shall be flat to within 1.5 mm in 1220 mm (1/16" in 4 ft).
- 3.7.3. Locate joints in mirrors at maximum available mirror sizes to the Consultant's direction, unless otherwise indicated. Provide butt joints with flat ground and polished edges to Provide inconspicuous joint complete with black tape behind joint to hide wall substrate.
- 3.7.4. Mastic adhesive and top and bottom support clip installation:
- 3.7.4.1. Secure mirrors in place over mastic adhesive with metal clips. Locate clips at not more than 914 mm (36") on centre on top and bottom edges of mirrors.
- 3.7.4.2. Make sure mirror and substrate are free of dust, clean, and dry. On nonporous substrates, such as glass, tile, or metal, sealing is not necessary. On porous substrates, such as drywall or wood, use Mirro-Mastic Bond (or a primer or sealer, not paint) on the substrates and allow it to dry. Painted surfaces should be sanded through to the original surface and the substrate cleaned and sealed where the mastic is to be applied.
- 3.7.4.3. Support mirror at the bottom using concealed bottom angles.
- 3.7.4.4. Apply mirror adhesive to the mirror or substrate in a minimum of 1 ping-pong ball size mound for every 0.0929 m<sup>2</sup> (1 ft<sup>2</sup>) of mirror. Do not apply mastic too close to the edge to prevent "squeeze out". Place the mounds so space will be left between them when the mirror is installed. Mastic adhesive shall be at room temperature (22°C).
- 3.7.4.5. Press mirror firmly in place making good contact between the mirror, mastic, and substrate. Mastic should spread to a pat approximately 114 mm (4-1/2") in diameter. The mastic needs air circulation to cure properly. Curing time will depend on temperature, humidity, type of substrate, and amount of air that can reach the mastic.

### **3.8. INSTALLATION – GLASS FILM**

- 3.8.1. Install film with adhesive, applied in accordance with film manufacturer's written instructions.
- 3.8.2. Comply with requirements of the Building Code regarding the installation of film at vision panel in doors and in doors in a barrier free-path of travel.
- 3.8.3. Place without air bubbles, creases or visible distortion.
- 3.8.4. Fit tight to glass perimeter with razor cut edge.

### **3.9. FIELD QUALITY CONTROL**

- 3.9.1. Conduct quality control in accordance with Section 01 45 00.

### **3.10. PROTECTION**

- 3.10.1. *Provide* safety markings to installed glass by attaching streamers or tape to face of sash. Do not apply tape directly to the glass. Do not mark the glass with paint or any other substance that is hard to remove or could leave permanent stains.
- 3.10.2. Take all precautions necessary to protect stored glass and installed glass from lime mortar, water run-off from concrete or copper, weld spatter, acids, roofing tar, solvents, abrasive cleaners, careless handling of construction machinery and equipment, and any other activities that could permanently damage the glass.
- 3.10.3. Install protective cover to glass where there is a high risk of damage. Use plywood, heavy kraft paper, or non-staining transparent plastic sheet. Do not let protective materials contact surface of glass.
- 3.10.4. Do not rely on use of adhesive plastic films to protect installed glass. When plastic sheeting is used, it must be transparent, suspended away from the surface of the glass, and be provided with adequate ventilation holes to prevent heat build-up.

### **3.11. FINISHING**

- 3.11.1. Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.
- 3.11.2. Final cleaning of glass in accordance with Section 01 77 00.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Closeout Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, and Handling
- .8 1.8. Field Conditions
- .9 1.9. Warranty
- .10 2.1. Performance/Design Requirements
- .11 2.2. Materials
- .12 3.1. Examination
- .13 3.2. Preparation
- .14 3.3. Installation
- .15 3.4. Adjusting and Cleaning
- .16 3.5. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Applied glazing film; opaque.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.4.3. Samples:
  - 1.4.3.1. Submit 3 - 200 mm x 200 mm (8" x 8") samples of each specified film type, pattern and colour.

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit maintenance and cleaning instructions for incorporation into operating and maintenance manuals.
  - 1.5.2.2. Instruct Owner's representative on proper care and maintenance for work of this section.

### **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. Subcontractor: Shall have 5 years' experience, minimum, in application of Products specified.

### **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Package materials and identify on attached labels the manufacturer, contents and material specification number.

### **1.8. FIELD CONDITIONS**

- 1.8.1. Conform to manufacturer's written documented temperatures, relative humidity, and substrate moisture content and temperature for application of materials of this section.

### **1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.9.2. Extended warranty:
  - 1.9.2.1. System:
    - (1) Labour, materials, and workmanship for work of this section.
    - (2) Duration: 2 years.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Applied film shall function as intended, and exhibit none of the following:
  - 2.1.1.1. Bubbling.
  - 2.1.1.2. Cracking.
  - 2.1.1.3. Crazing.
  - 2.1.1.4. Delamination.
  - 2.1.1.5. Discolouration.
  - 2.1.1.6. Peeling.

### **2.2. MATERIALS**

- 2.2.1. Applied glazing films; opaque:
  - 2.2.1.1. Acceptable Products:
    - (1) '3M Fasara Glass Finishes' by Convenience Group 3M
      - (A) Pattern Name: Illumina Seamless-PR
    - (2) Substitutions: in accordance with Section 01 25 00.
- 2.2.2. Location:
  - 2.2.2.1. Interior glazing of Gym, not on exterior windows.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine glass surfaces to receive film and verify that they are free from defects and imperfections which will affect the final appearance of installed film. Correct such deficiencies before starting film application.

### **3.2. PREPARATION**

- 3.2.1. Prepare surfaces for film application in accordance with film manufacturer's written requirements.
- 3.2.2. Window and window framing will be cleaned thoroughly with a neutral cleaning solution. Surface of glass shall be bladed with industrial razor to ensure the removal of any foreign contaminants in accordance with film manufacturer's instructions.
- 3.2.3. Towelling or other absorbent material shall be placed on the window sill or sash to absorb moisture accumulation generated by the film application.

### **3.3. INSTALLATION**

- 3.3.1. Applied film; interior application:
  - 3.3.1.1. Apply film to indicated surface of glazing units in accordance with film manufacturer's written requirements, applied plumb, true and level over clean glazing, without air bubbles, wrinkles, blisters, and other defects.
  - 3.3.1.2. After installation, applied film shall be flat with no obvious concentrations of moisture, free of creases, free of tears, with no moisture dimples when viewed under normal conditions.

- 3.3.1.3. Film edges shall be cut neatly and square at a uniform distance of 1.5 mm (1/16") to 0.79 mm (1/32") from frame.

### **3.4. ADJUSTING AND CLEANING**

- 3.4.1. Clean film and glass surfaces so they are free of foreign matter using cleaners recommended by film manufacturer.

### **3.5. PROTECTION**

- 3.5.1. Comply with manufacturer's written requirements respecting protection.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Related Requirements
- .5 1.5. References
- .6 1.6. Administrative Requirements
- .7 1.7. Submittals
- .8 1.8. Closeout Submittals
- .9 1.9. Quality Assurance
- .10 1.10 Mock-Ups
- .11 1.11. Delivery, Storage And Handling
- .12 1.12. Site Conditions
- .13 1.13. Warranty
- .14 2.1. Manufacturer
- .15 2.2. Performance / Design Requirements
- .16 2.3. Materials
- .17 3.1. Examination
- .18 3.2. Preparation
- .19 3.3. Installation
- .20 3.4. Cleaning And Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes requirements for supply and installation of visible markers onto exterior glazed surfaces to reduce the incidence of bird collisions.

### **1.4. RELATED REQUIREMENTS**

- 1.4.1. 08 35 13 – Four-Fold Doors  
1.4.2. 08 81 00 – Glass and Glazing

### **1.5. REFERENCES**

- 1.5.1. American Society for Testing and Materials (ASTM):  
1.5.1.1. ASTM E84-12b, Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.5.2. National Fire Protection Association (NFPA):  
1.5.2.1. NFPA 101 - 2012, Life Safety Code; Class A (1)
- 1.5.3. Toronto Green Standard, Revised December 31, 2010  
1.5.3.1. Ecology; Glass and Other Design Features for Migratory Birds.
- 1.5.4. City of Toronto Green Development Standard, March 2007  
1.5.4.1. Bird-Friendly Development Guidelines.
- 1.5.5. American Bird Conservancy, 2011  
1.5.5.1. Bird-Friendly Building Design.

### **1.6. ADMINISTRATIVE REQUIREMENTS**

- 1.6.1. Coordination:  
1.6.1.1. Coordinate the Work of this Section with the installation of glazing; Sequence work so that installation of bird friendly films coincides with installation of glass materials without causing delay to the Work.



## **1.7. SUBMITTALS**

- 1.7.1. Submit required submittals in accordance with Section 01 33 00.
- 1.7.2. Provide the following submittals before starting any work of this Section:
  - 1.7.2.1. Product Data:
    - (1) Submit manufacturers product data for each type of product specified.
- 1.7.3. Samples for Initial Selection:
- 1.7.4. Submit one (1) sample 300mm x 300mm (12" x 12") of each type of bird friendly films showing pattern spacing and colour of visible markers.
- 1.7.5. Samples for Verification:
  - 1.7.5.1. Submit two (2) samples 300mm x 300mm (12" x 12") for verification for each type and colour of bird friendly films specified in this Section prior to ordering samples from film manufacturer.

## **1.8. CLOSEOUT SUBMITTALS**

- 1.8.1. Operation and Maintenance Data:
  - 1.8.1.1. Submit manufacturer's written instructions for cleaning solutions, materials and procedures, include name of original installer and contact information in accordance with Section 01 78 23 Operation and Maintenance Manuals.
  - 1.8.1.2. Provide specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

## **1.9. QUALITY ASSURANCE**

- 1.9.1. Qualifications:
  - 1.9.1.1. Manufacturer / Supplier:
    - (1) Obtain materials from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties.
  - 1.9.1.2. Installers:
    - (1) Execute Work of this Section using qualified personnel skilled in installation of work of this Section, having a minimum of three (3) years proven experience of installations similar in material, design, and extent to that indicated for this Project.

## **1.10. MOCK-UPS**

- 1.10.1. Sample Installation: Construct a sample installation to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution in accordance with Section 01 45 00 Quality Control. Sample installation consists of three (3) glazing panels.
- 1.10.2. Once reviewed by Consultant, acceptable sample installation can form a permanent part of the Work, and will form the basis for acceptance for the remainder of the project.
- 1.10.3. Remove and replace materials found not acceptable at no cost to Owner or Consultant.

## **1.11. DELIVERY, STORAGE AND HANDLING**

- 1.11.1. Delivery and Acceptance Requirements: Deliver and store packaged materials in their original containers with manufacturer's labels and seals intact.
- 1.11.2. Store as recommended by manufacturer in a weatherproof enclosure, and protect materials during handling and application to prevent damage.

## **1.12. SITE CONDITIONS**

- 1.12.1. Ambient Conditions:
  - 1.12.1.1. Proceed with bird friendly film installation when ambient and substrate temperature conditions are within limits permitted by manufacturer and when glass substrates are free from dirt or wetness arising from frost, condensation, or other causes detrimental to adhesion.
  - 1.12.1.2. Temperature Range: Between 4 deg C and 38 deg C

### **1.13. WARRANTY**

- 1.13.1. Warrant work of this section in accordance with the following:
  - 1.13.1.1. Against defects for the period of 6 years, from the date of Substantial Performance of the Work, and;
  - 1.13.1.2. Labour for 2 years, from the date of Substantial Performance of the Work.

## **2 PRODUCTS**

### **2.1. MANUFACTURER**

- 2.1.1. Approved Manufacturer:
  - 2.1.1.1. Convenience Group Inc.
    - (1) 10 Butterick Road, Toronto, Ontario, Canada, M8W 3Z8;
    - (2) Phone: (416) 233-6900;
    - (3) Email: info@conveniencegroup.com;
    - (4) URL: www.conveniencegroup.com

### **2.2. PERFORMANCE / DESIGN REQUIREMENTS**

- 2.2.1. Design Performance:
  - 2.2.1.1. Visible Marker Spacing:
    - (1) Meeting highest requirements indicated in the City of Toronto Green Development Standard of 100mm (4") vertical x 100mm (4") horizontal
  - 2.2.1.2. Visible marker size:
    - (1) 6mm (1/4") diameter.
  - 2.2.1.3. Height Requirements:
    - (1) 12m (39.5') above grade or to height of tallest surrounding vegetation;

### **2.3. MATERIALS**

- 2.3.1. Bird Friendly Film: Single layer poly vinyl chloride, 50.8 microns, with exterior permanent adhesive.
  - 2.3.1.1. Basis-of-Design Material:
  - 2.3.1.2. Circular visible markers, 6mm (1/4") diameter and spaced 100mm (4") to 279mm (11") and 100mm (4") to 279mm (11"); CityScape Duotone Series by Convenience Group Inc.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Verification of Conditions:
  - 3.1.1.1. Examine glazing and surrounding adjacent surfaces for conditions affecting installation.
- 3.1.2. Notify Contractor in writing of any conditions that are not acceptable.
- 3.1.3. Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

### **3.2. PREPARATION**

- 3.2.1. Clean glass surfaces of substances that could impair glazing film bond including mildew, oil, grease, dirt and other foreign materials immediately before beginning installation of films.
- 3.2.2. Protect window frames and surrounding conditions from damage during installation.

### **3.3. INSTALLATION**

- 3.3.1. Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, and level over clean glazing.
- 3.3.2. Install film continuously with no gaps or overlaps and as follows:
  - 3.3.2.1. First surface applied
  - 3.3.2.2. Installed without seams

- 3.3.2.3. Do not remove release liner from film until just before each piece of film is ready for installation.
- 3.3.2.4. Install film on glazing centered within mullions aligned with adjoining windows.
- 3.3.2.5. Remove air bubbles, wrinkles, blisters, and other defects.

### **3.4. CLEANING AND PROTECTION**

- 3.4.1. Progress Cleaning:
  - 3.4.1.1. Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.
- 3.4.2. Final Cleaning:
  - 3.4.2.1. At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.
- 3.4.3. Waste Management:
  - 3.4.3.1. Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Extended Warranty
- .7 2.1. Manufacturer
- .8 2.2. Performance/Design Requirements
- .9 2.3. Louvres
- .10 2.4. Accessories
- .11 2.5. Finishes
- .12 2.6. Fabrication
- .13 3.1. Installation

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Louvres.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section, including the following information:
    - (1) Air flow and water entrainment performance test results.
    - (2) Material types and thickness.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Submit engineered shop drawings.
  - 1.4.3.2. Include elevations, sections, and specific details for each louvre.
  - 1.4.3.3. Show anchorage details and connections for component parts.
- 1.4.4. Samples:
  - 1.4.4.1. Submit colour chips for approval. Submit duplicate samples of each type of louvre showing colour and finish.
- 1.4.5. Test and evaluation reports:
  - 1.4.5.1. Air and water performance data: Submit AMCA test data as required to confirm that the louvres have the specified air and water performance characteristics when tested in accordance with AMCA Standard 500-L-99.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:
  - 1.5.1.1. Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with minimum a 5 years' experience in application of Products, systems and assemblies specified, and with approval of *Product* manufacturer.

### **1.6. EXTENDED WARRANTY**

- 1.6.1. Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years as specified in Article A-15 of the Agreement Between *Owner* and *Contractor*.

## **2 PRODUCTS**

### **2.1. MANUFACTURER**

- 2.1.1. Specifications are based on Products of the McGill Architectural Products. The following listed manufacturers are acceptable only when in compliance with requirements of this section:
  - 2.1.1.1. E.H. Price Ltd.
  - 2.1.1.2. McGill Architectural Products
  - 2.1.1.3. TenPlus Architectural Products Ltd.
  - 2.1.1.4. Or equivalent

### **2.2. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.2.1. Structural requirements: Design louvres to withstand wind and snow loads as required by the Ontario Building Code. Maximum allowable deflection for the louvre structural members to be  $L/180$  or 19 mm (3/4"), whichever is less. Maximum allowable deflection for the louvre blades to be  $L/120$  or 13 mm (1/2") across the weak axis, whichever is less.
- 2.2.2. Aluminum framing members shall be designed in accordance with CAN/CSA-S157-05/S157.1-05.
- 2.2.3. Design structural steel structural components and fasteners in accordance with CSA-S16-09.
- 2.2.4. Delegated design: Design louvres, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- 2.2.5. Structural performance: Louvres shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louvre blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
- 2.2.6. Thermal movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

### **2.3. LOUVRES**

- 2.3.1. Except as noted in this specification section, *Provide* HP245, frame depth 50 mm, flanged frame, complete with bird screen, to sizes indicated.
- 2.3.2. At a interior Generator Room, *Provide* HP445, frame depth 100 mm, channel frame, complete with bird screen, to sizes indicated.

### **2.4. ACCESSORIES**

- 2.4.1. Bird screen and frames:
  - 2.4.1.1. Bird screen mesh: 15.9 mm (5/8") mesh, 1.27 mm (0.050") thick expanded and flattened aluminum screen secured within 1.40 mm (0.055") thick extruded aluminum frames with mitered corners and corner locks.
  - 2.4.1.2. Finish: Mill finish.
- 2.4.2. Aluminum extrusions: ASTM B211-12, Alloy 6063-T5, 6063-T6 or 6061-T6.
- 2.4.3. Aluminum sheet: ASTM B209-14, Alloy 1100, 3003 or 5005. For anodized finish if required use Alloy 5005.
- 2.4.4. Fasteners and anchors: Stainless steel Type 304.
- 2.4.5. Arrange blades and frame extrusions as indicated.
- 2.4.6. Attach bird screen to non-exposed face of louvres.
- 2.4.7. Isolate from other dissimilar metals and materials to prevent electrolysis.
- 2.4.8. Sealant: in accordance with Section 07 92 00.

### **2.5. FINISHES**

- 2.5.1. Exposed aluminum surfaces:
  - 2.5.1.1. Elsewhere: Finish to be Interpon D2000, AAMA 2604, Powder Coating, or equivalent

(1) Colour: to be selected by the *Consultant*.

- 2.5.2. Finish exposed metal fasteners, if applicable, to related aluminum surfaces.
- 2.5.3. Finish steel clips and reinforcing steel with 380 g/m<sup>2</sup> (13 oz/ft<sup>2</sup>) zinc coating to CAN/CSA G164-M92.

## **2.6. FABRICATION**

- 2.6.1. Fabricate finish work free from distortion and effects detrimental to appearance and performance.
- 2.6.2. Fasten aluminum louvre framing, blade with stainless steel screws or heliarc welding.
- 2.6.3. Louvres indicated to wrap continuously around corners shall be mitred at corner intersection.
- 2.6.4. Blank off panels to be full extent of louvres except where penetrated by mechanical services, unless indicated otherwise.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Verify dimensions of supporting structure at the Site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure. Fasten louvres with angle, lag bolts and anchors where required for support with rust proof screws and anchor bolts.
- 3.1.2. Apply sealant to joints and penetrations to maintain weather tight installation, while allowing drainage to exterior at sill flashing.
- 3.1.3. Anchor louvres to the building substructure.
- 3.1.4. Allow for thermal expansion and contraction.
- 3.1.5. Repair or replace damaged finishes or materials.
- 3.1.6. Erection tolerances:
  - 3.1.6.1. Maximum variation from plane or location shown on the reviewed shop drawings: 3 mm per 3660 mm (1/8" per 12 feet) of length, but not exceeding 13 mm (1/2") in any total building length or portion thereof (non-cumulative).
  - 3.1.6.2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 75 mm (3"): 1.5 mm (1/16") (shop or field joints). This limiting condition shall prevail under both load and no-load conditions.
- 3.1.7. Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with its recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.
- 3.1.8. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- 3.1.9. Set units level, plumb and true to line, with uniform joints.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 2.1. Performance/Design Requirements - Fire Resistance Rated Assemblies
- .7 2.2. Materials - General
- .8 2.3. Partition Support Materials
- .9 2.4. Ceiling Support Materials And Systems
- .10 2.5. Furring
- .11 2.6. Accessories
- .12 3.1. Installation General
- .13 3.2. Blocking
- .14 3.3. Furring - General
- .15 3.4. Suspended And Furred Ceilings
- .16 3.5. Wall Furring
- .17 3.6. Resilient Furring
- .18 3.7. Metal Stud Partition Framing
- .19 3.8. Control Joints
- .20 3.9. 3.9 Concrete Anchors
- .21 3.10. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:  
1.3.1.1. Metal support systems for interior partitions, interior ceilings and interior assemblies as indicated.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:  
1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section, including additional data as may be required to demonstrate compliance with the *Contract Documents*.
- 1.4.3. Test and evaluation reports:  
1.4.3.1. Submit certified test results for each required fire resistance rated assembly for work of this section.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:  
1.5.1.1. Installers / applicators / erectors:  
(1) Provide work of this section, executed by a *Subcontractor* with a minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS - FIRE RESISTANCE RATED ASSEMBLIES**

- 2.1.1. Where gypsum board systems with fire resistance ratings are indicated or required, provide materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to authorities having jurisdiction.

### **2.2. MATERIALS - GENERAL**

- 2.2.1. For sheet metal Products: Sheet metal thickness indicated herein pertains to the "minimum base steel thickness exclusive of coating".
- 2.2.2. Protective coatings for metal supports and framing:
  - 2.2.2.1. Minimum corrosion protection: Z120 (G40) ASTM A653/A653M-13
  - 2.2.2.2. Heavy duty corrosion protection: Z275 (G90) ASTM A653/A653M-13, high humidity rooms where schedule or indicated including the following:
    - (1) Universal and regular washrooms with showers.
- 2.2.3. Sheet metal screws shall have a minimum coating thickness of 0.008 mm (0.0003") of zinc. Other coatings providing equal or better corrosion protection may be used, subject to acceptance of Consultant.
- 2.2.4. Screws:
  - 1.1.1.1. Steel screws shall be equal to or exceed minimum diameter indicated on shop drawings.
  - 1.1.1.2. Penetration beyond joined materials shall be not less than 3 exposed threads.
  - 1.1.1.3. Thread types and drilling capability shall conform to manufacturer's recommendations

### **2.3. PARTITION SUPPORT MATERIALS**

- 2.3.1. Interior non-loadbearing channel stud framing: to ASTM C645-18; roll formed from 0.455 mm (0.0179") minimum thickness unless otherwise indicated, electro-galvanized steel sheet. *Provide* service holes starting at 450 mm (18") from bottom, then 914 mm (36") on centre to top of studs.
  - 2.3.1.1. Steel studs; at backer plate locations: 0.836 mm (0.0329") minimum thickness.
  - 2.3.1.2. Steel studs at cement board locations: 0.836 mm (0.0329") minimum thickness.
  - 2.3.1.3. Steel studs at tile backer board locations: 0.836 mm (0.0329") minimum locations.
- 2.3.2. Interior floor and ceiling tracks (runners): to ASTM C645-18; in widths to suit stud sizes.
  - 2.3.2.1. Metal thickness: to match studs.
  - 2.3.2.2. For openings wider than 914 mm (36"), *Provide* 0.836 mm (0.0329") minimum thickness for header.
- 2.3.3. Deflection track; for non-fire-rated assemblies: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in metal thickness not less than indicated for studs and in width to accommodate depth of studs.
- 2.3.4. Interior floor and ceiling track (runner) fasteners:
  - 2.3.4.1. To concrete and masonry: Use stub nails or power-driven fasteners.
    - (1) Power actuated fastening systems are not permitted.
  - 2.3.4.2. To suspended acoustic ceiling tile grid: Manufactured to fit applicable ceiling grid profile; CGC 'Partition Clip'.
- 2.3.5. Bracing channels: Minimum 19 mm x 10 mm x 1.087 mm (3/4" x 3/8" x 0.0428") cold rolled galvanized steel.

### **2.4. CEILING SUPPORT MATERIALS AND SYSTEMS**

- 2.4.1. General: Size ceiling support components to comply with ASTM C754-20 unless otherwise indicated.
- 2.4.2. Main runners: Steel channels, hot or cold rolled; Z180 (G60) galvanized.



- 2.4.3. Hanger wire: in accordance with ASTM A641/A641M-09A(2014), soft, Class 1 galvanized, minimum 4.064 mm (0.160", 8 AWG).
- 2.4.4. Hanger rods and flats: Mild steel with zinc coating, galvanized for exterior applications.
  - 2.4.4.1. General: Size devices for 5 times load imposed by completed system as determined in accordance with ASTM E488/E488M-22.
  - 2.4.4.2. Screws, clips, bolts, concrete inserts or other devices for ceiling hangers whose suitability for use intended has been proven through standard construction practices or by certified test data.
  - 2.4.4.3. Hangers: Comply with ASTM C754-20 for maximum ceiling area and loads to be supported.
  - 2.4.4.4. Interior concrete ceiling anchors:
    - (1) Acceptable Products:
      - (A) ITW Ramset/Red Head 'Dynabolt Sleeve Anchor TW-1614' or 'Redi-Drive Tie Drive' or 'Redi-Drive' with angle clip.
      - (B) ITW Ramset/Red Head 'Trubolt' or 'Dynabolt' anchors complete with galvanized angle clip.
      - (C) Hilti 'Kwik-Bolt 3' and 'HHDCA 1/4 Ceiling Hangers'.
  - 2.4.4.5. Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable product lines specified in preceding paragraphs.
- 2.4.5. Tie wire: 1.19 mm (0.047", 18 AWG) minimum zinc coated, soft-annealed wire, to ASTM A641/A641M-09A(2014).
- 2.4.6. Furring anchorages: 1.62 mm (0.0637", 16 AWG) galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ASTM C754-20.
- 2.4.7. Runner (carry) channels: 1.367 mm (0.0538") thick cold rolled steel, primer painted or zinc coated for interior locations, Z275 galvanized for exterior locations to ASTM C754-20, with minimum 228 MPa yield strength:
  - 2.4.7.1. 38 mm x 12.7 mm (1-1/2" x 1/2") where supported at centres of 914 mm (36") maximum.
  - 2.4.7.2. 38 mm x 19 mm (1-1/2" x 3/4") where supported at centres of 1220 mm (48") maximum.

## 2.5. FURRING

- 2.5.1. Furring channels: 0.455 mm (0.0179") minimum typical thickness, minimum 0.836 mm (0.0329") at exterior soffits, cold rolled steel, wiped coated, nominal size of 22 mm (7/8") depth x 35 mm (1-3/8") face, hat type with knurled face.
- 2.5.2. Resilient furring channels:
  - 2.5.2.1. Acceptable Product:
    - (1) Bailey Metal 'Resilient Channel'.
    - (2) Substitutions: in accordance with Section 01 25 00.
- 2.5.3. Z-furring members: Galvanized steel z-shaped furring members; ASTM A653/A653M-13, G60, 0.836 mm (0.0329") minimum thickness of base metal, of depth indicated, designed for mechanical attachment of insulation boards or blankets.
- 2.5.4. Fasteners for furring members: Type and size recommended by furring manufacturer for substrate and application indicated, corrosion resistant finish for exterior building envelope applications, load rating and spacing to support materials carried by assembly with factor of safety of 3x per fastener manufacturer data sheets

## 2.6. ACCESSORIES

- 2.6.1. Backer plates:
  - 2.6.1.1. Metal backer plates: Steel, galvanized; minimum 150 mm (6") wide x 0.836 mm (0.0329") minimum x length and width to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.

- 2.6.1.2. Plywood backer plates: Softwood plywood; 19 mm (3/4") minimum x length and width to suit size of items to be attached; fastened to studs for attachment of surface mounted fittings and accessories.
- 2.6.1.3. Dimensional wood blocking in accordance with Section 06 10 53 Rough Carpentry.
- 2.6.1.4. Elimination of backer plates or direct attachment of accessories or equipment to studs will not be permitted

### 3 EXECUTION

#### 3.1. INSTALLATION GENERAL

- 3.1.1. Comply with ASTM C754-20 and manufacturer's instructions, except as modified herein. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated.
- 3.1.2. *Provide* and install studs, framing, shimming, and furring to *Provide* proper support for gypsum board to achieve the following installation tolerances:
  - 3.1.2.1. Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane.
  - 3.1.2.2. Do not exceed 10 mm (3/8") from the Drawing locations.
  - 3.1.2.3. Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
  - 3.1.2.4. Install each framing member so fastening surfaces vary not more than 3.2 mm (1/8") from the plane formed by faces of adjacent framing.
- 3.1.3. Give complete cooperation and direction to trades erecting framing and furring over which this work is applied. Coordinate finished joint location with framing.
- 3.1.4. Coordinate installation and cooperate with mechanical and electrical work to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with the partitions, ceiling, and soffit systems.
  - 3.1.4.1. Where the presence of suspended ductwork or other mechanical or electrical services or devices above ceiling framing conflicts with ceiling framing suspension points from structure above, provide bridging framing below conflicting work as required to support ceiling framing on specified intervals.
  - 3.1.4.2. Do not suspend ceiling framing from mechanical or electrical suspension systems unless agreement is obtained in writing from Professional Engineer for *Subcontractor* installing such framing that additional imposed loads are acceptable; obtain the *Consultant's* acceptance before proceeding.
- 3.1.5. *Provide* clearances between work of this section and structural elements to prevent transference of structural loads.
- 3.1.6. Do not bridge building expansion joints with steel framing or furring members. Independently frame both sides of joints with framing of furring members or as indicated.
- 3.1.7. Size framing systems according to manufacturer's engineered load tables, to meet allowable deflection without permanent deformation.
  - 3.1.7.1. Maximum allowable deflection: L/240.
  - 3.1.7.2. Maximum allowable deflection for tiled partitions: L/360.

#### 3.2. BLOCKING

- 3.2.1. Attach to framing adequate backer plates to support the load of, and to withstand the withdrawal and shear forces imposed by, items installed upon the work of this section.

#### 3.3. FURRING - GENERAL

- 3.3.1. Furring indicated in Contract Documents is schematic. Do not regard as exact or complete. Provide all necessary framing and furring to support gypsum board in accordance with manufacturers' specifications.
- 3.3.2. Shim furring as required to achieve required installation tolerances.
- 3.3.3. Leave finished work rigid, secure, square, level, plumb, curved to detailed radius and erected to maintain finish gypsum board line dimensions and contours. Make allowance for thermal movement.
- 3.3.4. Thermally separate metal studs from exterior concrete or masonry.

### **3.4. SUSPENDED AND FURRED CEILINGS**

- 3.4.1. Arrange hangers for suspended gypsum board ceilings to provide support independent of walls, columns, pipes, ducts; erect plumb, and securely anchored to structural frame, or embed in concrete slabs.
- 3.4.2. Keep lateral braces at hangers back 450 mm (18") minimum unless otherwise noted.
- 3.4.3. Space hangers at 914 mm (36") on centre maximum along runner channels, and not more than 150 mm (6") from ends.
- 3.4.4. Space runner channels at 1220 mm (48") on centre, maximum, and not more than 150 mm (6") from boundary walls, interruptions of continuity, and changes in direction. Run channels transversely to structural framing members.
- 3.4.5. Where splices are necessary, lap members at least 200 mm (8") and wire each end with 2 loops. Avoid clustering or lining up of splices.
- 3.4.6. Attach to rod hangers by bending hanger sharply under bottom flange of runner, and securely wiring in place with saddle tie.
- 3.4.7. Erect cross furring channels transversely across runner channels at 400 mm (16") on centre maximum, 305 mm (12") on centre at fire rated assemblies, at not more than 150 mm (6") from boundary wall openings, interruptions in ceiling continuity, and changes in direction.
- 3.4.8. Secure furring channels to each support with purpose-made slips or wire tie. Splice joints by lapping channels and tying together.
- 3.4.9. Level cross furring channels to maximum tolerance of 3 mm in 3 m (1/8" in 10 ft).
- 3.4.10. Soffit assemblies at exterior conditions: under work of Section 05 41 13.

### **3.5. WALL FURRING**

- 3.5.1. Install steel furring for braced walls, free standing walls, walls that are furred out as indicated.
- 3.5.2. Frame openings and around built-in equipment, cabinets, access panels, on 4 sides, with channels. Extend furring into reveals. Check clearances with equipment suppliers.
- 3.5.3. Provide bulkheads and boxed-in duct shafts, for beams, columns, pipes and around exposed services where indicated. Install 19 mm (3/4") channels at corners and at 305 mm (12") on centre.

### **3.6. RESILIENT FURRING**

- 3.6.1. Ceilings:
  - 3.6.1.1. Fasten the resilient furring perpendicular to the ceiling framing every 305 mm (12").
  - 3.6.1.2. Fasten the first furring member 150 mm (6") from the wall.
  - 3.6.1.3. Fasten the second furring member 305 mm (12") from the same wall.
  - 3.6.1.4. Fasten the last furring member 150 mm (6") from the opposite wall.
- 3.6.2. Partitions:
  - 3.6.2.1. Install resilient furring with outer leg oriented upward.
  - 3.6.2.2. Fasten the resilient furring maximum 610 mm (24") on centre.
  - 3.6.2.3. Fasten the first furring member 50 mm (2") from the floor. Install 150 mm (6") continuous strip of 12.7 mm (1/2") gypsum board along base of partitions where resilient furring installed.
  - 3.6.2.4. Fasten the second furring member 610 mm (24") from the floor.
  - 3.6.2.5. Fasten the last furring member 150 mm (6") from the ceiling.
- 3.6.3. Secure to each support with 25 mm (1") gypsum wallboard screw.
- 3.6.4. Provide resilient furring channel transverse to framing members, or as indicated.

### **3.7. METAL STUD PARTITION FRAMING**

- 3.7.1. Provide partition tracks (runners) at floor and underside of structural assembly and as follows:
  - 3.7.1.1. Align accurately and lay out according to partition layout.

- 3.7.1.2. Secure runners to concrete, access flooring and to concrete slabs, as applicable, with screwed or shot fasteners located 50 mm (2") from each end and spaced at maximum 610 mm (24") on centre.
- 3.7.1.3. At partition corners, extend one runner to end of corner and butt other runner to it, allowing necessary clearance for gypsum board thickness. Runners should not be mitred.
- 3.7.2. Unless otherwise indicated, place interior studs vertically at centres as follows:
  - 3.7.2.1. Provide studs at 400 mm (16") on centre, and as specially spaced in accordance with details indicated.
  - 3.7.2.2. Provide studs not more than 50 mm (2") from abutting walls, openings and each side of corners.
  - 3.7.2.3. Provide freedom for 19 mm (3/4") deflection under beams, structural slabs and the like to avoid transmission of structural loads to studs, or install 50 mm (2") leg ceiling tracks.
- 3.7.3. Install studs in tracks at floor and ceiling.
- 3.7.4. Where horizontal runs of service lines are scheduled to be installed, arrange with applicable trades and install studs simultaneously with services.
- 3.7.5. At openings in stud walls, erect track at head and sills to accommodate intermediate studs. At each end of track, cut out flanges, turn up web, and fasten to studs. Install intermediate studs above and below openings in same manner and spacing as wall studs. Install double studs at each jamb, and double tracks at head of door openings.
- 3.7.6. At partitions requiring fire rating, erect in accordance with requirements of listing.
- 3.7.7. Size studs, connections, and runners to carry loads according to stud manufacturer's load tables, at 24 kg/m<sup>2</sup> (5 lb/ft<sup>2</sup>) live load to meet maximum allowable deflection limits. Where depth of stud is indicated, size metal thickness to meet allowable deflection limits.
- 3.7.8. Provide three studs at corner and intermediate intersections of partitions.
- 3.7.9. Coordinate work with others installing horizontal runs of service lines so that work is done simultaneously. Where standard holes are too small for installed services, notch studs, and splice notched flanges with splice pieces 305 mm (12") longer than notches, each fastened with 2 screws.
- 3.7.10. Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- 3.7.11. Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other sections.
- 3.7.12. Unless otherwise indicated, partitions, together with gypsum board facings, shall extend above ceilings to underside of structure above.
- 3.7.13. Chase walls:
  - 3.7.13.1. Provide chase walls consisting of two parallel steel stud partitions.
  - 3.7.13.2. Provide cross bracing consisting of metal furring, located at quarter points on each pair of studs. Attach cross bracing to studs with metal screws.
- 3.7.14. Lateral support bracing channels:
  - 3.7.14.1. Stiffen partitions over 3 m (10') in vertical span, at mid-height to maximum vertical spacing of 2440 mm (8') on centre, with at least one 19 mm (3/4") horizontal bracing channel, extending full length of partition, overlapping at least two stud spaces at ends of bracing channels.
  - 3.7.14.2. Stiffen partitions at not more than 150 mm (6") from the top and bottom of openings and across two full stud spaces at each side of openings with horizontal bracing channel.

### **3.8. CONTROL JOINTS**

- 3.8.1. Control joints: in accordance with Section 09 29 00.

### **3.9. 3.9 CONCRETE ANCHORS**

- 3.9.1. Provide anchors and anchorage points in reinforced concrete floor slab underside in accordance with gypsum board manufacturer's suspension requirements. Drill holes with carbide-tipped drill bits conforming to ANSI B212.15-1994 (R2000).

- 3.9.2. Provide anchors; minimum installation depth, and method of expansion as recommended by the anchor manufacturer.

**3.10. FIELD QUALITY CONTROL**

- 3.10.1. Conduct quality control in accordance with Section 01 45 00.
- 3.10.2. Work of this section shall be subject to independent inspection and testing.
  - 3.10.2.1. Field tests and inspections:
    - (1) Independent inspection and testing company will perform random load tests for ceiling anchor installation.
    - (2) Allow for testing of 1 in 20 anchors.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, and Handling
- .7 1.7. Field Conditions
- .8 2.1. Performance/Design Requirements
- .9 2.2. General
- .10 2.3. Gypsum Board Panels
- .11 2.4. Cement Board Panels
- .12 2.5. Attachment Materials
- .13 2.6. Accessories
- .14 2.7. Related Support Assemblies and Backer Plates
- .15 2.8. Joint Treatment Materials
- .16 2.9. Acoustic Wall Assembly Materials
- .17 2.10. Access Doors
- .18 3.1. Installation
- .19 3.2. Accessories
- .20 3.3. Board Application - General
- .21 3.4. Water Resistant Gypsum Board Application
- .22 3.5. Exterior Sheathing Board Application – Gypsum Sheathing Board
- .23 3.6. Interior Tile Backer Board Application
- .24 3.7. Interior Cement Board
- .25 3.8. Acoustic Wall Assemblies
- .26 3.9. Finishing
- .27 3.10. Fire Separations
- .28 3.11. Access Doors
- .29 3.12. Adjusting and Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Gypsum board; plain.
  - 1.3.1.2. Gypsum board; fire-rated.
  - 1.3.1.3. Water resistant backing board; paper faced gypsum.
  - 1.3.1.4. Tile backer board; cement board.
  - 1.3.1.5. Exterior sheathing board; glass scrim gypsum sheathing board.
  - 1.3.1.6. Gypsum board accessories and miscellaneous related materials.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.4.3. Fire-rated assembly listings and STC assembly ratings:
  - 1.4.3.1. Submit fire-rated assembly listings for each required fire resistance rated assembly for work of this section.
  - 1.4.3.2. Submit STC assembly ratings for each required STC rated assembly for work of this section

## **1.5. QUALITY ASSURANCE**

### **1.5.1. Qualifications:**

- 1.5.1.1. *Subcontractor* executing the work of this section shall have a minimum of 10 years' continuous experience in successful installation of work of type and quality indicated and specified.

## **1.6. DELIVERY, STORAGE, AND HANDLING**

- 1.6.1. Store materials in protected dry areas. Store gypsum board flat in piles with edges protected.
- 1.6.2. Ensure that finish metal members are not bent, dented, or otherwise deformed.
- 1.6.3. Deliver Products supplied under the work of this section only to those who are responsible for installation, to the place they direct, and to meet installation schedules.
- 1.6.4. Package fire rated materials with labels attached.

## **1.7. FIELD CONDITIONS**

- 1.7.1. Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum boards.
- 1.7.2. When ambient outdoor temperatures are below 12°C maintain continuous, uniform comfortable building working temperatures of not less than 12°C for a minimum period of 48 hours before, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- 1.7.3. Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.
- 1.7.4. Protection:
  - 1.7.4.1. *Provide* adequate protection of materials and work of this section from damage by weather and other causes. Protect work of other trades from damage resulting from work of this section. Make good such damage at no additional cost to the *Owner*.
  - 1.7.4.2. Exterior sheathing board's exposure to weather: Comply with manufacturer's printed instructions. *Provide* protection prior to exposure for periods greater than manufacturer's recommendations and warranty.
- 1.7.5. Panels that are wet, moisture damaged, or mould damaged shall not be installed.
  - 1.7.5.1. Indications that panels are wet or moisture damaged include, but are not limited to, discolouration, sagging, or irregular shape.
  - 1.7.5.2. Indications that panels are mould damaged include, but are not limited to, fuzzy or splotchy surface contamination and discolouration.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Single source responsibility: Obtain gypsum and cement board products from a single manufacturer.
- 2.1.2. Fire resistance rating:
  - 2.1.2.1. Construct fire resistance rated assemblies in accordance with listing and CAN/ULC S101-14.
  - 2.1.2.2. Where gypsum board systems with fire resistance ratings are indicated or required, *Provide* materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to *Authorities Having Jurisdiction*
- 2.1.3. Paper-faced gypsum board: in accordance with ASTM C1396/C1396M-17.
- 2.1.4. Glass scrim gypsum board: in accordance with ASTM C1658/C1658M-13.
- 2.1.5. Fire rated in accordance with listed assemblies where indicated: Type X or Type C.

### **2.2. GYPSUM BOARD PANELS**

- 2.2.1. Plain gypsum board:

- 2.2.1.1. Paper faced gypsum core panel solid set core enclosed in paper, 12.7 mm (1/2") or 16 mm (5/8") thick unless otherwise indicated, 1220 mm (48") wide x maximum practical length, ends square cut, tapered edges, to ASTM C1396/C1396M-11.
- 2.2.1.2. Acceptable Products:
  - (1) CertainTeed 'Regular Gypsum Board'.
  - (2) CGC Inc. 'SHEETROCK Gypsum Panel, Regular'.
  - (3) Georgia-Pacific 'ToughRock Gypsum Board'.
  - (4) Lafarge 'Gypboard'.
  - (5) National Gypsum 'Gold Bond Gypsum Board'.
  - (6) Or equivalent.
- 2.2.2. Fire-rated gypsum board:
  - 2.2.2.1. Paper faced gypsum core panel with a specially formulated core for use in fire-resistive Type X or Type C designs, to ASTM C1396/C1396M-11.
  - 2.2.2.2. Acceptable Products:
    - (1) CertainTeed 'Type X and Type C'.
    - (2) CGC Inc. 'SHEETROCK Firecode X and Firecode C'.
    - (3) Georgia-Pacific 'ToughRock Fireguard and Fireguard Gypsum Board'.
    - (4) Lafarge 'Firecheck C and X'.
    - (5) National Gypsum 'Gold Bond Fire-Shield and Fire Shield C Gypsum Board'.
    - (6) Or equivalent.
- 2.2.3. Water resistant gypsum backing board (greenboard), wall applications:
  - 2.2.3.1. Paper faced gypsum core panel with enhanced water and water resistant paper facers to ASTM C1396/C1396M-11, fire rated where indicated.
  - 2.2.3.2. Acceptable Products:
    - (1) CertainTeed 'ProRoc Moisture Resistant'.
    - (2) CGC Inc. 'SHEETROCK Mold Tough Panel'.
    - (3) Georgia-Pacific 'ToughRock Moisture-Guard'.
    - (4) Lafarge 'Mold Defense'.
    - (5) Or equivalent.
- 2.2.4. Exterior sheathing board:
  - 2.2.4.1. Service grade: Exterior grade.
  - 2.2.4.2. Fibreglass mat faced on front and back sides and long edges, silicone-treated water-resistant core, to ASTM C1177/C1177M-08, fire rated where indicated.
    - (1) Acceptable Products:
      - (A) CertainTeed 'GlasRoc Sheathing'.
      - (B) CGC Inc. 'Securock Glass-Mat Sheathing'.
      - (C) Georgia-Pacific 'Dens-Glass Gold'.
      - (D) Lafarge; Weather Defense Platinum Sheathing'.
      - (E) Or equivalent.

## **2.3. CEMENT BOARD PANELS**

- 2.3.1. Cement board; interior and exterior grade, tile backer board and sheathing applications:
  - 2.3.1.1. Composition:
    - (1) Portland cement, sand, and expanded polystyrene beads, with a fully embedded alkali resistant glass fibre mesh facing.
    - (2) Free of asbestos, gypsum, organic fibres or cellulose.
- 2.3.2. Thickness: 12.7 mm (1/2") minimum.
- 2.3.3. Acceptable Products:
  - 2.3.3.1. CGC 'Durock'.
  - 2.3.3.2. National Gypsum 'PermaBase Plus Cement Board'.
  - 2.3.3.3. Or equivalent.



## **2.4. ATTACHMENT MATERIALS**

- 2.4.1. Screws; for gypsum board: bugle head, fine thread, self-tapping, Type W or S or S-12 point to suit framing type and metal gauge, with corrosion resistant finish to ASTM C1002-07/ASTM C954-11.
  - 2.4.1.1. Screw sizing:
    - (1) #6 x 25 mm (1") for single thickness board fastening.
    - (2) #6 x 32 mm (1-1/4") for single thickness 15.9 mm (5/8") board fastening.
    - (3) #7 x 41 mm (1 5/8") for double thickness board fastening.
- 2.4.2. Screws; for cement board: Wafer head, Type S-12 point or 'Hi-Lo', self-tapping, with corrosion resistant polymer finish.
- 2.4.3. Tie wire: 1.6 mm (0.063") diameter galvanized soft annealed steel wire.

## **2.5. ACCESSORIES**

- 2.5.1. Accessories: to ASTM C1047-19 unless otherwise indicated, maximum length pieces per location. Flanges shall be free from dirt, grease, or other material that adversely affects the bond of joint treatment or decoration.
- 2.5.2. Trim reveal: Standard metal trim reveal for suspended gypsum board walls or ceilings abutting concrete block walls, suitable for paint finish in all locations except where indicated otherwise in the *Contract Documents*.
- 2.5.3. Control joints: No. 093 Zinc Control Joint by CGC Inc. or equivalent, certified by manufacturer for use at fire resistance rated assemblies.
- 2.5.4. Casing beads, corner beads: 0.5 mm (0.02") base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A525, perforated flanges, one piece length per location.

## **2.6. RELATED SUPPORT ASSEMBLIES AND BACKER PLATES**

- 2.6.1. Wind bearing metal studs at wind bearing exterior assemblies: in accordance with Section 05 41 13.
- 2.6.2. Dimensional wood blocking at interior assemblies: in accordance with Section 06 10 53.
- 2.6.3. Metal support systems and backer plates at interior assemblies: in accordance with Section 09 22 00.

## **2.7. JOINT TREATMENT MATERIALS**

- 2.7.1. General: Comply with ASTM C475/C475M-17.
- 2.7.2. Joint tape:
  - 2.7.2.1. Interior gypsum board: Paper.
  - 2.7.2.2. Glass-mat gypsum sheathing board: 10-by-10 glass mesh.
  - 2.7.2.3. Tile backing panels: As recommended by panel manufacturer.
- 2.7.3. Joint compound for interior gypsum board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 2.7.3.1. Prefilling: Use setting-type compound as recommended by panel manufacturer.
  - 2.7.3.2. Embedding and first coat: Use setting-type or taping compound as recommended by panel and trim manufacturers.
  - 2.7.3.3. Fill and finish coats: Use sanding type setting-type or taping compound as recommended by panel manufacturer.
- 2.7.4. Joint compound for exterior applications:
  - 2.7.4.1. Glass-mat gypsum sheathing board: As recommended by sheathing board manufacturer.
- 2.7.5. Joint compound for tile backing panels:
  - 2.7.5.1. Cementitious backer units: As recommended by backer unit manufacturer.
  - 2.7.5.2. Water-resistant gypsum backing board: Use setting-type taping compound and setting-type, sandable topping compound.

## **2.8. ACOUSTIC WALL ASSEMBLY MATERIALS**

- 2.8.1. Acoustic sealant; concealed locations: non-skinning butyl sealant, non-hardening, remains soft and tacky, to CGSB 19.21-M87:

- 2.8.1.1. Sealant shall not deteriorate (stain or bleed into) painted surfaces.
  - (1) Acceptable Products:
  - (2) DAP 'Mono Acoustic Sealant'.
  - (3) Pecora 'BA98'.
  - (4) Quiet Solution 'QuietSeal'.
  - (5) Tremco 'Acoustical Sealant'.
  - (6) Or equivalent (substitutions in accordance with Section 01 25 00).
- 2.8.2. Acoustic sealant; exposed locations: Interior paintable sealant in accordance with Section 07 92 00.
- 2.8.3. Acoustic compound: premixed perlite plaster.
- 2.8.4. Acoustic (sound attenuation) insulation:
  - 2.8.4.1. Mineral-fibre sound attenuation batts: to CAN/ULC S702-09, Type 1, fire resistant and non-combustible to CAN/ULC-S114-05, high density for sag-free, tight fitting installation.
    - (1) Density: minimum 40 kg/m<sup>3</sup> (2.5 lbs/ft<sup>3</sup>).
    - (2) Acceptable Products:
      - (F) Roxul 'AFB'.
      - (G) Or equivalent.
  - 2.8.4.2. Fasteners: use mechanical fasteners where required to secure insulation into position in accordance with insulation manufacturer.

## **2.9. ACCESS DOORS**

- 2.9.1. Access doors: in accordance with Divisions 21, 22, and 23 and Divisions 26, 27, and 28.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. General:
  - 3.1.1.1. Comply with ASTM C840-11, GA-216, GA-600, and manufacturer's instructions, except as otherwise indicated.
  - 3.1.1.2. Do not bridge building expansion joints with support system.
  - 3.1.1.3. Frame both sides of joints with furring and other supports as indicated.
- 3.1.2. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.
- 3.1.3. Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceiling, and the like) unless otherwise indicated, except in chase walls which are properly braced internally.
- 3.1.4. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cut-outs.
- 3.1.5. Securely attach trim, casings, framing, and accessories.
- 3.1.6. Apply components of fire-rated assemblies in conformance with indicated designs.
- 3.1.7. Erect materials to dimensions indicated, plumb, level, straight, and square to adjoining elements.
- 3.1.8. Do not apply gypsum board in close proximity to hot pipes or heating ducts.
- 3.1.9. Install materials with the minimum number of joints. Tightly butt joints, without force, and neatly align them.
- 3.1.10. Frame openings on every side. Provide clearances with services.
- 3.1.11. Work shall include bulkheads over doors, frames, screens, and changes in ceiling levels, pipe space and as indicated.
- 3.1.12. Provide clearances between work of this section and structural elements to prevent transference of structural loads in accordance with Section 09 22 00.
- 3.1.13. Tolerances:
  - 3.1.13.1. Do not exceed 3 mm (1/8") in 3 m (10') variation from plumb, level, and plane in exposed surfaces, except at end joint between gypsum board panels.
  - 3.1.13.2. Do not exceed 10 mm (3/8") from indicated location.

- 3.1.13.3. Do not exceed 1.5 mm (1/16") variation between planes of abutting edges or ends.
- 3.1.13.4. Surface flatness shall not exceed 1.5 mm (1/16") within 305 mm (12") straight edge. For non-tapered-edge end joints between boards, measure flatness tolerance with end of straight end at centreline of joint.

### **3.2. ACCESSORIES**

- 3.2.1. At external corners install corner trim secured to framing at 230 mm (9-1/16") on centre on both flanges with screw fasteners or clinch tool.
- 3.2.2. Secure casing trim at board edges where exposed to view, where board butts against other materials with no trim to conceal junction, at perimeter of ceiling surfaces at tops of partitions where they stop against continuous ceiling surfaces, and where indicated.
- 3.2.3. Erect accessories straight, plumb or level, rigid and at proper plane.
- 3.2.4. Use full length pieces.
- 3.2.5. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners, free from rough edges. Secure in accordance with manufacturer's specifications unless otherwise required.
- 3.2.6. Installation tolerances:
  - 3.2.6.1. Alignment with board panels shall not exceed tolerances specified above.
  - 3.2.6.2. End joints shall be flush aligned to maximum offset of 0.5 mm (0.020").

### **3.3. BOARD APPLICATION - GENERAL**

- 3.3.1. Before application of gypsum board commences, ensure that internal services have been installed, tested, and approved; that conduits, pipes, cables, and outlets are plugged, capped, or covered; and that fastenings and supports installed by others are in place.
- 3.3.2. Extend board into door, window, and other openings, reveals, behind fitments, and other applied items and on metal stud partitions to structure above unless indicated otherwise in the Contract Documents.
- 3.3.3. Apply board with long dimension perpendicular to supports, unless otherwise indicated in the Contract Documents.
- 3.3.4. Locate joints on opposite sides of partitions on different studs, and at least 305 mm (12") from opening jambs.
- 3.3.5. Install board to minimize joints, and align end joints to be the least objectionable (where they are unavoidable), according to the indicated lighting design. Locate joints in ceilings where least prominently discerned, and never line them up with opening edges.
- 3.3.6. Form smooth joints at ends and at field cut edges of board panels.
- 3.3.7. Fasten board to metal support members by metal gypsum board screws, 9.5 mm (0.374") minimum to, and 12.7 mm (1/2") maximum from, center of joints. Space screws:
  - 3.3.7.1. At fire rated board as per fire-rated assembly.
  - 3.3.7.2. At typical board walls at 400 mm (16") on centre at edges and field unless otherwise required.
  - 3.3.7.3. At typical board ceilings at 305 mm (12") on centre at edges and field unless otherwise required.
- 3.3.8. At laminated plain gypsum board locations: Apply adhesive with notched spreader to leave ribbons 10 mm x 13 mm (3/8" x 1/2") at 38 mm (1-1/2") apart over entire back side of face layer. Erect board immediately after spreading adhesive. Temporarily secure face boards with screws or bracing to ensure adequate bond until adhesive sets. Temporary face screws may also be used. Substrate shall be fully cured and sufficiently dry to allow adhesive to fully cure and not re-emulsify.
- 3.3.9. Offset gypsum board joints 150 mm (6") minimum from corners of openings.
- 3.3.10. Gypsum panel product joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

### **3.4. WATER RESISTANT GYPSUM BOARD APPLICATION**

- 3.4.1. Apply water resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

### **3.5. EXTERIOR SHEATHING BOARD APPLICATION – GYPSUM SHEATHING BOARD**

- 3.5.1. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253, ASTM C1280-13, and ASTM C1397-13. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other supports as indicated in the Contract Documents.
- 3.5.2. Use maximum board lengths to minimize number of joints. Sheathing joints shall be staggered, offset by at least one framing member. Offset gypsum board joints 150 mm (6") minimum from corners of openings.
- 3.5.3. Install sheathing with exterior board side facing exterior. Butt boards together for a light contact at edges and ends with not more than 1.6 mm (1/16") open space between boards. Do not force into place.
- 3.5.4. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.
- 3.5.5. Locate fasteners minimum 10 mm (3/8") from edges and ends of sheathing boards.
- 3.5.6. Provide clearances between work of this section and structural elements to prevent transference of structural loads, and in no case less than 16 mm (5/8").
- 3.5.7. Tolerances:
  - 3.5.7.1. Sheathing where acting as substrate for direct applied or insulated finishing system shall be flat to within 6 mm in 3050 mm (1/4" in 10'), in accordance with ASTM C1397-13.
  - 3.5.7.2. Maximum gap between board joints: 1.6 mm (1/16").

### **3.6. INTERIOR TILE BACKER BOARD APPLICATION**

- 3.6.1. Install in accordance with manufacturer's specifications.
- 3.6.2. Section 09 31 00 to install tile setting material over tape installed by this section. Install mesh tape centred over tile backer board joints.
- 3.6.3. Apply tile backer board full height unless otherwise indicated, and in accordance with manufacturer's installation instructions. Install water barrier sheeting over gypsum board substrates, where applicable.
- 3.6.4. Fastener spacing:
  - 3.6.4.1. Walls: fasten at 150 mm (6") on centre at vertical butt joints and 210 mm (8") on centre in field.
  - 3.6.4.2. Ceilings: fasten at 150 mm (6") on centre.
- 3.6.5. Maintain 6 mm (1/4") gap between board and tub or shower base as applicable.

### **3.7. INTERIOR CEMENT BOARD**

- 3.7.1. Apply cement board with rough side towards interior, as and with ends applicable, and edges over supports. Fit ends and edges closely, but not forced together. Stagger end joints in successive courses.
- 3.7.2. Fasten cement board to framing with specified fasteners. Drive fasteners in field of cement board first, working toward ends and edges. Hold cement board in firm contact with framing while driving fasteners. Space fasteners along framing with perimeter fasteners at least 9.5 mm (0.374") and less than 15.9 mm (5/8") from ends and edges. Drive fasteners so bottom of heads are flush with surface of cement board to *Provide* firm board contact with framing. Do not drive fastener heads below panel surface.
  - 3.7.2.1. Maximum fastener spacing as follows:
    - (1) Walls: 200 mm (8").
    - (2) Ceiling: 150 mm (6").
    - (3) Perimeters: minimum 9.5 mm (3/8") and maximum 15.9 mm (5/8") from ends and edges.

### **3.8. ACOUSTIC WALL ASSEMBLIES**

- 3.8.1. Sound attenuation insulation:
  - 3.8.1.1. Install sound attenuation insulation to fill cavity unless otherwise indicated in the Contract Documents.

- 3.8.1.2. Trim insulation to Provide close-fit contact to framing assemblies and fill the partition cavity or acoustic insulation assemblies to thicknesses specified or indicated.
- 3.8.1.3. Maintain air space between backs of sound attenuation insulation and back of opposite partition face layer, as applicable.
- 3.8.1.4. Cut insulation to Provide close-fit contact around electrical boxes, pipes, and other obstructions and penetrations through and within acoustic assemblies.
- 3.8.1.5. Extend acoustic partition assemblies to underside of structure. Incorporate approved provision to prevent transmittance of structural deflection to partition assembly.
- 3.8.1.6. Staple sound attenuation insulation where required by manufacturer's installation instructions.
- 3.8.1.7. Where studs are not faced with gypsum board on both sides, mechanically fasten wire mesh to non-faced side of stud to retain insulation.
- 3.8.1.8. Mechanically attach sound attenuation insulation in wall assemblies where cavity of wall assembly is greater than 150 mm (6").
- 3.8.1.9. Secure insulation in such a manner that it will not sag or settle away from required locations.

### 3.9. FINISHING

- 3.9.1. Provide levels of gypsum board finish for locations as follows, in accordance with GA-214.
  - 3.9.1.1. Level 1: Ceiling plenum areas and concealed areas, except *Provide* higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
  - 3.9.1.2. Level 2: Gypsum board substrate at applied hard surfaces, except remove tool marks and ridges.
  - 3.9.1.3. Level 4: Exposed gypsum board surfaces, except where another finish level is indicated the in the *Contract Documents*.
  - 3.9.1.4. Level 5: Exposed gypsum board surfaces where indicated in the *Contract Documents*.
- 3.9.2. Interior gypsum board:
  - 3.9.2.1. Prefill:
    - (1) Use setting-type joint compound. Mix joint compound according to manufacturer's directions.
    - (2) Fill joints between boards flush to top of eased or beveled edge.
    - (3) Fill joints of gypsum board above suspended ceilings in fire rated partitions.
    - (4) Wipe off excess compound and allow compound to harden.
    - (5) Joint gaps not greater than 3.2 mm (1/8") shall be prefilled with either ready- mix or setting type joint compound; joint gaps greater than 3.2 mm (1/8") shall be prefilled with setting-type joint compound.
  - 3.9.2.2. Taping (Level 1):
    - (1) Butter taping compound into inside corners and joints.
    - (2) Center tape over joints and press down into fresh compound.
    - (3) Remove excess compound.
    - (4) Tape joints of gypsum board above suspended ceilings.
  - 3.9.2.3. First coat (Level 2):
    - (1) Use taping or all-purpose drying-type compound.
    - (2) Immediately after bedding tape, apply skim coat of compound and allow to dry completely in accordance with manufacturer's instructions.
    - (3) Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.
    - (4) Fastener heads and accessories shall be covered with 1 coat of joint compound.

- 3.9.2.4. Second coat (Level 3): After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 50 mm (2") beyond edge of first coat.
  - (1) Fastener heads and accessories shall be covered with total of 2 separate coats of joint compound.
- 3.9.2.5. Third coat (Level 4):
  - (1) After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 50 mm (2") beyond edge of second coat.
  - (2) Allow third coat to dry. Apply additional compound, and touch-up and sand, to Provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.
  - (3) Finished joints will be accepted with a camber not greater than 1 mm (1/32") and shall be seamless, plumb, true and flush and with square, neat corners.
  - (4) Fastener heads and accessories shall be covered with total of 3 separate coats of joint compound.
- 3.9.2.6. Skim coat (Level 5):
  - (1) After the fourth coat has dried, apply skim coat of topping or all-purpose drying-type compound over exposed surfaces of gypsum board.
  - (2) After skim coat has dried, touch-up and sand to Provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.
- 3.9.3. Water-resistant gypsum board: Treat fastener heads and joints with setting-type joint compound.
  - 3.9.3.1. For joints to be covered with tile, apply tape and joint compound bedding coat and skim coat only; do not apply finish coats.
  - 3.9.3.2. Do not crown joints or leave excess compound on panels.
  - 3.9.3.3. Remove tool marks and ridges.
  - 3.9.3.4. For fastener heads to be covered with tile, apply one coat of joint compound.
- 3.9.4. Interior tile backer board: Prepare and finish joints in accordance with manufacturer's instructions.
- 3.9.5. Cement board: Prepare, tape, and finish joints in accordance with manufacturer's instructions.
- 3.9.6. Joint compound:
  - 3.9.6.1. Apply finish coat of compound feathering 75 to 100 mm (3" to 4") beyond tape edges.
  - 3.9.6.2. Feather coats onto adjoining surfaces so that camber is maximum 0.79 mm (1/32").
- 3.9.7. Trim:
  - 3.9.7.1. Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.
  - 3.9.7.2. Install metal corner beads at external corners.
  - 3.9.7.3. Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi exposed, and where gypsum base terminates against dissimilar material.
  - 3.9.7.4. Erect beads plumb or level, with minimum joints.
- 3.9.8. Control joints:
  - 3.9.8.1. Provide control joints set in board facing. Support control joints with studs or furring channels on both sides of joint.
  - 3.9.8.2. Provide control joints in required locations.
    - (1) Review control joint locations with the *Consultant* prior to installation.
  - 3.9.8.3. Install control joints where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the building structure.
  - 3.9.8.4. Install control joints where a wall or partition runs in an uninterrupted straight plane exceeding 9100 mm (30 linear feet).

- 3.9.8.5. Install control joints in interior ceilings:
  - (1) With perimeter relief:
    - (H) Linear dimensions between control joints shall not exceed 15000 mm (50 ft) and total area between control joints shall not exceed 230 m<sup>2</sup> (2500 ft<sup>2</sup>).
  - (2) Without perimeter relief:
    - (I) Linear dimensions between control joints shall not exceed 9100 mm (30 ft) and total area between control joints shall not exceed 84 m<sup>2</sup> (900 ft<sup>2</sup>).
- 3.9.8.6. Install control joints where ceiling framing members change direction.
- 3.9.8.7. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 16 mm (5/8") type X gypsum panel products, mineral fibre, or other tested equivalent. Construct through-wall control joints at fire-rated assemblies in accordance with assembly listing requirements.
- 3.9.8.8. Line up control joints with joints in other construction or with centre lines of mullions, columns, piers, or similar building elements, where accepted by the Consultant.
- 3.9.8.9. Install control joints straight and true.
- 3.9.8.10. Ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners. If control joints are not used, additional reinforcement is required at corners to distribute concentrated stresses.
- 3.9.8.11. Board joints shall be located so that no joint will align with the edge of an opening unless control joints are to be installed at these locations.

### **3.10. FIRE SEPARATIONS**

- 3.10.1. Install fire-rated assemblies in accordance with assembly listing requirements in order to obtain fire ratings indicated and as required by the Authorities Having Jurisdiction.
- 3.10.2. Vertical bulkheads in ceiling spaces over fire rated partitions, doors and the like shall have same fire rating as the partition over which they occur. Such bulkheads shall be of gypsum board construction unless otherwise indicated in the Contract Documents.
- 3.10.3. Use fire rated gypsum wallboard as specified in the Contract Documents.
- 3.10.4. Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, Provide enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.
- 3.10.5. Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, *Provide* gypsum board enclosure or backing to maintain required fire rating, unless otherwise detailed in the *Contract Documents*.

### **3.11. ACCESS DOORS**

- 3.11.1. Install access doors to mechanical and electrical fixtures specified in respective sections of Divisions 21, 22, and 23 and Divisions 26, 27, and 28.
- 3.11.2. Access doors shall be as supplied by Divisions 21, 22, and 23 and Divisions 26, 27, and 28. Locations to be reviewed and confirmed by the Consultant.
- 3.11.3. Install access panels in locations to be determined by coordination with trades installing mechanical, electrical and other building services and consultation with the Consultant.
- 3.11.4. Rigidly secure frames to furring or framing systems.

### **3.12. ADJUSTING AND CLEANING**

- 3.12.1. Remove debris and rubbish from wall and ceiling cavities before enclosing with board.
- 3.12.2. Clean up and remove surplus materials and rubbish resulting from the work of this section upon completion.
- 3.12.3. Clean off beads, casings, joint compound droppings and the like, leave the work of this section ready for painting trades.

## **END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Field Conditions
- .9 1.9. Warranty
- .10 2.1. Performance/Design Requirements
- .11 2.2. General
- .12 2.3. Tile Products
- .13 2.4. Mortar Materials
- .14 2.5. Grout Materials
- .15 2.6. Adhesive Materials
- .16 2.7. Sheet Waterproofing/Uncoupling Membrane Materials
- .17 2.8. Accessories And Related Materials
- .18 3.1. Examination
- .19 3.2. Preparation
- .20 3.3. Mixing
- .21 3.4. Sheet Waterproofing/Uncoupling Membrane Installation
- .22 3.5. Installation - General
- .23 3.6. Thin-Set Method
- .24 3.7. Tile Setting
- .25 3.8. Control And Expansion Joints
- .26 3.9. Trim Accessories Installation.
- .27 3.10. Grouting Or Pointing
- .28 3.11. Tile Installation Tolerances
- .29 3.12. Field Quality Control
- .30 3.13. Adjusting And Cleaning
- .31 3.14. Protection

### **1.3. SUMMARY**

- 1.3.1. Section Includes
- 1.3.1.1. Interior hard surface tiling.
  - 1.3.1.2. Mortar bed for tiling
  - 1.3.1.3. Thin-set Mortar for tiling
  - 1.3.1.4. Sheet Waterproofing/uncoupling membrane
  - 1.3.1.5. Trim accessories

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Sequencing and Scheduling
- 1.4.1.1. Coordinate installation of tile work with related work.
  - 1.4.1.2. Proceed with tile work only after curbs, vents, drains, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.



- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
  - 1.5.2.2. Submit manufacturer's installation requirements for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Indicate location and sizes of expansion and control joints.
- 1.5.4. Samples:
  - 1.5.4.1. Submit 3 -full size samples of each type of tile specified.
  - 1.5.4.2. Submit 3 - 305 mm (12") long samples trim accessory.
  - 1.5.4.3. Submit 3 - 305 mm (12") long samples of control joint sealant.
- 1.5.5. Test and evaluation reports:
  - 1.5.5.1. Submit moisture, alkalinity, and mortar bond test results.
- 1.5.6. Tiling system manufacturer's system warranty and design criteria:
  - 1.5.6.1. Submit tiling system manufacturer's warranty specimen and warranty design criteria prior to the commencement of work of this section.

## **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.6.2. Operation and maintenance data:
  - 1.6.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- 1.6.3. Maintenance materials:
  - 1.6.3.1. Provide minimum 2% of each type and colour of tile required for the Work for maintenance use.
  - 1.6.3.2. Maintenance material to be of same production run as installed material.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Subcontractor:
    - (1) Has adequate plant, equipment, and skilled workers to perform the work expeditiously.
    - (2) Has successfully completed installations similar to that specified during a period of at least the immediate past 5 years.
    - (3) Shall be a member company in good standing of the Terrazzo, Tile and Marble Association of Canada and have been a member for at least the past 5 years.
- 1.7.2. Mock-ups:
  - 1.7.2.1. Grouted mock-up: 1220 mm x 1220 mm (48" x 48") sample panels of each tile type and colour, texture, size, and pattern of tile and grout.
  - 1.7.2.2. Install each product and colour mock-up for acceptance by Consultant. Accepted mock-up shall form basis of standard of workmanship for remainder of work.
  - 1.7.2.3. Mock-up shall consist of floor/wall/base corner intersection, with 300 mm (12") of finish product on each face and control joints.

## **1.8. FIELD CONDITIONS**

- 1.8.1. Ambient conditions:
  - 1.8.1.1. Execute work of this section while temperature is maintained within safe working temperatures in accordance with manufacturer's installation instructions for a period of 72 hours before, during and following installation. Avoid concentrated or irregular heating during curing period.
- 1.8.2. Protection:
  - 1.8.2.1. Protect work of this section against damage by work of other sections for a minimum of 72 hours after application of grouting by prohibiting passage of

traffic over tile. Do not immerse in water and protect tilework from freezing for at least 28 Days after installation.

1.8.3. Testing:

- 1.8.3.1. For concrete floor substrates subject to moisture sensitive materials, conduct the following tests in accordance with the following:
- (1) Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written installation instructions. Results must not exceed the written recommendations of the product manufacturer.
  - (2) Test for surface pH. Levels of pH shall not exceed the written recommendations of the product manufacturer. Test in accordance with ASTM F710-11.
  - (3) For each test type: Conduct 3 tests for flooring applications up to 93 m<sup>2</sup> (1000 square feet) in area, and 1 additional test for each additional 93 m<sup>2</sup> (1000 square feet) of flooring area.

**1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36.

**2 PRODUCTS**

**2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. ANSI - American Standard Specification for the Installation of Ceramic Tile.  
2.1.2. Terrazzo, Tile and Marble Association of Canada ("TTMAC") Specification Guide 09 30 00 Tile Installation Manual TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual.

**2.2. GENERAL**

- 2.2.1. Tile products shall be from same production run, dye lot, calibre, and batch number. If shading variation is evident, notify Consultant prior to installation

**2.3. TILE PRODUCTS**

- 2.3.1. Ceramic tile:  
2.3.1.1. Acceptable Products: Refer to Materials and Finish Schedule.

**2.4. MORTAR MATERIALS**

- 2.4.1. Unless otherwise specified, select from the following thin-set mortar:
- 2.4.1.1. Latex modified Portland cement thin bed mortar gauged:
- (1) ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
  - (2) White colour for translucent tile applications.
  - (3) Acceptable Products:
    - (A) Ardex 'X77 Microtec Fiber Reinforced Mortar' with Ardex 'E90 Mortar Admix'.
    - (B) Custom Building Products 'ProLite'.
    - (C) Flextile '51' mixed with Flextile '44'.
    - (D) Laticrete 'Laticrete 4237 Latex Thin Set Liquid' with 'Portland 211 Crete Filler Powder'.
    - (E) Mapei 'KERALASTIC' mixed with 'KERABOND'.
    - (F) Profix '6500' liquid latex mixed with '8500' thin set mortar.
    - (G) Promo Adhesives Inc. 'Pro Bond Plus' with 'Pro Bond Plus Additive'.
    - (H) TEC 'Superflex Ultra-Premium Thin Set'.
- 2.4.1.2. Enriched, modified, Portland cement thin bed mortar, single component, with integral polymer:
- (1) ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
  - (2) White colour for translucent tile applications.

- (3) Acceptable Products:
  - (A) Ardex 'X 5 Flexible Tile & Stone Mortar'.
  - (B) Custom Building Products 'Versabond LFT'.
  - (C) Flextile '52'.
  - (D) Laticrete '254 Platinum Multipurpose Thin-Set Mortar'.
  - (E) Mapei 'Ultraflex 3' or 'Ultraflex RS'.
  - (F) Profix 'Megaflex' thin set mortar.
  - (G) Promo Adhesives Inc. 'Pro HPX'.
  - (H) TEC 'Ultimate Large Tile Mortar'.
- 2.4.2. Special mortar and setting materials:
  - 2.4.2.1. Mortar for large format tiles meeting definition under paragraph 1.2.1.1:
    - (1) Enriched, modified, fast-set Portland cement medium bed mortar high-hydration, low residual moisture behind the tile formula.
    - (2) ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
    - (3) Substrate primer: in accordance with manufacturer's installation requirements.
    - (4) White colour for translucent tile applications and light coloured stones.
    - (5) Acceptable Products:
      - (A) Ardex 'S 28 Microtec Rapid Hardening and Rapid Drying Semi-Pourable Natural Stone Floor Tile'.
      - (B) Custom Building Products: 'MegaLite'.
      - (C) Flextile '58XT'.
      - (D) Mapei 'Granirapid'.
      - (E) Laticrete '4-XLT Rapid'.
      - (F) Profix 'Flex GT-30'.
      - (G) Profix 'Optiflex' Full-Contact Mortar.
      - (H) Promo Adhesives Inc. 'Pro Quick SF' with 'Pro Quick Plus Additive'.
      - (I) TEC 'Fast Set Ultimate Large Tile Mortar'.
      - (J) TEC 'Fast Set 3N1 Performance Mortar'.
  - 2.4.2.2. Latex-Portland cement mortar for thick beds, levelling beds and scratch coats:
    - (1) ANSI A118.4 (ANSI A108/A118/A136.1-20) and ANSI A118.11 (ANSI A108/A118/A136.1-20).
    - (2) Acceptable Products:
      - (A) Ardex 'A 38 Rapid Hardening and Drying Cement for Floor Screeds in Internal or External Locations'.
      - (B) Custom Building Products 'SpeedSlope'.
      - (C) Custom Building Products 'Thick Bed Bedding Mortar'.
      - (D) Flextile '4:1 Dry Pack Mortar mixed with Flextile '44'.
      - (E) Laticrete '226 Thick Bed Mortar' gauged with Laticrete '3701 Mortar Admix'.
      - (F) Mapei 'Ultraflex LFT'.
      - (G) Profix 'GT 30' medium bed mortar.
      - (H) Promo Adhesives Inc. 'Pro P-151 SF'.
      - (I) TEC 'Floor Mud'.
- 2.4.3. Mortar beds, levelling coats:
  - 2.4.3.1. Materials:
    - (1) Water: clean and free of chemicals detrimental to mortar and grout mixes.
    - (2) Sand: to ASTM C144-18, passing 16 mesh.
    - (3) Cement: to CSA A3002-13, Type U.
    - (4) Latex: Formulated for use with Portland cement mortars.
    - (5) Cleavage membrane: 0.10 mm (4 mil) thick polyethylene film to CAN/CGSB 51.34-M86.
    - (6) Metal lath: Galvanized type, 1.4 kg/m<sup>3</sup> to ASTM C847-18.
    - (7) Reinforcing mesh: 51 mm x 51 mm (2" x 2") mesh size, fabricated from 1.6 mm (0.06") thick galvanized steel wire; welded fabric design.

2.4.3.2. Mixes:

- (1) Scratch coat (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.
- (2) Slurry bond coat: Mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC detail.
- (3) Mortar bed for walls (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.
- (4) Levelling coat (by volume): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability.
- (5) Mortar bed for floors (by performance): 1 part Portland cement, 4 parts sand, and water or latex where required by TTMAC detail. Premixed mortar may be used per manufacturer's requirements. Adjust liquid volume may be adjusted depending on water content of sand to obtain consistency and workability that will allow compaction during tamping of the mortar bed, and achieve minimum compressive strength of 15 MPa after 28 days

## 2.5. GROUT MATERIALS

2.5.1. Epoxy grout:

2.5.1.1. ANSI A118.3 (ANSI A108/A118/A136.1-20).

2.5.1.2. Acceptable Products:

- (1) Ardex 'WA Epoxy Grout'.
- (2) Custom Building Products: 'CEG Lite 100% Solids Commercial Epoxy Grout'.
- (3) Flextile 'Flex-Epoxy 100 Grout'.
- (4) Laticrete 'SpectraLOCK PRO Grout'.
- (5) Mapei 'Kerapoxy' or 'Kerapoxy CQ'.
- (6) Profix 'Poly 800'.

2.5.1.3. Grout colours to later selection by Consultant from manufacturer's full range.

2.5.1.4. Grout sealer: as recommended by grout manufacturer.

2.5.1.5. TEC Specialty Products, Inc. '100% Solids Epoxy Mortar and Grout 470'.

- (1) Sanded, polymer-modified, latex-modified, non-shrink, ANSI A108/A118/A136.1- 2013 and ANSI A108/A118/A136.1-2013.
- (2) Ardex Canada 'FL Rapid Set, Flexible Sanded'.
- (3) Flextile Ltd. '600'.
- (4) Laticrete International Inc. '1500 Series' mixed with '1776 Grout Admix'.
- (5) Mapei Corp. 'Keracolour S'.
- (6) TEC Specialty Products, Inc. 'AccuColour Premium Sanded'.
- (7) Or equivalent.

2.5.1.6. Unsanded, polymer-modified, latex-modified, non-shrink, ANSI A108/A118/A136.1-2013 and ANSI A108/A118/A136.1-2013.

- (1) Ardex Canada 'FG-C Microtec (unsanded)'.
- (2) Flextile Ltd. '500'.
- (3) Laticrete International Inc. '1600 Series' mixed with '1776 Grout Admix'.
- (4) Mapei Corp. 'Keracolour U'.
- (5) TEC Specialty Products, Inc. 'AccuColour Premium Unsanded'.
- (6) Or equivalent.

- 2.5.2. Scratch coat (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.
- 2.5.3. Slurry bond coat: mix Portland cement and water to a creamy paste consistency. Include latex additive where required by TTMAC Detail.
- 2.5.4. Mortar bed for walls (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions. Adjust water volume depending on moisture content of sand to obtain consistency and workability.
- 2.5.5. Leveling coat (by volume): 1 part Portland cement, 4 parts sand, and latex additive where required by TTMAC Detail. Premixed mortar may be used in accordance with manufacturer's instructions.
- 2.5.6. Mortar bed for floors; where applicable: 1 part cement, 4 parts sand, 1 part water. Water volume may be adjusted depending on water content of sand.

## **2.6. ADHESIVE MATERIALS**

- 2.6.1. Setting adhesives; interior applications:
  - 2.6.1.1. Portland cement/sand/latex mixture, to ANSI A108/A118/A136.1-2013 and with minimum Shear Bond (Porcelain Tile, immersion and dry 28 Day cure tests) of 2.3 MPa (340 psi) when tested to ANSI A108/A118/A136.1-2013.
    - (1) Acceptable products:
      - (A) Ardex 'X 77 Microtec Fibre Reinforced'.
      - (B) Flextile '51' mixed with Flextile '44'.
      - (C) Laticrete 'Laticrete 4237 Latex Thin Set Liquid' with 'Portland 211 Crete Filler Powder'.
      - (D) Mapei 'KERALASTIC' mixed with 'KERABOND'.
      - (E) TEC Specialty Products, Inc. 'Super Flex Latex-Modified Thin Set Mortar'.
      - (F) Or equivalent.
  - 2.6.1.2. Metal substrate conditions: Epoxy mortar setting mix to ANSI A108/A118/A136.1- 2013.
    - (1) Ardex Canada 'S 16 Rapid Setting Thin Set'.
    - (2) Flextile Ltd. '100 Flex-Epoxy'.
    - (3) Laticrete International Inc. 'Latapoxy 210 Modified Epoxy Adhesive'.
    - (4) Mapei Corp. 'Kerapoxy 9931'.
    - (5) Or equivalent.

## **2.7. SHEET WATERPROOFING/UNCOUPLING MEMBRANE MATERIALS**

- 2.7.1. Review floor assembly design (live load deflection) with Consultant and uncoupling membrane manufacturer's representative. Confirm uncoupling membrane manufacturer's recommended product to Consultant in writing, on uncoupling membrane manufacturer's company letterhead prior to commencing the installation.
- 2.7.2. Walls: waterproofing membrane:
  - 2.7.2.1. Polyethylene membrane with polypropylene fleece laminated on both sides. Membrane meets or exceeds ANSI A118.10 (ANSI A108/A118/A136.1-20).
  - 2.7.2.2. Acceptable Products:
    - (1) Schluter 'Kerdi'.
- 2.7.3. Floors; waterproofing/uncoupling membrane:
  - 2.7.3.1. High density corrugated polyethylene matting with dovetail-shaped ribs with polypropylene-fibre support webbing laminated to the underside to provide a mechanical bond to the substrate mortar. Membrane meets or exceeds ANSI A118.10 (ANSI A108/A118/A136.1-20) and ANSI A118.12 (ANSI A108/A118/A136.1-20).
  - 2.7.3.2. Acceptable Products:
    - (1) Schluter 'Ditra'.

- (2) Schluter 'Ditra XL'.
- 2.7.4. Accessories:
  - 2.7.4.1. Mortar for setting tile and installing membranes and membrane waterproofing accessories: Compatible product as recommended by sheet uncoupling membrane manufacturer.
  - 2.7.4.2. Membrane waterproofing accessories:
    - (1) Use Schluter 'KERDI-BAND' to seal waterproofing membrane seams and joints where manufacturer preformed corners cannot be used.
    - (2) Use 'KERDI-FLEX' to seal expansion joints or flexible edge joints.
    - (3) Use 'KERDI-KERS-B' and 'KERDI-KERS' for inside and outside corners.
    - (4) Use 'KERDI-SEAL-PS/-MV' for sealing pipe protrusions.
    - (5) Use 'KERDI'FIX' to seal pipe protrusions where 'KERDI-SEAL-PS/-MV' cannot be used.

## **2.8. ACCESSORIES AND RELATED MATERIALS**

- 2.8.1. Trim accessories:
  - 2.8.1.1. Shower threshold: Schluter 'SHOWPROFILE-WSC'.
  - 2.8.1.2. Finishing and edge protection, wall: Schluter 'JOLLY', satin nickel anodized aluminum AT.
  - 2.8.1.3. Inside corner: Schluter 'DILEX-HKW'.
  - 2.8.1.4. Floor transitions:
    - (1) Flush conditions: Schluter 'Schiene', satin anodized aluminum.
    - (2) <13 mm conditions: Schluter 'RENO-U'.
- 2.8.2. Joint sealants: mildew resistant sealant in accordance with Section 07 92 00.
- 2.8.3. Expansion and control joint sealant:
  - 2.8.3.1. One-component, neutral cure, exterior grade silicone sealant.
  - 2.8.3.2. Tensile strength (ASTM C794-18): 1.5 MPa (225 psi).
  - 2.8.3.3. Hardness (ASTM D751-19; Shore A): Minimum 25 (coloured sealant)/15 (clear sealant).
  - 2.8.3.4. Weather Resistance (QUV Weather-ometer): No change after 10,000 hours.
  - 2.8.3.5. Acceptable Products:
    - (1) Flextile 'Ultra Performance Caulk'.
    - (2) Latricrete 'Latasil Tile and Stone Sealant'.
    - (3) Mapei 'Mapesil T'.
- 2.8.4. .4 Control joint sealant:
  - 2.8.4.1. .1 One-component, neutral cure, exterior grade silicone sealant.
  - 2.8.4.2. .2 Tensile strength (ASTM C794-18): Minimum 1.5 MPa (225 psi).
  - 2.8.4.3. .3 Hardness (ASTM D751-19; Shore A): Minimum 15.
  - 2.8.4.4. .4 Weather resistance (QUV Weather-ometer): No change after 10,000 hours.
  - 2.8.4.5. .5 Acceptable Products:
    - (1) .1 Ardex 'SX'.
    - (2) .2 Flextile 'Tile & Grout Caulk'.
    - (3) .3 Latricrete 'Latasil Tile and Stone Sealant'.
    - (4) .4 Mapei 'Mapesi TI'.
    - (5) .5 Profix 'Poly 400 Flexible Caulking'.
    - (6) .6 TEC 'Accucolour 100% Silicone Sealant'.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Ensure compatibility of Products supplied under this section, and which bear contact with substrate.
- 3.1.2. Before work of this section commences, examine the areas to be covered and report any flaw or adverse conditions in writing to the Contractor and the Consultant. Do not proceed with the tilework until surfaces and conditions comply with the requirements indicated in the manufacturer's instructions and in ANSI A108.5 (ANSI A108/A118/A136.1-20) specification.

- 3.1.3. Miscalibrated tiles, tiles with chipped corners, tiles with holes, will not be accepted for installation.
- 3.1.4. Inspect tiles for colour variation. Tiles presenting noticeable variations shall be carefully selected, set aside and used in areas where they fit in the pattern homogeneously. Provide for appropriate lighting equipment in addition to existing lighting in the immediate area where the installation is being performed so that any shade differences which are normally very slight can be identified easily.

### **3.2. PREPARATION**

- 3.2.1. Completely remove contaminants and deleterious substances and debris which may prevent, reduce, and affect adhesion or performance or may act as bond breaker.
- 3.2.2. Wire brush steel substrates to remove deleterious substances and rust, to promote full adhesion to steel.
- 3.2.3. Roughen surfaces with previously painted glossy finishes by sandpaper or other abrasive medium, and completely remove finishes which are not compatible with products specified under this section.
- 3.2.4. Prime gypsum, wood or porous concrete with primer, brush or roller applied at full strength in accordance with mortar manufacturer's recommendations.
- 3.2.5. Floor surfaces:
  - 3.2.5.1. Prepare concrete to receive crack isolation membrane in accordance with International Concrete Repair Institute (ICRI) designation CSP-2.
  - 3.2.5.2. Concrete shall be minimum of 90 days old.
  - 3.2.5.3. At door opening locations where finished flooring is adjacent to weather-stripping or automatic door bottoms provide trowel-applied levelling compound to provide full contact between finished flooring and weather-stripping or automatic door bottoms. Taper trowel-applied levelling compound to transition with adjacent flooring substrate to provide smooth and seamless transition at maximum slope of 3:1000 (height to distance) ratio.
- 3.2.6. Concrete shall be dry with maximum allowable moisture in accordance with product manufacturer's written requirements for products to be installed directly over concrete.
- 3.2.7. Alkalinity, moisture, and adhesion testing:
  - 3.2.7.1. Perform moisture and alkalinity tests and mortar bond test.
  - 3.2.7.2. Where concrete substrate exhibits higher than permitted moisture and alkalinity levels, provide water vapour reduction system and repeat moisture and alkalinity tests and mortar bond tests.
  - 3.2.7.3. Proceed with installation only after substrates pass testing. Document tests performed and submit in writing to Consultant.

### **3.3. MIXING**

- 3.3.1. Mix mortars, additives and grouts in accordance with manufacturer's written requirements.

### **3.4. SHEET WATERPROOFING/UNCOUPLING MEMBRANE INSTALLATION**

- 3.4.1. Levelling and sloping of substrates shall be completed prior to installation of waterproofing/uncoupling membranes.
- 3.4.2. Remove dust, dirt, oil, grease, paint, laitance, efflorescence, curing compounds, sealers, water repellents and other deleterious materials that prevent bond. Metal plumbing pipe penetrations and fixtures must be clean of oil, grease, rust and other potential bond breakers.
- 3.4.3. Install membrane to provide watertight performance to the following locations:
  - 3.4.3.1. Install to shower floors and install on associated vertical surfaces up to underside ceiling.
  - 3.4.3.2. Install to associated floor areas in washrooms and install on associated vertical surfaces up to minimum height of 150 mm (6").

- 3.4.4. Install membranes to comply with ANSI A108.13 (ANSI A108/A118/A136.1-20) and manufacturer's written requirements to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- 3.4.5. Install prefabricated corners at outside and inside corner conditions.
- 3.4.6. Install prefabricated pipe collars at penetrations.
- 3.4.7. Provide strips of membrane where required to span expansion joints or terminate membrane into movement joint type tile setting accessories, in accordance with manufacturer's requirements.
- 3.4.8. Seal membranes at penetrations and terminations in accordance with manufacturer's installation requirements.
- 3.4.9. Floors; uncoupling/waterproofing membrane:
  - 3.4.9.1. At the joints, fill the cut-back cavities with mortar centred over membrane seams and apply additional mortar with notched trowel. Centre membrane bands over seam and embed to achieve 100% contact with mortar and substrate removing air pockets.
  - 3.4.9.2. At wall junctions apply a 250 mm (10") band strips in same manners as membrane seams.
  - 3.4.9.3. Membrane bands shall overlap uncoupling membrane seams, floor/wall transitions minimum 50 mm (2").
- 3.4.10. Drains shall be of the clamping ring type, with weepers.
- 3.4.11. Embed reinforcing fabric/mesh into waterproofing/crack isolation membrane to achieve full contact and to remove air pockets.
- 3.4.12. Seal waterproofing/crack isolation at penetrations and terminations.
- 3.4.13. Apply waterproofing/crack isolation membrane coats at manufacturer's recommended application rates.

### **3.5. INSTALLATION - GENERAL**

- 3.5.1. Install Products in accordance with manufacturer's specifications and as indicated herein, in accordance with TTMAC Specification Guide 09 30 00 Tile Installation Manual TTMAC 2019-2021 Specification Guide 09 30 00, Tile Installation Manual, and in accordance with ANSI A108.5 (ANSI A108/A118/A136.1-20) except where specified otherwise

### **3.6. THIN-SET METHOD**

- 3.6.1. Make joints even, straight, plumb and of uniform width.
- 3.6.2. Provide mortar beds and levelling coats in accordance with TTMAC details.
- 3.6.3. Provide uniform positive slope to floor drains, to minimum allowable slope of 20 mm/m (1/4 inch/ft).
- 3.6.4. At floor drains in mortar bed: Provide minimum setting bed of 10 mm (3/8"), sloped to drain at 20 mm/m (1/4 inch/ft).
- 3.6.5. Provide edge protection at tile edges and corners, unless otherwise indicated, using maximum length pieces.
- 3.6.6. Provide edge protection and transition strips at tile transitions, unless otherwise indicated, using maximum length pieces.
- 3.6.7. Review locations of tile accessories with Consultant prior to setting tile and comply with directions of Consultant.
- 3.6.8. Lap tile and seal with sealant at shower fixtures. Caulk around pipes and openings made in tile with sealant.
- 3.6.9. Apply sealant at interface with frames at openings. Apply sealant in accordance with Section 07 92 00 and manufacturer's requirements.
  - 3.6.9.1. Sealant colour to later selection by Consultant.
- 3.6.10. Install flooring to entire area indicated or scheduled. Unless otherwise indicated, include coverplates occurring within finished floor areas. Maintain overall uniform continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Do not install flooring to floor drains occurring within finished floor areas.



### **3.7. TILE SETTING**

- 3.7.1. Lay out tile work as indicated on drawings, and where lay-out is not indicated, lay-out tiles so tiles less than 1/2 the least dimension do not occur and with minimum amount of cutting.
- 3.7.2. Using a damp towel, wipe off the back side of tile to remove any dust or other residue that may be left over from the manufacturing process.
- 3.7.3. Place as much tile as possible in one operation before setting bed reaches initial set. Clean back and remove bed when it has set before tile is laid.
- 3.7.4. Prime materials and by methods specified by manufacturer of bond coat.
- 3.7.5. Except where tiles have setting tabs, and except for expansion, control and isolation joints, maintain joint widths as selected by Consultant.
- 3.7.6. Back up tile coves, curbs and other shaped pieces solid with mortar. Rigidly set, reinforce or otherwise make firm and secure such pieces.
- 3.7.7. Beat tiles in thoroughly and sufficiently to cause mortar ribs or notches to come together into a continuous void free bed and allow the mortar to flow up partially into the joint space to maximum of 1/3 the thickness of the tile. Sound floor tiles by tapping and reset all tiles with voids in setting bed.
- 3.7.8. Tile shall contact setting materials for minimum of 95% coverage unless otherwise indicated.
- 3.7.9. Obtain 100% mortar coverage with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108/A118/A136.1-20 series of tile installation standards for the following:
  - 3.7.9.1. Exterior tile.
  - 3.7.9.2. Tile in wet areas.
  - 3.7.9.3. Tile installed with chemical resistant mortars and grouts.
  - 3.7.9.4. Tile having any dimension 300 mm (12") or larger in any direction.
  - 3.7.9.5. Tile with raised or textured backs.
  - 3.7.9.6. Tile installation rated for Heavy or Extra Heavy Duty.
  - 3.7.9.7. Porcelain tiles with more than 20% of the tile backs covered with firing release dust back buttered so that 100% of the back is covered with mortar rated for C627, Extra Heavy Duty rating.
- 3.7.10. Remove any excess setting material from the joint area so that 2/3 of the depth of the tile is available for grouting.
- 3.7.11. Remove smudges or smears of setting material from the tile surface with a damp sponge or cloth immediately after final adjustment and beat-in while the mortar is fresh.
- 3.7.12. Do necessary cutting and drilling of fixtures, fittings, and built-in or penetrating units without marring the tile. Replace all cracked or damaged tile.
- 3.7.13. Extend tile into recesses at windows, doors, or other openings.
- 3.7.14. Extend tiles 100 mm (4") behind mirrors, and fully behind cabinets, cupboards and other fixed objects at walls.
- 3.7.15. Cut tiles to conform to irregularities in wall lines and vertical planes along outer edges. Smooth cut edges with carborundum block or by other means to provide clean straight edge.
- 3.7.16. Install tiles to provide even distribution of shading, colour, and characteristics.

### **3.8. CONTROL AND EXPANSION JOINTS**

- 3.8.1. Install control joints and expansion joints in tile work in accordance with TTMAC Detail 301MJ-2019-2021 in floors and walls and at perimeters of floors, around columns and where tile abuts other hard materials and as indicated.
- 3.8.2. Review locations with Consultant prior to setting tile and comply with instruction given by Consultant.
- 3.8.3. Carry substrate control and movements joints through to tile work.
- 3.8.4. Incorporate expansion joints over building expansion joints.
- 3.8.5. Cut tiles on both sides along the edges of control or expansion joints.
- 3.8.6. Sealant control joints: Raking out joints to full depth of tile and cleaning joints for application of sealant in accordance with Section 07 92 00.

- 3.8.7. Manufactured control joint trim: in accordance with "Accessories and Related Materials" paragraph.

### **3.9. TRIM ACCESSORIES INSTALLATION.**

- 3.9.1. Install trims in accordance with manufacturer's written requirements.  
3.9.2. Install in continuous lengths.  
3.9.3. Scribe and fit to obstructions.  
3.9.4. Mitre corners.  
3.9.5. Tile shall be installed flush with top surface of trim accessory with tolerance of 1 mm (1/32") lower than the top surface of trim accessory. The trim accessory shall not be higher than the tiled surface. A joint of 3 mm (1/8") shall be left between the tile and the profile to be filled with grout.

### **3.10. GROUTING OR POINTING**

- 3.10.1. Install grout to comply with ANSI A118.4 (ANSI A108/A118/A136.1-20) unless otherwise specified and in accordance with manufacturer's written requirements.  
3.10.2. Allow tile installation to cure a minimum of 24 hours prior to grouting.  
3.10.3. Grout joints shall be free of dirt, debris, water or tile spacers and face of tiles are clean.  
3.10.4. Apply a coat of grout release and achieve 100% surface covered of tile following grout release manufacturer's written requirements.  
3.10.5. Pack joints full and free of voids/pits.  
3.10.6. Allow grout joints to become firm. Inspect joint for pinholes/voids and repair them with freshly mixed grout. Within 24 hours, check for remaining haze and remove it with warm soapy water and a nylon scrubbing pad, using a circular motion, to lightly scrub surfaces and dissolve haze/film.  
3.10.7. Epoxy grout: Install epoxy grout to comply with ANSI A108.1 (ANSI 108/A118/A136.1-20) and ANSI A108.10 (ANSI A108/A118/A136.1-20).  
3.10.8. Grout joint width to be 3.2 mm (1/8") unless otherwise indicated; except at mosaic type tiles on paper or mesh backed sheets.  
3.10.9. Use caution when using sanded grouts to prevent scratching of tile or other material surfaces.  
3.10.10. Do not cover, bridge or fill any expansion joints in tile with grout.

### **3.11. TILE INSTALLATION TOLERANCES**

- 3.11.1. Maximum allowable lippage:  
3.11.1.1. Tile up to 152 mm x 152 mm (6" x 6") in size: 1 mm (0.040").  
3.11.1.2. Tile greater than 152 mm x 152 mm (6" x 6") in size: 2 mm (0.080").  
3.11.2. Finish planes shall be straight and plumb to within 6 mm in 3 m (1/4" in 10 feet).

### **3.12. FIELD QUALITY CONTROL**

- 3.12.1. Conduct quality control in accordance with Section 01 45 00.  
3.12.1.1. Field tests and inspections:  
(1) For concrete floor substrates subject to moisture sensitive materials, conduct the following tests in accordance with the following:  
(A) Test for moisture vapour transmission in accordance with ASTM F710-21 and ASTM F1869-16a or ASTM F2170-19a in accordance with manufacturer's written installation requirements. Results must not exceed the written recommendations of the product manufacturer.  
(B) Test for surface pH. Levels of pH shall not exceed the written recommendations of the product manufacturer. Test in accordance with ASTM F710-21.  
(C) For each test type: Conduct 3 tests for flooring applications up to 93 m<sup>2</sup> (1000 square feet) in area, and 1 additional test for each additional 93 m<sup>2</sup> (1000 square feet) of flooring area.  
(2) Adhesion bond test:

- (A) Proceed with bond test after substrates have been prepared and alkalinity and moisture test have been completed.
- (B) Adhesion bond test shall be completed in accordance with tile flooring and mortar setting manufacturer's written requirements and in accordance with the independent inspection and testing company's requirements.
- (C) Using the specified mortar, set test tiles using mortar manufacturer's recommended trowel.
- (D) After pre-determined duration, attempt to remove the test tiles by pulling up from the corners.
- (E) Using the specified mortar, set test tiles using mortar specified and to comply with specifications.
- (F) After tiles have set and after duration of time as specified by independent inspection and testing company, commence pull off test to determine bonding strength of mortar between tile and substrate. Testing specimen sizes and number of tests including locations of tests shall be as directed by independent inspection and testing company.
- (G) Minimum bonding strength requirements shall be as determined by independent inspection and testing company.

### **3.13. ADJUSTING AND CLEANING**

- 3.13.1. Clean installed tile surfaces after grouting has cured.
- 3.13.2. Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.

### **3.14. PROTECTION**

- 3.14.1. Protect work of this section against damage by work of other sections for a minimum of 72 hours after application of grouting by prohibiting passage of traffic over tile. Do not immerse in water and protect tilework from freezing for at least 28 days after installation.
- 3.14.2. Protect floors from impact and vibration for a minimum of 48 hours after installation.
- 3.14.3. Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.
- 3.14.4. Where latex or polymer additives are used in mortar materials, materials shall be cured a minimum of 14 days before exposure to moisture and before water immersion and longer as included in mortar manufacturer's written requirements.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout submittals:
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, and Handling
- .9 1.9. Field Conditions
- .10 2.1. Performance/Design Requirements
- .11 2.2. General
- .12 2.3. Acoustical Tiles
- .13 2.4. Metal Suspension Systems
- .14 2.5. Miscellaneous Materials
- .15 2.6. Metal Finish
- .16 3.1. Installation - General
- .17 3.2. Installation - Suspension System
- .18 3.3. Installation - Tiles
- .19 3.4. Installation - Tolerances
- .20 3.5. Field Quality Control
- .21 3.6. Adjusting and Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Acoustical tile ceiling systems.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination
  - 1.4.1.1. Cooperate with mechanical and electrical Subcontractors.
  - 1.4.1.2. Coordinate layout and installation of acoustic ceiling units and suspension systems components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, partition system, fire suppression system components and other work required to be incorporated in or coordinated with the ceiling system.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Submit manufacturer's standard details.
  - 1.5.3.2. Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, and acoustical unit support at ceiling fixture.
  - 1.5.3.3. Submit reflected ceiling plans for special grid patterns as indicated.
- 1.5.4. Samples:
  - 1.5.4.1. Submit sample of each component of ceiling system. Samples shall fully represent materials to be supplied in colour, texture, finish and construction.

- 1.5.4.2. Submit samples, load test data and design tables for each type of insert to be used in the Work for hanger supports.
- 1.5.5. Certificates:
  - 1.5.5.1. Submit certificate of compliance stating that the suspension system provided, including materials and installation, comply with the requirements of the *Contract Documents*.

#### **1.6. CLOSEOUT SUBMITTALS:**

- 1.6.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.6.2. Maintenance data:
  - 1.6.2.1. Submit maintenance and cleaning instructions for acoustical ceiling systems for incorporation into the maintenance manuals.
- 1.6.3. Maintenance materials:
  - 1.6.3.1. Deliver for maintenance use, 2% of each type and colour of suspension components and acoustical tiles used in the Work.
  - 1.6.3.2. Pack panels in suitable containers, clearly dated and identified as to type and location of installation in the *Work*, and store where directed by the *Owner*.

#### **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:
  - 1.7.1.1. Installers / applicators / erectors:
    - (1) Provide work of this section, executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers.
- 1.7.2. Mock-ups:
  - 1.7.2.1. Construct in locations acceptable to the *Consultant* a typical sample ceiling installation 10 m2 in area, complete with perimeter wall trim, and cut tegular tile demonstrating rectified edge. Modify sample as required to obtain approval. Upon acceptance retain sample as standard of quality for acoustical ceiling.
  - 1.7.2.2. Do not begin fabrication and erection of remainder of ceiling system until sample installation has been reviewed and accepted. Accepted sample may become a part of the final *Work*, subject of approval of the *Consultant*.

#### **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Ship exposed members and mouldings in rigid crates to avoid damage. Bent or deformed material shall be rejected. Baked enamelled members shall be suitably wrapped and protected against damage.
- 1.8.2. Deliver acoustical ceiling units to the Place of the Work in original, unopened packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- 1.8.3. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- 1.8.4. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units.

#### **1.9. FIELD CONDITIONS**

- 1.9.1. Commence installation after building is enclosed with windows and exterior doors in place and glazed, and roof watertight.
- 1.9.2. Interior temperature of building to range from 15°C to 30°C and relative humidity of not more than 70% before and during installation. Maintain uniform temperatures for 72 hours prior to commencement of the work of this section and maintain temperature until completion of the work of this Section.

#### **1.10. WARRANTY**

- 1.10.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.10.2. Extended warranties:
  - 1.10.2.1. Labour, materials, and workmanship for work of this section.

1.10.2.2. Duration: 2 years.

## **2 PRODUCTS**

### **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Design suspension systems for a maximum mid-span deflection not exceeding L/360 in accordance with ASTM C635/C635M-17 deflection test.
- 2.1.2. Design suspension system to support safely, and without distortion, the superimposed loads of:
  - 2.1.2.1. Air supply diffusers and return grilles.
  - 2.1.2.2. Lighting fixtures.
- 2.1.3. Regulatory Requirements:
  - 2.1.3.1. Fire resistance rated system: Listed by accredited listing agency

### **2.2. GENERAL**

- 2.2.1. Single source responsibility:
  - 2.2.1.1. Obtain each type of acoustical ceiling unit and suspension system from a single source with resources to *Provide* products of consistent quality in appearance and physical properties without delaying progress of the *Work*.
  - 2.2.1.2. Products installed as part of the work of this section shall be from same production run.

### **2.3. ACOUSTICAL TILES**

- 2.3.1. ACT-01; Lay-in acoustical tiles:
  - 2.3.1.1. Classification: Type III, Form 2, Pattern C E in accordance with ASTM E1264-08e1.
  - 2.3.1.2. Size: to suit metal suspension system.
  - 2.3.1.3. NRC: 0.65.
  - 2.3.1.4. Material: wet formed mineral fibre.
  - 2.3.1.5. Surface texture: Smooth.
  - 2.3.1.6. Edge: Square.
  - 2.3.1.7. Colour: 1488 in White.
  - 2.3.1.8. Flame Spread: Class A Flame Spread 25 or under, to CAN/ULC S102.
  - 2.3.1.9. Acceptable Products:
    - (1) Canyon by Armstrong.

### **2.4. METAL SUSPENSION SYSTEMS**

- 2.4.1. Hanger anchorage devices: Screws, clips, bolts, concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 x calculated load supported except size direct pull-out concrete inserts for 5 x calculated loads.
- 2.4.2. Concrete hanger anchors; post installed: Steel eye bolts and nuts to suit ceiling hangers with capability to sustain, without failure, a load equal to 4 times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M-15, conducted by a qualified independent testing laboratory.
  - 2.4.2.1. ITW Ramset Dynabolt Sleeve Anchor 'TW-1614' or Readi-Tie-Drive 'TD4-112' tie wire anchor by ITW Construction Products Canada or equivalent.
  - 2.4.2.2. Kwik-Bolt II 'HCKB 1/4' tie wire anchor by Hilti Corporation or equivalent.
  - 2.4.2.3. Fasteners exposed to weather, condensation, and corrosion: Zinc-plated or stainless steel fasteners in applicable product lines specified in preceding paragraphs.
- 2.4.3. Hangers and tie wire: Galvanized wire, recommended by manufacturer of suspension system, minimum 2.66 mm (0.1") (12 gauge).
- 2.4.4. Suspension system accessories:

- 2.4.4.1. Splices, clips, and perimeter moulding, of manufacturer's standard type to suit the applicable conditions unless special conditions and access area are shown or specified in the *Contract Documents*.
- 2.4.4.2. Angle wall mouldings; hemmed with prefinished exposed flanges:
  - (1) For 24 mm (15/16") grid applications; angle moulding with exposed bottom flange of 22 mm (7/8").
    - (A) Armstrong World Industries '7803' or equivalent.
  - (2) CGC Inc. 'M7' or equivalent.
- 2.4.5. Standard suspension system, non fire-rated:
  - 2.4.5.1. Intermediate duty to ASTM C635/C635M-13a, 24 mm (15/16") interlocking tee system, designed to support acoustical panels in patterns indicated with deflection of main tees less than L/360, consisting of main tees and cross tees. The system shall *Provide* lock joint intersections of cross and main tees.
  - 2.4.5.2. Acceptable Products:
    - (1) Standard
      - (A) Armstrong World Industries 'Prelude XL 15/16" Exposed Tee Systems'.
      - (B) CGC Inc. 'DX'.
      - (C) Or equivalent.
    - (2) Wet area environment:
      - (A) Armstrong 'Prelude XL 15/16" Exposed Tee Systems for Exterior Applications'.

## **2.5. MISCELLANEOUS MATERIALS**

- 2.5.1. Acoustical sealant:
  - 2.5.1.1. Non-drying, non-hardening, non-skinning, non-staining, non- bleeding, gunnable sealant complying with requirements specified in Section 07 92 00.

## **2.6. METAL FINISH**

- 2.6.1. Metal exposed in finished work shall have a pre-coated baked enamel finish in non-yellowing colour. Submit paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies.
- 2.6.2. Colour:
  - 2.6.2.1. Flat white.

## **3 EXECUTION**

### **3.1. INSTALLATION - GENERAL**

- 3.1.1. Install ceiling panels and metal suspension system in accordance with manufacturer's directions. Where manufacturer's directions are at variance with the Contract Documents, notify the Consultant before proceeding with installation.
- 3.1.2. Do not commence installation until all work above suspended ceiling has been completed, inspected and accepted.

### **3.2. INSTALLATION - SUSPENSION SYSTEM**

- 3.2.1. Install suspension system rigid, secure, square, level and plumb, framed and erected to maintain dimensions and contours indicated, and in accordance with ASTM C636 / C636M - 19, Cisca installation standards and any other applicable national or local code requirements. Make allowance for thermal and structural movement.
- 3.2.2. Attach hangers to structure with inserts and hanger supports. Do not use powder activated fasteners.
- 3.2.3. Support hangers for suspended ceiling grid independent of walls, columns, pipes and ducts.
- 3.2.4. Space hangers for ceilings at maximum 1220 mm (48") on centre in both directions. Provide additional hangers as required to comply with manufacturer's written installation instructions.

- 3.2.5. Locate hangers at not more than 150 mm (6") from ends of main tee members.
- 3.2.6. Install exposed tee members to pattern indicated. Securely attach hangers to main tee members.
- 3.2.7. Exposed tees shall be as long as possible to minimize joints. Make joints square, tight, flush and reinforce with splines. Distribute joints to prevent clustering in one area.
- 3.2.8. Space tee bars to suit ceiling panels and as detailed, and to accommodate lighting fixtures, diffusers and return grilles.
- 3.2.9. Cooperate in the installation of ceiling systems, making adjustments where required to ensure that the lighting fixtures, supply diffusers, exhaust grilles and other built-in items properly fit into ceiling module and finish flush with rest of ceiling.
- 3.2.10. Restrict creep inside module panels so that in all cases strips are centred on module lines.
- 3.2.11. Install edge moulding as detailed where ceiling abuts vertical surfaces. Lap corners use maximum lengths to minimize joints. Make joints square, tight and flush.
  - 3.2.11.1. Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing mouldings.
  - 3.2.11.2. Screw attach mouldings to substrates at intervals not more than 400 mm (16") on centre and not more than 210 mm (8") from ends, levelling with suspension system. Lap corners accurately and connect securely.

### **3.3. INSTALLATION - TILES**

- 3.3.1. Take precautions during installation to ensure tile edges are not chipped or otherwise damaged.
- 3.3.2. Minimize field cutting. Rectify cut tile edges of tile to match factory cut edge profile and colour.
- 3.3.3. Install acoustical tiles to form horizontal and level ceiling with all parts flush and joints butted tightly to hairline appearance.
- 3.3.4. Distribute variations in colour and texture of panels to obtain a uniform appearance.

### **3.4. INSTALLATION - TOLERANCES**

- 3.4.1. Allowable tolerances: to ASTM C636 / C636M - 19.
- 3.4.2. Install suspension systems level to tolerance of 1:1200.
- 3.4.3. Install edge mouldings level to tolerance of 3 mm in 3660 mm (1/8" in 12'-0").

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.

### **3.6. ADJUSTING AND CLEANING**

- 3.6.1. Replace uneven, defective or damaged materials and finishes, eliminate waves, and remove soiled or stained areas.
- 3.6.2. Clean dirty and discoloured surfaces of acoustical units and suspension system according to manufacturer's recommendations.

**END OF SECTION**



## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Field Conditions
- .9 1.9. Warranty
- .10 2.1. Performance/Design Requirements
- .11 2.2. Materials
- .12 3.1. Installation
- .13 3.2. Field Quality Control
- .14 3.3. Adjusting And Cleaning
- .15 3.4. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Tactile attention indicators at locations indicated.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Conduct a pre-installation meeting in accordance with Section 01 31 19.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
  - 1.5.2.2. Product data sheets shall include material test reports from qualified independent testing laboratories, current within a 24 month period preceding date of installation, indicating that materials proposed for use in the Work are in compliance with the requirements of the Contract Documents, and meet the properties specified or indicated.
- 1.5.3. .3 Shop drawings:
  - 1.5.3.1. Submit shop drawings showing fabrication details, tile placement, and installation methods and materials.
- 1.5.4. .4 Samples:
  - 1.5.4.1. Submit full size sample of each type and colour of tactile warning surfacing specified or required for the Work.

### **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.6.2. Maintenance data:
  - 1.6.2.1. Submit manufacturer's maintenance instructions for inclusion in the operation and maintenance manuals.

### **1.7. QUALITY ASSURANCE**

- 1.7.1. Qualifications:

- 1.7.1.1. Installers: Shall have 3 years' experience, minimum, in application of Products, systems and assemblies specified, and with approval and training of Product manufacturers.

## **1.8. DELIVERY, STORAGE AND HANDLING**

- 1.8.1. Surface Applied Warning tiles shall be suitably packaged or crated to prevent Damage in shipment and handling.
- 1.8.2. Surface Applied Warning tiles shall be delivered to location at building site for storage prior to installation.

## **1.9. FIELD CONDITIONS**

- 1.9.1. Ambient conditions:
  - 1.9.1.1. Maintain minimum temperature of 5°C in spaces to receive tactile warning surfaces for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

## **1.10. WARRANTY**

- 1.10.1. Warrant work of this section in accordance with Section 01 78 36.

# **2 PRODUCTS**

## **2.1. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.1.1. Tactile warning surfacing, where required as a tactile attention indicator by the building code, shall conform to sentence (2) and Clauses 4.1.1 and 4.1.2 of ISO 23599, "Assistive Products for Blind and Vision-Impaired Persons – Tactile Walking Surface Indicators.

## **2.2. MATERIALS**

- 2.2.1. Tactile warning surfacing tiles:
  - 2.2.1.1. Vitrified polymer composite (VPC) tiles fabricated from an epoxy polymer composition employing aluminum oxide particles in the truncated domes, integral homogeneous colour throughout the tile, and with the following properties:
  - 2.2.1.2. Acceptable Product:
    - (1) 'Armor-Tile Tactile Systems 'Surface Applied Tiles'.
    - (2) Colour:
      - (A) To later selection by the Consultant from the manufacturer's full range.
  - 2.2.1.3. Substitutions: in accordance with Section 01 25 00.
- 2.2.2. Anchors:
  - 2.2.2.1. Colour matched to tiles with which they are being used, flat head, drive anchors, 6.4 mm (1/4") diameter x 38 mm (1-1/2") long, as recommended and supplied by tactile warning surfacing tile manufacturer for use with tiles being installed.
- 2.2.3. Adhesive:
  - 2.2.3.1. as recommended and supplied by tactile warning surfacing tile manufacturer for use with tiles being installed.
- 2.2.4. Perimeter sealant:
  - 2.2.4.1. as recommended and supplied by tactile warning surfacing tile manufacturer for use with tiles being installed.

# **3 EXECUTION**

## **3.1. INSTALLATION**

- 3.1.1. Install tactile warning surfacing in accordance with tactile warning surfacing manufacturer's requirements and recommendations, to locations indicated, scheduled, or required by authorities having jurisdiction.
  - 3.1.1.1. Anchors:

- (1) Colour matched to tiles with which they are being used, flat head, drive anchors, 1/4" diameter x 1-1/2" long, as recommended and supplied by tactile warning surfacing tile manufacturer for use with tiles being installed.
- 3.1.2. The application of all tiles, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by the manufacturer.
- 3.1.3. Contractor to ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Consultant
- 3.1.4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. A thin permanent marker works well. Remove tile when done marking its location.
- 3.1.5. The surface to receive the Surface Applied Warning tile is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a clean rag soaked in Acetone ensuring all dust and debris are removed.
- 3.1.6. Immediately prior to installing the Surface Applied Warning tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for a minimum of 30 days.
- 3.1.7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
- 3.1.8. Apply TBS to the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the rescribed areas to have full coverage across the 2" width of the adhesive locator and shall be applied to within 1/4" continuously around the perimeter edge of the tile. The entire tube of adhesive shall be applied to the back of each tile, sizes 24 x 36 in. and greater.
- 3.1.9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
- 3.1.10. Working from the center of the tile outwards, proceed to drill and install all fasteners in the tile's molded recesses.
- 3.1.11. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3 1/2" using a 1/4" masonry drill bit. Drill through the tile without hammer option (on the drill) until the tile has been successfully penetrated, then with hammer option (on the drill) to drill into the concrete. Maintaining foot pressure on both sides of the hole while drilling prevents concrete dust from accumulating between the tile and concrete which can affect the tile being installed flush and may compromise installation integrity.
- 3.1.12. Immediately after drilling each hole, before moving on to the next, and while still applying foot pressure, mechanically fasten tiles to the concrete substrate using a leather bound or hard plastic mallet to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the mallet, taking care to avoid any inadvertent blows to the truncated dome or tile surface.
- 3.1.13. Following the installation of the fasteners, the concrete dust should be vacuumed, brushed or blown away from the tile's surface and adjacent concrete. Using Acetone on a rag, wipe the concrete around the tile's perimeter to ensure a clean, dry surface to receive perimeter sealant.

### **3.2. FIELD QUALITY CONTROL**

- 3.2.1. Conduct quality control in accordance with Section 01 45 00.

### **3.3. ADJUSTING AND CLEANING**

- 3.3.1. Clean tiles by method recommended by tile manufacturer not less than 4 days prior to inspection for Substantial Performance of the Work.

**3.4. PROTECTION**

- 3.4.1. Protect tiles and installation against damage during construction period in accordance with the tile manufacturer's requirements and recommendations.
- 3.4.2. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood in accordance with tile manufacturer's requirements and recommendations.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .1 1.2. Section Includes
- .2 1.3. Summary
- .3 1.4. Submittals
- .4 1.5. Closeout Submittals
- .5 1.6. Quality Assurance
- .6 1.7. Field Conditions
- .7 1.8. Warranty
- .8 2.1. General
- .9 2.2. Manufacturers
- .10 2.3. Resilient Base
- .11 2.4. Accessories
- .12 3.1. Examination
- .13 3.2. Preparation
- .14 3.3. Installation Of Resilient Base
- .15 3.4. Installation Tolerances
- .16 3.5. Field Quality Control
- .17 3.6. Adjusting And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Resilient base
  - 1.3.1.2. Resilient floor transition trims.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.4.3. Samples:
  - 1.4.3.1. Samples for verification: Submit 3 samples of the following:
    - (1) 305 mm (12") long samples of each colour and type of base material. Include sample of outside corner of base.
    - (2) 100 mm (4") long samples of each colour and type of floor transition trims.
- 1.4.4. Test and evaluation reports:
  - 1.4.4.1. Submit moisture, alkalinity test results.
- 1.4.5. Manufacturer's instructions:
  - 1.4.5.1. Submit manufacturer's installation instructions for Products proposed for use in the work of this section

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- 1.5.3. Maintenance materials:
  - 1.5.3.1. Provide minimum 2% of each colour, pattern and type of resilient base required for this project.

- 1.5.3.2. Maintenance materials to be same production run as installed materials.
- 1.5.3.3. Suitably package for protection and storage, each identified with name of manufacturer and material.
- 1.5.3.4. Tag and store where directed by Owner.

## **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. Installers / applicators / erectors:
    - (1) Provide work of this section, executed by competent installers with minimum 5 years experience in application of Products, systems and assemblies specified and with approval and training of *Product* manufacturers.
  - 1.6.1.2. Products installed as part of the work of this section shall be from same production run.
- 1.6.2. Mock-up:
  - 1.6.2.1. Resilient base mock-up shall include at least one inside corner, one outside corner plus 20 m (65'-0") of straight run.
  - 1.6.2.2. Locate at the Place of the Work as part of final installation.
  - 1.6.2.3. Location of installation shall be determined by Consultant.

## **1.7. FIELD CONDITIONS**

- 1.7.1. Temperature of room and materials shall be at least 18°C and 21°C for 48 hours before, during and 7 days after the installation of resilient accessories.
- 1.7.2. Applications exposed to intense or direct sunlight, protect Products during the conditioning, installation, and adhesive curing periods, by covering the light source.
- 1.7.3. Allow coiled wall base to lay flat for at least 24 hours at 18°C prior to installation, and maintain this temperature during installation.

## **1.8. WARRANTY**

- 1.8.1. Warrant work of this section in accordance with Section 01 78 36.
- 1.8.2. Extended warranty:
  - 1.8.2.1. Labour, materials, and workmanship for work of this section.
  - 1.8.2.2. Duration: 5 years

## **2 PRODUCTS**

### **2.1. GENERAL**

- 2.1.1. Single source responsibility:
  - 2.1.1.1. Obtain each type of resilient Product from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
  - 2.1.1.2. Products installed as part of the work of this section shall be from same production run

### **2.2. MANUFACTURERS**

- 2.2.1. Johnsonite.
- 2.2.2. Substitutions: in accordance with Section 01 25 00.

### **2.3. RESILIENT BASE**

- 2.3.1. Resilient base types:
  - 2.3.1.1. Manufactured from thermoplastic rubber formulation meeting ASTM F1861-16, Type TP, Group 1 (Solid).
  - 2.3.1.2. Acceptable Products: Refer to Materials and Finish Schedule.
  - 2.3.1.3. Height: 4" (100 mm).
  - 2.3.1.4. Thickness: 3.17mm (1/8") tapered wedge thickness
  - 2.3.1.5. Corners: Preformed

## **2.4. ACCESSORIES**

- 2.4.1. Block wall filler:
  - 2.4.1.1. Latex filler, "Planicrete AC" by Mapei Canada Ltd., "43 Thin-Set Mortar Additive and 53 Floor Mix" by Flextile Ltd. or waterproof filler recommended by flooring manufacturer.
- 2.4.2. Concrete patching and leveling compound:
  - 2.4.2.1. Trowel applied Portland cement based, moisture, mildew, and alkali-resistant.
  - 2.4.2.2. Minimum compressive strength after 28 days shall be minimum 3,500 psi when tested in accordance with ASTM C109/C109M-21.
  - 2.4.2.3. Gypsum based compounds are not acceptable.
  - 2.4.2.4. Acceptable manufacturers:
    - (1) Ardex.
    - (2) Mapei.
    - (3) Substitutions: in accordance with Section 01 25 00.
  - 2.4.2.5. Acceptable Product: type as recommended by resilient product manufacturer for substrate conditions.
- 2.4.3. Resilient leveller strip and level strip extension system: LS Series, as manufactured by Johnsonite, sized to suit condition.
- 2.4.4. Adhesive: Types as recommended by manufacturer to suit substrate types and compatible with materials.
  - 2.4.4.1. Porous wall surfaces: Johnsonite #960 Wall Base adhesive
  - 2.4.4.2. Non-porous wall surfaces (i.e.: metal, epoxy paint, ceramics): Johnsonite #945 Contact Bond adhesive.
- 2.4.5. Sealant:
  - 2.4.5.1. Medium-modulus, neutral-curing silicone sealant; complying with ASTM C920-14, Type S, Grade NS.
  - 2.4.5.2. Colour: Clear.
  - 2.4.5.3. Acceptable Manufacturers:
    - (1) Dowsil.
    - (2) Momentive.
    - (3) Tremco.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Verify that field conditions have been provided as requested and specified.
- 3.1.2. Substrates shall be firm, structurally sound, sufficiently porous, and dry.
- 3.1.3. Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.
- 3.1.4. Examine substrates in advance of application of products to ensure that substrates are protected against entry of water and moisture.
- 3.1.5. Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- 3.1.6. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the substrate. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.
- 3.1.7. Defective work resulting from application to unsatisfactory surfaces will be considered the responsibility of those performing the work of this section

### **3.2. PREPARATION**

- 3.2.1. Substrates shall be free of deleterious material that may inhibit bond strength or act as a bond breaker. Remove such contaminants and deleterious material using mechanical methods recommended by manufacturer. Do not use chemical abatement methods.
- 3.2.2. Fill gaps, voids, and cracks, and remove ridges, or other defects which will ghost or telegraph through finished product installation.

- 3.2.3. Expansion joints, isolation joints, and other movement joints in substrates shall not be filled with patching or levelling compound.
- 3.2.4. Sweep and vacuum clean substrates minimum 24 hours prior to alkalinity, moisture, and adhesion testing. Do not use sweeping compounds.
- 3.2.5. Notify Consultant of any substrate or levelling compound defects or installation conditions that may result in unsatisfactory performance.
- 3.2.6. Alkalinity, moisture, and adhesion bond testing:
  - 3.2.6.1. Perform moisture and alkalinity tests and adhesive bond test.
  - 3.2.6.2. Proceed with installation only after substrates pass testing. Document tests performed and submit in writing to Consultant.
- 3.2.7. Do not install products until they are same temperature as space where they are to be installed.
- 3.2.8. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. Do not use sweeping compounds.
- 3.2.9. Where flooring adjoins thicker floor materials, apply levelling screed, feather out to make up difference in level between materials
- 3.2.10. Spray paints, permanent markers and other indelible ink markers shall not be used to write on the back of the resilient material or used to mark the substrate as they could bleed through and permanently stain the resilient material. If such contaminants are present on the substrate they shall be mechanically removed prior to the installation of the resilient material.

### **3.3. INSTALLATION OF RESILIENT BASE**

- 3.3.1. Spread adhesive to ribbed surface (back) of wall base with a 3 mm (1/8") square-notched trowel; allow slight set-up, then bring base into contact with substrate. Ensure full adhesion of base to substrate. Adhesive should cover 80% of back surface. Leave a 6 mm (1/4") uncovered space at the top of the wall base to prevent the adhesive from oozing onto the wall above the base when installed.
- 3.3.2. Position wall base on wall surface and roll with hand roller. Always roll back to starting point to prevent stretching the wall base.
- 3.3.3. Set base to ensure installation over finished flooring material is free of gaps.
- 3.3.4. Install base in longest lengths possible, minimum 2440 mm (8'). Adhere toe of base to substrate, and ensure edge of toe is straight.
- 3.3.5. Scribe and fit to door frames and other obstructions.
- 3.3.6. Joints shall be tightly fitted, straight and vertical, and not less than 610 mm (24") from corners.
- 3.3.7. Provide joints in base over substrate control joints.
- 3.3.8. Field-made inside corners:
  - 3.3.8.1. Install wall base to terminate into the corner with a mitre cut.
  - 3.3.8.2. Position another piece of wall base on opposing wall, without adhesive, approximately 25 mm (1") from the installed piece.
  - 3.3.8.3. Utilizing the dividers, place the hooked end at the top of the installed piece and the pointer end on the top of the uninstalled piece. Carefully, move the dividers downward in a straight vertical motion, allowing the hooked end of the dividers to follow the profile of the installed piece. At the same time, place adequate pressure on the pointer end to transfer and/or scribe the profile onto the surface of the uninstalled piece.
  - 3.3.8.4. Use a utility knife to cut the pattern on the uninstalled wall base, apply adhesive, and position the trimmed section into place.
- 3.3.9. Field-made outside corners:
  - 3.3.9.1. Install wall base to terminate into the corner with a mitre cut.
  - 3.3.9.2. Stop application of adhesive to wall base approximately 450 mm (18") from the outside corner of the wall.
  - 3.3.9.3. Position the wall base at the corner and pencil line the back of the wall base where the bend is desired.



- 3.3.9.4. Lay the wall base on the floor with the back up. Utilizing a top-set or pull-type gouge tool, make a shallow notch along the pencil line.
- 3.3.9.5. Notch depth should not exceed one-quarter the total thickness of the wall base.
- 3.3.9.6. Reposition the wall base corner on the wall. The corner of the wall should fit snugly into the notched recess on the back of the wall base.
- 3.3.9.7. Apply adhesive and roll firmly into place.

### **3.4. INSTALLATION TOLERANCES**

- 3.4.1. Install straight and level to variation of 3 mm (1/8") over 3 m (10'-0").

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.
  - 3.5.1.1. Field tests and inspections:
    - (1) Moisture and alkalinity:
      - (A) Test for moisture and alkalinity in accordance with product manufacturer's written requirements.
    - (2) Adhesion bond test:
      - (A) Proceed with bond test after substrates have been prepared and alkalinity and moisture test have been completed.

### **3.6. ADJUSTING AND CLEANING**

- 3.6.1. Remove adhesive from surfaces as work progresses in manner described by manufacturer. Remove wet adhesive with a water dampened cloth. If adhesive has dried, use a cloth dampened with mineral spirits.
- 3.6.2. Wash surfaces using non-phosphate detergent to remove silicone, wax, dirt and dust using rotary scrubbing machines fitted with nylon brushes. Wash with neutral mild detergent and water, thoroughly buff dry with smooth wool pad. Do not apply any other compounds.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Closeout Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage And Handling
- .8 1.8. Site Conditions
- .9 1.9. Warranty
- .10 2.1. Manufacturer
- .11 2.2. Products
- .12 2.3. Wall Base
- .13 3.1. Examination
- .14 3.2. Preparation
- .15 3.3. Installation Of Tile Flooring
- .16 3.4. Base Application
- .17 3.5. Field Quality Control
- .18 3.6. Adjusting And Cleaning
- .19 3.7. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:  
1.3.1.1. All provisions for labour, products, equipment and services necessary for athletic flooring work in accordance with Contract Documents.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:  
1.4.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.4.3. Samples:  
1.4.3.1. Submit samples of each pattern and colour of rubber tile flooring proposed for use in the *Work*.

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:  
1.5.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- 1.5.3. Maintenance materials:  
1.5.3.1. Deliver 2% of each colour, pattern and type of flooring material required for this project for maintenance use. Store where directed. Clearly identify each box.  
1.5.3.2. Maintenance materials to be same production run as installed materials.

### **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:  
1.6.1.1. Installers / applicators / erectors: *Provide* work of this section, executed by competent installers with minimum 5 years experience in application of

Products, systems and assemblies specified and with approval and training of *Product* manufacturers.

- 1.6.2. Mock-up:
  - 1.6.2.1. Prior to commencing flooring installation for this section, prepare full room mock-up (room size at least 10 m<sup>2</sup> (100 ft<sup>2</sup>) in area) for acceptance by the Consultant.
  - 1.6.2.2. Do not proceed flooring specified in this section until mock-up has been accepted by *Contractor* and *Consultant*.

## **1.7. DELIVERY, STORAGE AND HANDLING**

- 1.7.1. Products Supplied must be delivered in Manufacturer's original, unopened and undamaged packaging with identification labels intact.
- 1.7.2. Products Supplied must be protected from exposure to harmful weather conditions and must be safely stored on a clean, dry, flat surface. Store rolls of resilient athletic flooring upright; store tiles of resilient athletic flooring on a flat surface, carefully protecting corners and edges.
- 1.7.3. Climate controlled storage is recommended. Storage temperature must not be below 4°C and must not exceed 38°C. Materials must be delivered to site a minimum of 24 hours before work is scheduled to begin so that they may acclimate.
- 1.7.4. Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.
- 1.7.5. Products Supplied need not suffer damage during delivery, storage and handling (i.e. dents/scratches, excessive compression or warping, chipped edges, etc.).

## **1.8. SITE CONDITIONS**

- 1.8.1. Install materials of this section only when surfaces and air temperatures have been maintained between 18°C and 24°C for 48 hours preceding installation and will be so maintained during installation and for 48 hours thereafter. Maintain a minimum temperature of 13°C after above period.
- 1.8.2. Ensure that adequate ventilation is provided during installation and curing of materials of this section.
- 1.8.3. Concrete floors are to be dry, and exhibit negative alkalinity, carbonization, or dusting, and be free of curing/sealing compounds, residue from paint and adhesives.
- 1.8.4. Conduct the tests in accordance with ASTM F710-11 and the following:
  - 1.8.4.1. Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written flooring installation instructions. Results must not exceed 170 µg/m<sup>2</sup> (3 lb per 1,000 ft<sup>2</sup>) in 24 hours when tested to ASTM F1869-11 or exceed 75% when tested to ASTM F2170-11.
  - 1.8.4.2. Test for surface pH. Levels of pH shall not exceed the written recommendations of the flooring manufacturer and adhesive manufacturer. Test in accordance with ASTM F710-11.
  - 1.8.4.3. For each test type: Conduct 3 tests for flooring applications up to 93 m<sup>2</sup> (1000 ft<sup>2</sup>) in area, and 1 additional test for each additional 93 m<sup>2</sup> (1000 ft<sup>2</sup>) of flooring area.
  - 1.8.4.4. Testing shall be completed prior to application of water vapour reduction system, if applicable, and after application of water vapour reduction system in accordance with floor finish specifications.
- 1.8.5. In areas that are exposed to intense or direct sunlight, Products shall be protected during the conditioning, installation, and adhesive curing periods, by covering the light source.

## **1.9. WARRANTY**

- 1.9.1. Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

## **2 PRODUCTS**

### **2.1. MANUFACTURER**

- 2.1.1. Approved Manufacturer:
  - 2.1.1.1. Encore Athletic
    - (1) 715 Fountain Ave., Lancaster, PA 17601
    - (2) Telephone: (800) 322-1923
    - (3) Email: info@ecoreintl.com

### **2.2. PRODUCTS**

- 2.2.1. Performance UltraTile
  - 2.2.1.1. Size: 610mm x 610mm x 25mm
  - 2.2.1.2. Color: EL15A -Steel Appeal 2
- 2.2.2. Adhesive: Low VOC type as recommended by flooring manufacturer.
- 2.2.3. Sealant: Low VOC type, clear silicone, as manufactured by Tremco, Momenitive, or Dow Corning.
- 2.2.4. Water vapour reduction system:
  - 2.2.4.1. 100% solids epoxy one coat system, 0 VOC, suitable for application to 100% RH floors per ASTM F2170-11, designed to protect moisture sensitive adhered flooring systems from elevated moisture and alkalinity levels, warranted by manufacturer to cover subsequent flooring materials and labour, compatible with finish flooring products.
  - 2.2.4.2. ASTM E96/E96M-10 water vapour transmission (wet methods) performance shall be documented by independent testing laboratory at a minimum 97% for water vapour transmission reduction compared to untreated concrete.
  - 2.2.4.3. ASTM E96/E96M-10 perm rating shall not exceed a 0.10 Perm rating.
  - 2.2.4.4. ASTM D1308-02(2013) insensitivity to alkaline environment up to, and including, pH 14 in a 14-day bath test.
  - 2.2.4.5. Manufacturer certifies acceptance and exposure to continuous topical water exposure after final cure.
  - 2.2.4.6. Water vapour reduction system shall be a single coat, stand alone system with no requirements for additional components such as sand broadcast for adhesion of flooring systems.
  - 2.2.4.7. System shall reduce Calcium Chloride readings of up to 25lbs/1000 ft<sup>2</sup>/24 hrs by 97% in one coat. System must be able to perform as required with RH Probe readings of 100%.

### **2.3. WALL BASE**

- 2.3.1. Wall Base
  - 2.3.1.1. Height: 100mm high
  - 2.3.1.2. Thickness: 3mm
  - 2.3.1.3. Conforming to ASTM 1861, Type TV, Group 1
  - 2.3.1.4. Approved Product:
    - (1) Duracove Rubber Wall Base
    - (2) By: Johnsonite

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine substrate to ensure clean lines, correct level and freedom from cracks, ridges, dusting, scaling and carbonation.
- 3.1.2. Examine walls in advance of application of base to ensure that surfaces are protected against entry of water and moisture. Perform compatibility test with primer/adhesive and substrate.
- 3.1.3. Report conditions contrary to requirements preventing proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

- 3.1.4. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the substrate. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### **3.2. PREPARATION**

- 3.2.1. Comply with recommendations of ASTM F710-11.
- 3.2.2. Water vapour reduction system:
- 3.2.2.1. Where concrete substrate exhibits higher than permitted moisture and alkalinity levels, provide water vapour reduction system to protect moisture sensitive flooring system from elevated moisture and alkalinity levels.
- (1) Shot blast floors to a International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) #3 or #4 and clean surfaces with an industrial vacuum cleaner and remove residues from the substrate. Grinding is allowed only in areas not accessible by shot blasting. Remove defective materials, and foreign matter such as dust, adhesives, levelling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, and other deleterious substances. Repair cracks, expansion joints, control joints, and open surface honeycombs and fill in accordance with water vapour reduction system manufacturer's recommendations.
  - (2) Reinforcing fibres, if applicable, that are visible after shot blasting shall be removed and vacuumed leaving no fibres left on the concrete surfaces.
  - (3) Repair concrete prior to moisture vapour reduction system installation by using water vapour reduction system manufacturer's recommended bonding emulsion with approved concrete repair materials. Comply with requirements as listed in water vapour reduction system manufacturer's technical data information. Consult with vapour reduction manufacturer.
  - (4) Shot blast a small test area and review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, Provide feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation.
  - (5) Apply moisture vapour reduction system monolithically to manufacturer's recommended spreading rate in number of coats to achieve manufacturer's recommended thickness.
  - (6) Consult with vapour reduction manufacturer and comply with requirements as listed in water vapour reduction system manufacturer's technical data information.
  - (7) Review surface profile with the finished flooring applicator. As the water vapour reduction system is not a levelling material, provide feather finish or levelling material to "flatten" or level the water vapour reduction system treated concrete prior to the flooring installation. Flooring installation shall not show telegraphing of substrate. Flooring installation shall be homogenous free of substrate lines, pockets, bumps, and unevenness.
  - (8) Verify proper adhesion of flooring adhesives, coatings, and levelling compounds to the final vapour reduction coating system for acceptability.
  - (9) Do not proceed with finished flooring installation if moisture vapour transmission exceeds maximum permitted rates.
- 3.2.3. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- 3.2.4. Alkalinity and adhesion testing: Perform tests and proceed with installation only after substrates pass testing. Document tests performed and submit in writing to Consultant.
- 3.2.5. Fill cracks, holes, and depressions in substrates with trowel-applied levelling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

- 3.2.6. At door opening locations where finished flooring is adjacent to weather-stripping or automatic door bottoms Provide trowel-applied levelling compound to Provide full contact between finished flooring and weather-stripping or automatic door bottoms. Taper trowel-applied levelling compound to transition with adjacent flooring substrate to be Provide smooth and seamless transition at maximum slope of 3:1000 (height to distance) ratio.
- 3.2.7. Do not install floor coverings until they are same temperature as space where they are to be installed.
  - 3.2.7.1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- 3.2.8. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.
- 3.2.9. Remove chalking and dusting from concrete surfaces with wire brushes.
- 3.2.10. Where flooring adjoins thicker floor materials, apply epoxy levelling screed, feather out to make up difference in level between materials.

### **3.3. INSTALLATION OF TILE FLOORING**

- 3.3.1. Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- 3.3.2. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, and the like. Extend flooring into toe spaces, door recesses, closets, and similar openings.
- 3.3.3. Maintain continuity of colour and pattern.
- 3.3.4. Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.
- 3.3.5. Install flooring to entire area indicated or scheduled, including coverplates occurring within finished floor areas. Maintain overall continuity of colour and pattern with pieces of flooring installed on cover plates. Tightly butt edges to perimeter of floor around cover plates and to cover plates. Do not install flooring to floor drains occurring within finished floor areas.
- 3.3.6. Roll tile with a 45.36 kilogram (100-pound) 3-section roller prior to adhesive hardening. Refer to specific rolling instructions of the tile manufacturer. Telegraphing of adhesive marks not permitted. Perform second rolling 2 to 3 hours after first rolling.
- 3.3.7. Cut tile and fit neatly around fixed or excessively heavy objects.
- 3.3.8. Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.

### **3.4. BASE APPLICATION**

- 3.4.1. Lay out base to keep number of joints at minimum.
- 3.4.2. Prior to installation of base, fill cracks and irregularities with a filler recommended by base manufacturer.
- 3.4.3. Set base in adhesive using a 3kg hand roller, against wall and floor surfaces.
- 3.4.4. Install straight and level to variation of 1:1000.
- 3.4.5. Scribe and fit to door frames and other obstructions.
- 3.4.6. Cope internal corners.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.
- 3.5.2. Manufacturer's field review to be in accordance with Section 01 45 00.

### **3.6. ADJUSTING AND CLEANING**

- 3.6.1. Remove excess adhesive from surfaces of the sheet flooring and base as work progresses.
- 3.6.2. Wash surfaces using non-phosphate detergent to remove silicone, wax, dirt and dust using rotary scrubbing machines fitted with nylon brushes. Wash with neutral mild

detergent (pH of 7 - 8) and water, thoroughly buff dry with smooth wool pad. Do not apply any other compounds.

- 3.6.3. Thoroughly clean surfaces in accordance with manufacturer's recommendations.

### **3.7. PROTECTION**

- 3.7.1. Protect new floors from time of final set of adhesives until final inspection. Install suitable protection sheeting, lap joints of material by 150 mm (6") and seal with non-asphaltic tape.
- 3.7.2. Prohibit traffic on floor for 48 hours after installation. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- 3.7.3. Install floor protection in areas where other work, repairs and installation of equipment, and foot traffic will occur.
- 3.7.4. Protect exposed edges of flooring, where finished and unfinished areas adjoining, by means of a transition strip butting to and flush with the finished surface of the flooring covering material and securely adhered to the substrate material.
- 3.7.5. Install transition strips where flooring terminates. Set flush with adjacent floor finishes.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Section Includes
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Site Conditions
- .7 1.7. Delivery, Storage, And Handling
- .8 2.1. General
- .9 2.2. Material
- .10 3.1. Examination
- .11 3.2. Preparation
- .12 3.3. Application
- .13 3.4. Site Tolerances
- .14 3.5. Repair
- .15 3.6. Cleaning
- .16 3.7. Protection

### **1.3. SECTION INCLUDES**

- 1.3.1. Labour, Products, equipment and services necessary for epoxy flooring work in accordance with the Contract Drawings.

### **1.4. SUBMITTALS**

- 1.4.1. Product data: Submit manufacturer's Product data in accordance with Section 01 33 00 indicating:
- 1.4.1.1. Two copies of manufacturer's Product data on characteristics, performance criteria, and limitations.
  - 1.4.1.2. Preparation, installation requirements and techniques, Product storage, and handling criteria.
- 1.4.2. Samples: Submit duplicate samples of each type and colour of epoxy flooring mounted on 10" x 8" hardboard in accordance with Section 01 33 00.
- 1.4.3. Reports: Submit manufacturer's acceptance of substrate prior to installation in writing. Submit verification of moisture content of floor prior to installation.
- 1.4.4. Close-out submittals: Submit maintenance data for incorporation into Operations and Maintenance manuals in accordance with Section 01 77 00.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Perform work of this Section by a company that has a minimum of five years proven experience in installations of a similar size and nature and that is approved by manufacturer. Submit to Consultant, applicator's current certificate of approval by the material manufacturer as proof of compliance.
- 1.5.2. Mock-up:
- 1.5.2.1. Construct one 32 ft<sup>2</sup> mock-up of each type and colour of epoxy flooring in location acceptable to Consultant.
  - 1.5.2.2. Arrange for Consultant's review and acceptance, allow 48 Hours after acceptance before proceeding with work.
  - 1.5.2.3. Mock-up may remain as part of Work if accepted by Consultant. Remove and dispose of mock-ups which do not form part of Work.
  - 1.5.2.4. Upon acceptance, mock-up shall serve as a minimum standard of quality for the balance of the work of this Section.



- 1.5.3. Pre-installation meetings: Arrange with manufacturer's representative and Consultant to inspect substrates, and to review installation procedures 48 hours in advance of installation.

## **1.6. SITE CONDITIONS**

- 1.6.1. Do not install the work of this Section outside of the following environmental ranges without product manufacturer's written acceptance:
  - 1.6.1.1. Ambient air and surface temperature: 15°C to 30°C.
  - 1.6.1.2. Relative Humidity: In accordance with manufacturers' requirements.
  - 1.6.1.3. When no dust is being raised.
  - 1.6.1.4. In well-ventilated and broom clean areas.
- 1.6.2. Do not apply epoxy flooring over materials that contain over 4% moisture.
- 1.6.3. Install temporary protection and facilities to maintain the Product manufacturer's, and the above specification, environmental requirements for 24 hours before, during, and 24 h after installation.
- 1.6.4. Post do not enter and appropriate warning signs at conspicuous locations.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Package, seal and label each epoxy flooring material to show manufacturer's and product name, and colour.
- 1.7.2. Store materials at site in an area specifically set aside for purpose that is locked, ventilated, and maintained at a minimum temperature of 60.8°F.
- 1.7.3. Ensure that health and fire regulations are complied with in storage area, and during handling and application.

## **2 PRODUCTS**

### **2.1. GENERAL**

- 2.1.1. All materials under work of this Section, including but not limited to, primers and epoxy flooring are to have low VOC content limits.
- 2.1.2. Each material used in the application of each flooring system shall be as recommended or manufactured by the supplier of the flooring system.

### **2.2. MATERIAL**

- 2.2.1. Epoxy Flooring: Trowelled system, silica sand filled 100% epoxy binder, minimum 6 mm thick, with one coat of 100% solids chemical free resistant epoxy topcoat.
  - 2.2.1.1. Acceptable Products:
    - (1) 'Sikafloor Morritex Trowel System' by Sika Canada Inc
    - (2) 'MasterTop 1245CLAD' by Master Builders Solutions
    - (3) 'Stonshield SLT' by Stonhard
    - (4) Or Equivalent
- 2.2.2. Colours and finishes from manufacturer's full colour range; or. or equivalent.
- 2.2.3. Refer to schedule on drawings for colors and finishes.
- 2.2.4. Primer: As recommended by manufacturer.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Verify condition of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of work of this Section means acceptance of existing conditions.
- 3.1.2. Verify that concrete floor has cured 28 days minimum and that substrate is acceptable to epoxy manufacturer.
- 3.1.3. Test surfaces for moisture content to ensure that they are suitable for application.

### **3.2. PREPARATION**

- 3.2.1. Surfaces
  - 3.2.1.1. Concrete and Masonry:

- (1) All masonry surfaces must be allowed to cure a minimum of 30 days before painting. Acid etch or abrasive blast all slick, glazed concrete or concrete with laitance. For acid etching, follow all manufacturer's directions and safety instructions. Rinse thoroughly and allow to dry. Prime concrete with one coat of Solid Epoxy Pre-Primer or Moisture Tolerant Fast Set Epoxy Sealer.
  - 3.2.1.2. Steel and ferrous metal:
    - (1) Complete a commercial blast cleaning in accordance with SSPC-SP 6. The steel profile after the blast should be 1-2 mils and be jagged in nature. Surfaces must be free of grit dust. The coating should be applied as soon as possible after the blast in order to prevent flash rusting or surface contamination. Hand tool cleaning (SSPCSP 2) or power tool cleaning (SSPC-SP 3) can be used if blasting is not possible..
  - 3.2.1.3. Galvanized and Non-Ferrous Metals:
    - (1) Solvent clean all surfaces SSPC-SP-1. Apply one coat of Acrylic Metal Primer or Waterborne Bonding Primer.
  - 3.2.1.4. Drywall:
    - (1) Insure drywall is dust & chalk free. Prime with an acrylic drywall primer.
- 3.2.2. Prepare substrate using steel aggregate blast method and vacuum substrate free of debris and dust.
- 3.2.3. Fill minor cracks and voids and prime surfaces in accordance with manufacturer's recommendations.
- 3.2.4. Protect adjacent surfaces from damage resulting from this work. Mask and/or cover adjacent surfaces, fixtures, and equipment as necessary.
- 3.2.5. Fill open control joints, and other cracks and voids with material compatible with epoxy materials.
- 3.2.6. Clean prime and seal surfaces as recommended by epoxy manufacturer.

### **3.3. APPLICATION**

- 3.3.1. Apply epoxy flooring in accordance with manufacturer's printed instructions. Epoxy manufacturer shall supervise application.
- 3.3.2. General:
  - 3.3.2.1. Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated, uninterrupted except at expansion joints or other types of joints (if any), indicated or required.
    - (1) Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coloured, quartz aggregate shall be broadcast into the wet primer until refusal. Excess aggregate shall be removed following appropriate cure time. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.
    - (2) Apply cove base material immediately after mixing using preformed cove trowels to a height of 100 mm where indicated on the room finish schedule in accordance with manufacturer's recommended procedures. Cove base shall be finished smooth and free of all possible waves, undulations, and other surface defects. Minor imperfections shall be mechanically removed prior to application of topcoat.
    - (3) Apply undercoat material immediately after mixing using squeegees or premium nap rollers in accordance with manufacturer's recommended procedures. Coloured, quartz aggregate shall be broadcast into the wet undercoat until refusal. Excess aggregate shall be removed following appropriate cure time. Strict adherence to manufacturer's coverage rates shall be maintained.
    - (4) Topcoat material shall be applied in one coat at 6-8 mils per coat immediately after mixing using high quality medium nap rollers in

accordance with manufacturer's recommended procedures. Strict adherence to manufacturer's coverage rates shall be maintained.

- (5) Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.
- 3.3.3. Stop epoxy in a straight line on each side of control joints; fill space over expansion joint with a self-levelling, non-sag polyurethane sealant.
- 3.3.4. Apply epoxy with care to ensure that no laps, voids, or other marks or irregularities are visible, and with an appearance of uniform colour, sheen and texture, all within limitations of materials and areas concerned.
- 3.3.5. Match colours and textures of approved samples.
- 3.3.6. Make clean true junctions with no visible overlap between adjoining applications of epoxy.
- 3.3.7. Chase edge of adjacent floor systems so that epoxy finishes flush with adjacent floor systems.
- 3.3.8. Provide 4" coved base at room perimeter and at built-in fitment locations. Form cove with 1" radius.

### **3.4. SITE TOLERANCES**

- 3.4.1. Finish surfaces shall be level, or straight where sloped to drains, within a tolerance of 1.5mm in 3m, and shall not vary more than 0.8mm in any running 300mm.

### **3.5. REPAIR**

- 3.5.1. Touch-up and refinish minor defective work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

### **3.6. CLEANING**

- 3.6.1. Remove promptly as work progresses spilled or spattered materials from surfaces of work performed under other Sections. Clean floors on completion of work. Do not mar surfaces while removing.
- 3.6.2. Leave storage and mixing areas in same condition as equivalent spaces in project.

### **3.7. PROTECTION**

- 3.7.1. Erect barriers to prevent the entry and presence of personnel not performing work of this Section during application of epoxy flooring, and for 48 hours following completion of application.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Paintable And Non-Paintable Surfaces
- .5 1.5. Administrative Requirements
- .6 1.6. Submittals
- .7 1.7. Closeout Submittals
- .8 1.8. Quality Assurance
- .9 1.9. Delivery, Storage, And Handling
- .10 1.10 Field Conditions
- .11 1.11. Waste Management And Disposal
- .12 1.12. Warranty
- .13 2.1. Regulatory Requirements
- .14 2.2. Performance/Design Requirements
- .15 2.3. Materials
- .16 2.4. Equipment
- .17 2.5. Mixing And Tinting
- .18 2.6. Colours And Gloss Levels
- .19 3.1. Examination
- .20 3.2. Preparation
- .21 3.3. Application - Primers
- .22 3.4. Installation
- .23 3.5. Mechanical And Electrical Items
- .24 3.6. Field Quality Control
- .25 3.7. Patching
- .26 3.8. Exterior Paint Systems
- .27 3.9. Interior Paint Systems
- .28 3.10. Adjusting And Cleaning
- .29 3.11. Schedules
- .30 3.12. Schedule – Colours

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Painting of exterior paintable surfaces.
  - 1.3.1.2. Painting of interior paintable surfaces.

### **1.4. PAINTABLE AND NON-PAINTABLE SURFACES**

- 1.4.1. Paint and finish paintable surfaces included in the Work, except where excluded by the Contract Documents.
- 1.4.2. The following surfaces are considered non-paintable, except as otherwise indicated or scheduled:
  - 1.4.2.1. Material and equipment furnished prime and finish painted.
  - 1.4.2.2. Internal surfaces of steel tanks and stacks.
  - 1.4.2.3. Sprayed fire-resistive materials.
  - 1.4.2.4. Exterior concrete including building walls, building floors and pavements, except as otherwise scheduled.
  - 1.4.2.5. Stainless steel, weathering steel, copper, bronze, chromium plate, nickel, anodized or lacquered or mill finished aluminum, Monel metal.

- 1.4.2.6. Exposed insulation, glass, plastic, brick, stone, resilient floors, treads and bases, tile and hardware;
- 1.4.2.7. Metallic and mastic insulation finishes.
- 1.4.2.8. Abrasive material finishes on floors, stair treads, stair nosing and landings.
- 1.4.2.9. Insulated electric cables.
- 1.4.2.10. Machined parts of machinery and equipment.
- 1.4.2.11. Concealed surfaces.
- 1.4.2.12. Manufactured finish materials.
- 1.4.2.13. Prefinished metals, unless required to be colour coded.

## **1.5. ADMINISTRATIVE REQUIREMENTS**

- 1.5.1. Conduct a pre-installation meeting in accordance with Section 01 31 19.
- 1.5.2. Coordinate with other Work having a direct bearing on Work of this section.
- 1.5.3. Scheduling:
  - 1.5.3.1. Schedule painting operations to prevent disruption of and by other trades.

## **1.6. SUBMITTALS**

- 1.6.1. Submit required submittals in accordance with Section 01 33 00.
- 1.6.2. Product data and list of Products:
  - 1.6.2.1. Submit manufacturer's Product data sheets and list of Products proposed for use in the work of this section as identified in 'Approved Product List' section of the MPI Architectural Painting Specification Manual. Correlate Products to Schedule furnished by Consultant.
  - 1.6.2.2. At least 60 Days before the work of this section commences, submit name of paint manufacturer whose Products are proposed for use in the Work along with a complete list of Products intended for use in Work, prepared by paint manufacturer. Indicate manufacturer's official certification that Products listed thereon are the top quality made by the company unless otherwise indicated herein.
  - 1.6.2.3. List shall indicate name of paint manufacturer, the catalogue number, grade, and quality of the Products proposed for use, and be correlated to the schedule furnished by the Consultant.
  - 1.6.2.4. List shall be accompanied by manufacturer's Product data sheets for each Product listed.
  - 1.6.2.5. Products delivered to the *Place of the Work* shall conform to the reviewed list of Products.
- 1.6.3. Samples:
  - 1.6.3.1. Submit samples of various finishes for the *Consultant's* approval, at least 30 Days before materials are required.
  - 1.6.3.2. Sample surfaces:
    - (1) Use 50 mm (2") concrete block for finishes over concrete or concrete masonry surfaces.
    - (2) Use 3.2 mm (1/8") thick plate steel for finishes over metal surfaces.
    - (3) Use 12.7 mm (1/2") thick birch plywood for finishes over wood surfaces.
    - (4) Use 12.7 mm (1/2") gypsum board for finishes over gypsum board and other smooth surfaces.
  - 1.6.3.3. Where possible identify each sample as to project, finish, formula, colour name, number, sheen name and gloss values, date and name of the *Contractor* and painting *Subcontractor*.
  - 1.6.3.4. Resubmit as required until colours and gloss value are approved.
- 1.6.4. Colours:
  - 1.6.4.1. Prior to beginning painting work, *Contractor* will be furnished with paint colour numbers and copies of colour schedule for surfaces to be painted. Colours will be selected by the *Consultant*.
- 1.6.5. Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual):

- 1.6.5.1. Submit 1 copy of MPI Manual – latest edition and maintain at site office for reference.

## **1.7. CLOSEOUT SUBMITTALS**

- 1.7.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.7.2. Operation and maintenance data:
  - 1.7.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.
- 1.7.3. Maintenance materials
  - 1.7.3.1. *Provide* 2 sealed containers, each of 4 litres (one gallon) capacity of each paint product in each colour used in the work for the *Owner's* maintenance use. Containers shall be new, clearly labelled with manufacturer's name, type of paint, colour and colour number. Store at the *Place of the Work* where directed by the *Owner*.

## **1.8. QUALITY ASSURANCE**

- 1.8.1. Conform to MPI Painting Manual requirements for materials, preparation and workmanship.
- 1.8.2. Confirmation:
  - 1.8.2.1. Ensure written confirmation is received from steel fabricators of the specific surface preparation procedures and primers used for steel work to ascertain appropriate and compatible finish materials.
- 1.8.3. Special Systems:
  - 1.8.3.1. Where special coating system applications are used, provide manufacturer's certification of all surfaces and conditions for specific paint or coating system application including inspection and on-site supervision and approval of their system application at no additional cost.
- 1.8.4. Qualifications
  - 1.8.4.1. Manufacturers:
    - (1) Paint manufacturers and Products used shall be as listed under the Approved Product List section of the MPI Painting Manual
  - 1.8.4.2. Installers / applicators / erectors:
    - (1) Applicators shall have minimum of 5 years proven satisfactory painting experience of projects of similar size and class subject to the *Consultant's* approval.
    - (2) Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices shall work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- 1.8.5. Mock-ups:
  - 1.8.5.1. Provide mock-ups of each paint system for indicated surfaces of each colour and finish selected to verify preliminary paint selections made under Sample submittals.
  - 1.8.5.3. Mock-ups shall be located to areas as directed by Consultant under lighting conditions matching final area lighting, for acceptance by Consultant.
  - 1.8.5.4. Mock-ups shall demonstrate aesthetic effects of paint colour and sheen and shall set quality standards for material and execution of the Work. Final approval of colour and finish selections shall be based on mock-ups. If colour selections are not approved, apply additional mock-ups of additional colours selected by Consultant at no added cost to the Owner.
  - 1.8.5.5. Do not proceed with work, including ordering of paint Products, until mock-ups of each paint colour and finish and paint system for indicated surfaces have been reviewed and accepted by Consultant.
  - 1.8.5.6. Provide the following in-situ mock-ups:
    - (1) Concrete block, concrete: 9.3 m<sup>2</sup> (100 ft<sup>2</sup>) of vertical surfaces and 9.3 m<sup>2</sup> (100 ft<sup>2</sup>) of horizontal surfaces.

- (2) Gypsum board: 9.3 m<sup>2</sup> (100 ft<sup>2</sup>) of vertical surfaces and 9.3 m<sup>2</sup> (100 ft<sup>2</sup>) of horizontal surfaces.
- (3) Hollow metal doors and frames: 1 door and frame for each finish specified.
- (4) Site painted structural steel, one steel beam and one steel column.
- (5) Exposed structural deck, 9.3 m<sup>2</sup> (100 ft<sup>2</sup>) size.
- 1.8.5.7. Upon completion and approval, mock-ups shall serve as a standard for the balance of the work of this section. Subsequent work carried out and not in the Consultant's opinion equal to standard shall be repainted without charge.
- 1.8.5.8. In order to determine whether a surface has been "properly painted" it shall be examined without magnification at a distance of thirty-nine (39) inches or one (1) meter, under finished lighting conditions and from a normal viewing position.

#### **1.9. DELIVERY, STORAGE, AND HANDLING**

- 1.9.1. Deliver painting materials in sealed, original labelled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.
- 1.9.2. Store paint Products and materials in original labelled containers in secure (lockable), dry, heated and well ventilated single designated area meeting minimum requirements of both paint manufacturer and authorities having jurisdiction, and at a minimum ambient temperature of 7°C.
- 1.9.3. Exercise extreme caution in the storage of materials to prevent fire or that may create fire hazards. Thinners and solvents shall be stored in CSA approved metal safety containers in accordance with governing fire and safety regulations.
- 1.9.4. Protect floor and wall surfaces of storage area. Protect floors with sheets or clean plywood or metal pans where mixing is being carried out. Provide and maintain fire extinguishers, accessible in storage and mixing areas.
- 1.9.5. Leave storage areas clean and free from evidence of occupancy when these are required for intended use.
- 1.9.6. Keep waste rags in metal drums containing water and remove from the Place of the Work at the end of each Working Day.
- 1.9.7. Provide labels on each container, correlated to the reviewed list of Products, with the following information
  - 1.9.7.1. Name of title of Product.
  - 1.9.7.2. Manufacturer's stock number.
  - 1.9.7.3. Manufacturer's name.
  - 1.9.7.4. Contents by volume, for major pigment and vehicle constituents.
  - 1.9.7.5. Thinning instructions.
  - 1.9.7.6. Application instructions.

#### **1.10. FIELD CONDITIONS**

- 1.10.1. Comply with environmental requirements of MPI Manual.
- 1.10.2. Areas shall be clean and dust free before painting is commenced.
- 1.10.3. Make thorough examination of the complete the Contract Documents to determine intent, extent, materials, types of surfaces, and locations requiring painting and be fully cognizant of requirements.
- 1.10.4. Use sufficient clean drop cloths and protective coverings for full protection of floors, furnishings and work not being painted. Protect mechanical, electrical and special equipment and all other components of building which do not require painting from paint spotting and other soiling during painting process. Mask adjoining work adjacent to work being painted or carefully cut in without overlaps. Clean surfaces soiled by spillage of paint and paint spatters. If cleaning operations damage the surface, repair or replace damaged work at no extra cost to the Owner.
- 1.10.5. Do not paint over dust, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to the formation of a durable paint film.

- 1.10.6. Be responsible for damage to the work of this section until the building is complete and accepted by the Consultant. In cases of damage, surfaces shall be cleaned and repainted to the Consultant's approval.
- 1.10.7. Do not paint exterior surfaces at temperatures below 10°C for latex products and below 10°C for solvent based products, nor in rainy conditions or high humidity (maximum relative humidity shall be 85%). Avoid applying paint to surfaces when exposed to direct sunlight. Do not paint interior surfaces at temperatures under 10°C, nor on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.
- 1.10.8. Provide ventilation to remove odours, evaporating solvents and moisture.
- 1.10.9. Check moisture content of surfaces to be painted using electronic moisture meter approved by paint manufacturer, and the Consultant, or other approved method. Maximum moisture contents shall be in accordance with manufacturer's recommendations and as follows:
  - 1.10.9.1. Concrete and concrete masonry: Maximum 12% to 14% for solvent coatings, and as recommended by manufacturer for water-based coatings.
  - 1.10.9.2. Gypsum board and plaster: Maximum 12% to 14%.
  - 1.10.9.3. Wood: Maximum 15%.

#### **1.11. WASTE MANAGEMENT AND DISPOSAL**

- 1.11.1. Dispose of waste materials in accordance with Provincial and Local authorities having jurisdiction.
- 1.11.2. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- 1.11.3. Place non-reusable materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- 1.11.4. To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:
  - 1.11.5.1. Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
  - 1.11.5.2. Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - 1.11.5.3. Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - 1.11.5.4. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
  - 1.11.5.5. Dry out empty paint cans prior to disposal or recycling.
  - 1.11.5.6. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- 1.11.6. Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

#### **1.12. WARRANTY**

- 1.12.1. Warrant work of this, in accordance with Section 01 78 36.
- 1.12.2. Throughout the warranty period, painting systems shall remain free from failure due to causes including: material failure; surface preparation less than that specified; and paint film thickness less than that specified, or when not specified, less than that coverage recommended by manufacturer.
- 1.12.3. Presence of any of following during the warranty period shall constitute failure: visible corrosion; film peeling, blistering, checking, scaling, embrittling or general film disintegration; and poor adhesion as determined by tape "peel-off" test procedures.
- 1.12.4. Extended Warranty
  - 1.12.4.1. Labour, materials, and workmanship for work of this section.
  - 1.12.4.2. Duration: 3 years



## **2 PRODUCTS**

### **2.1. REGULATORY REQUIREMENTS**

- 2.1.1. Conform to applicable code for flame and smoke rating requirements for finishes, storage, mixing, application and disposal of paint and related waste materials.

### **2.2. PERFORMANCE/DESIGN REQUIREMENTS**

- 2.2.1. Except where more stringent requirements are specified, the following reference standard shall govern the work of this section:
  - 2.2.1.1. Master Painters Institute (MPI) Architectural Painting Specification Manual (MPI Manual), including Identifiers, Evaluation, Systems, Preparation and Approved *Product* List, latest edition, and referenced herein as the MPI Manual, as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- 2.2.2. CAN/CGSB 85.100 Painting.
- 2.2.3. Materials, preparation and workmanship shall conform to requirements of latest edition of Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- 2.2.4. Painting systems:
  - 2.2.4.1. Shall remain free from failure due to causes including: material failure; surface preparation less than that specified; and paint film thickness less than that specified, or when not specified, less than that coverage recommended by manufacturer.
  - 2.2.4.2. Presence of any of following shall constitute failure: visible corrosion; film peeling, blistering, checking, scaling, embrittling or general film disintegration; and poor adhesion as determined by tape "peel-off" test procedures.

### **2.3. MATERIALS**

- 2.3.1. Products listed in MPI Manual shall be used in the Work, unless specified otherwise.
- 2.3.2. Acceptable Products:
  - 2.3.2.1. Products by ICI Paints, Benjamin Moore Co. Ltd., Sherwin-Williams Co., or Pratt & Lambert Ltd. or equivalent shall be used in the *Work*.
- 2.3.3. Paint and materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and the like) shall be in accordance with the MPI Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- 2.3.4. Other paint materials, such as linseed oil, shellac, and the like, shall be highest quality Products of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials as required.
- 2.3.5. Paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.
- 2.3.6. Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by building code requirements and/or authorities having jurisdiction.
- 2.3.7. Paints and coatings materials used within the weatherproofing system shall not exceed the VOC content limits of the following criteria.
  - 2.3.7.1. Interior paints and coatings: to following Green Seal GS-11 VOC limits:
    - (1) Flat coating type: 50 gm/L.
    - (2) Non-flat coating type: 100 gm/L.
  - 2.3.7.2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Green Seal Standard GC-03, Anti-Corrosive Paints.
  - 2.3.7.3. Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings
- 2.3.8. Paint and finishing materials shall be highest grade, manufacturer's first line quality (not "Contractor's" first line).
- 2.3.9. Paint and coating materials for each system shall be Products of a single manufacturer.

- 2.3.10. Provide safe and adequate equipment, scaffolding, ladders, plant, tools, brushes, rollers, clean drop cloths and other items required for the completion of the work.
- 2.3.11. Undercoatings and primers shall be made for the purpose by the manufacturer of the finishing materials being used, or as approved by same.
- 2.3.12. Brushes, rollers, and the like shall be the best of their respective kinds, clean and suitable for the work.
- 2.3.13. Joint sealants: in accordance with Section 07 92 00.

## **2.4. EQUIPMENT**

- 2.4.1. Painting and coating equipment in accordance with written requirements of MPI Manual.
- 2.4.2. Painting and Decorating Equipment: To best trade standards for type of product and application.
- 2.4.3. Spray Painting Equipment: Of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

## **2.5. MIXING AND TINTING**

- 2.5.1. Unless otherwise specified, paints shall be ready-mixed. Re-mix prior to application to ensure colour and gloss uniformity.
- 2.5.2. Paste, powder or catalysed paint mixes shall be mixed in accordance with manufacturer's written requirements.
- 2.5.3. Perform colour tinting operations prior to delivery of paint to Place of the Work.
- 2.5.4. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.

## **2.6. COLOURS AND GLOSS LEVELS**

- 2.6.1. Paint colours and gloss levels shall be as selected by the Consultant. Locations as indicated or scheduled.
- 2.6.2. Colours and Finishes (PT) : Refer to Materials and Finish Schedule on the Drawings for a list of colours.
- 2.6.3. Interior Colours:
  - 1.1.1.1. Based on five (5) base colours and three (3) accent colours with a maximum of one (1) deep or bright colour. No more than eight (8) colours will be selected for entire project and no more than three (3) colours will be selected in each area.
- 2.6.4. Where required by authorities having jurisdiction, finish exit and vestibule doors in contrasting colour to walls and a different colour than any other door in the same area.
- 2.6.5. Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels:
  - 2.6.5.1. To match adjacent surfaces, unless otherwise noted or where pre-finished.
- 2.6.6. Low headroom areas:
  - 2.6.6.1. Minimum 100 mm wide yellow band on leading edge marked CAUTION - LOW CLEARANCE in 50 mm high black letters at suitable intervals and in accordance with requirements of authorities having jurisdiction.
- 2.6.7. Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 maximum
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 minimum
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Prior to commencement of work of this section, thoroughly examine surfaces scheduled to be painted.
- 3.1.2. Check surfaces with electric moisture meter and do not proceed if reading is higher than 12-15% or as otherwise required by paint or coating manufacturer.
- 3.1.3. Check surfaces to determine if pH of surfaces meet manufacturer's requirements.
- 3.1.4. Inspect surfaces to be coated for gouges, marks, nibs, and other defects and properly prepare patching, filling, smoothing or other surface preparation necessary to ensure satisfactory finish.
- 3.1.5. Report in writing any condition adversely affecting this work.
- 3.1.6. Proceed with work only when surfaces and conditions are satisfactory. Remove dust, grease, rust, scale and extraneous matter, tool and machine marks and insects from all surfaces which could be detrimental to a satisfactory and acceptable finish.

#### **3.2. PREPARATION**

- 3.2.1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- 3.2.2. Clean floors, adjacent surfaces and surfaces to be painted before work is commenced.
- 3.2.3. Use sufficient drop cloths and protective coverings for the full protection of work not to be painted or coated.
- 3.2.4. Keep waste rags in covered metal drums containing water and remove from building at end of each Day.
- 3.2.5. Shut down motors, fans, and mechanical ventilation systems during spray painting. Shut down air intakes in affected areas and ventilate to exterior, when applying noxious smelling or VOC containing paints and coatings.
- 3.2.6. Exposed concrete and concrete block walls which are scheduled to be painted or sealed shall not be painted or sealed until the sealant has been applied at control joints and joints with hollow metal frames.
- 3.2.7. Materials shall be thoroughly mixed before application and applied without cutting or admixture except as indicated in writing by the manufacturer.
- 3.2.8. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
- 3.2.9. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- 3.2.10. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, mildew, grease, and incompatible paints, encapsulants, and other deleterious materials.
- 3.2.11. Paint surfaces when moisture content or alkalinity of surfaces to be painted comply with paragraph Field Quality Control / Standard of Acceptance.
- 3.2.12. Concrete and Masonry:
  - 3.2.12.1. Remove release agents, curing compounds, efflorescence, and chalk.
  - 3.2.12.2. Thoroughly clean form oil, parting compounds, curing compounds and other incompatible materials from concrete surfaces.
  - 3.2.12.3. Thoroughly clean masonry and concrete surfaces to be painted free of mortar droppings, concrete spotter and extraneous matter.
  - 3.2.12.4. Check concrete and masonry surfaces to be painted for alkalinity with pink litmus paper or other recognized method. Where extreme alkalinity occurs (6.8 - 8.0 range) wash surface with tetra potassium solution where latex base paint is to be used and with zinc sulphate solution where oil base paints are to be used. Rinse with clean water and allow to dry thoroughly prior to application of primer.

- 3.2.13. Shop-primed steel substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- 3.2.14. ZF75 and ZF120 galvanized-metal substrates: Remove grease and oil residue from galvanized sheet metal by methods to produce clean surfaces that promote adhesion of subsequently applied paints.
- 3.2.15. Z275 galvanized-metal substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- 3.2.16. Metal:
  - 3.2.16.1. Clean unpainted and shop primed metal to *Provide* satisfactory surfaces to receive overcoats and *Provide* permanent adhesion of coatings. Remove rust and scale with emery paper and wire brushes. Prime bare metal, make good shop primed metal where abraded, feather out edges to make touch-up patches inconspicuous. Thoroughly clean metal surfaces including piping and ductwork of oil and grease with mineral spirits.
  - 3.2.16.2. Remove loose paint and scale from shop primed metal work.
- 3.2.17. Metal Surfaces; Galvanized:
  - 3.2.17.1. Apply cold phosphate surface treatment to SSPC-PT2-82 to unpassivated zinc-coated metal.
  - 3.2.17.2. For passivated zinc-coated metal ("white rusted"), power wire brush or vigorously hand wire brush to scuff galvanize thoroughly, and solvent clean to SSPC-SP1- 82.
  - 3.2.17.3. Prepare exterior exposed galvanized steel and galvanized steel at wet areas to SSPC-SP7 – Sweep Blast.
- 3.2.18. Prepare existing surfaces to be repainted in accordance with Article 6.2 of CAN/CGSB 85.100-93.
- 3.2.19. Existing painted substrates:
  - 3.2.19.1. Clean substrates as indicated above.
  - 3.2.19.2. Sound existing paint surfaces and remove paint surfaces that are not sound, loose or are otherwise stained, cracked, wrinkled, peeling, or defective.
  - 3.2.19.3. Dull hard or glossy surfaces by sanding or other abrasive methods prior to finishing.
  - 3.2.19.4. Apply tie-coat primer product that compatible with substrate as recommended by paint coatings manufacturer.
  - 3.2.19.5. Follow with paint finish coats as specified for like substrate materials specified herein.
- 3.2.20. Woodwork:
  - 3.2.20.1. Sand wipe off dust and grit before prime coat application. Putty nail holes and minimal cracks after primer has dried; sand between primer and top coats with No. 300 sandpaper and remove dust.

### **3.3. APPLICATION - PRIMERS**

- 3.3.1. Completely prime surfaces of exterior wood to receive paints or coatings.
- 3.3.2. Apply primer coats to steel and galvanized steel surfaces that have and have not received shop coat or primer.
- 3.3.3. Finish and back prime wood components prior to their installation.
- 3.3.4. When primer sealer is dry, touch up visible suction spots before the next coat is applied and do not proceed with the work until suction spots are sealed.
- 3.3.5. Use high-build type primer/sealers at glass mat finished gypsum board substrate.

### **3.4. INSTALLATION**

- 3.4.1. Do not paint unless substrates are acceptable and/or until Field Conditions (heating, ventilation, lighting and completion of work of other sections) are acceptable for applications of Products.

- 3.4.2. Apply to surfaces scheduled to be finished. Apply materials in accordance with manufacturer's printed directions.
- 3.4.3. Apply primer, paint or stain in accordance with MPI Manual Premium Grade finish requirements.
- 3.4.4. Apply paint and coatings within an appropriate time frame after cleaning when Field Conditions encourage flash-rusting, rusting, contamination or manufacturer's paint specifications require earlier applications.
- 3.4.5. Paint and coating finishes shall be free of defects in materials and workmanship affecting appearance and performance. Defects shall include but not be limited to improper cleaning and preparation of surfaces, entrapped dust and dirt, alligators, blisters, peeling, drips, runs, uneven coverage, misses, poor cutting in, improper use or application of materials.
- 3.4.6. Paint shall be applied by means of brushes, except for wall and ceiling surfaces that shall be applied by rollers or spray application. Apply varnish by brush. Apply stain by wiping.
- 3.4.7. *Consultant* shall have the right to prohibit the use of spray painting for such reasons during application as carelessness, poor masking or protective measures, drifting paint fog, disturbance to other trades or failure to obtain a dense even opaque finish.
- 3.4.8. Apply coats only when the previous coat is dry/cured, in accordance with manufacturer's printed installation instructions.
- 3.4.9. Apply materials evenly, in full coats free from brush and roller marks, sags, runs, crawls, ridges, and other defects. Completed paint or coating shall be uniform in finish, sheen, colour, and texture.
- 3.4.10. Areas exhibiting incomplete or unsatisfactory coverage shall have the entire plane painted. Where cutting and patching work has been performed, shall have the entire plane painted. Patching will not be acceptable.
- 3.4.11. Permit paint to dry before applying succeeding coats, touch up suction spots and prepare previous coats in accordance with manufacturer's printed instructions. Remove dust of sanding.
- 3.4.12. Arrange to have traffic barred from completed areas wherever possible or Provide adequate protection to prevent contamination of paints or coatings with foreign substances.
- 3.4.13. Tint filler to match wood to receive clear finishes, where filler is required. Work filler well into grain and before it has set wipe excess from surface.
- 3.4.14. Prime woodwork designed for painting as soon as possible after woodwork is delivered to site. Prime surfaces of such woodwork, exposed and semi-exposed, before installation. Back-prime woodwork indicated to receive transparent finish with 1 coat of specified transparent finish reduced 25%.
- 3.4.15. Sand semi-gloss, medium and high gloss finishes lightly between coats. Sand and dust between each coat to remove defects visible from distance of 1.5 m (5 ft).
- 3.4.16. Reseal cut edges of wood doors and seal unfinished tops and bottoms of wood doors with 3 coats polyurethane sealer.
- 3.4.17. Finishes and number of coats indicated are the minimum required. Apply further coats until complete uniform coverage is achieved to suit paint products and colours.
- 3.4.18. Priming coat shall be colour toned lighter than second coat and the second coat shall be toned lighter than finish coat. Only the finish coat shall match the colour of the accepted samples.
- 3.4.19. Paint inside surfaces of light coves white unless otherwise indicated in the Contract Documents.
- 3.4.20. Grilles and perforated items shall be spray painted. Do not block perforations and apply evenly to present consistent appearance free from defects visible from distance of 1.5 m (5 ft)
- 3.4.21. Do not apply paints and coating over fire rating labels.
- 3.4.22. Do not apply paints and coatings over identification labels on mechanical and electrical equipment.

- 3.4.23. Paint removable and operable items, such as access panels and doors, grilles, and similar items, while the item is removed or open, so as to not create a paint seal at the juncture of the opening or removable item and its fixed frame or substrate.
- 3.4.24. Keep sprinkler heads, fire detection equipment, and smoke detection equipment free of paint.
- 3.4.25. Repaint existing surfaces and finishes where scheduled, where alterations or renovations have been carried out, and where surfaces have been disturbed by the alterations or renovations. Repaint surfaces entirely between changes of plane.
- 3.4.26. Paint both sides and edges of plywood backboards for equipment before installation.
- 3.4.27. Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- 3.4.28. Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- 3.4.29. Unless otherwise approved by Consultant, apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.
- 3.4.30. Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- 3.4.31. Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- 3.4.32. Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.
- 3.4.33. Paint finish shall continue through behind wall-mounted items (i.e. chalk and tack boards) and exposed/ visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
- 3.4.34. Consultant shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to Owner.
- 3.4.35. Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour, texture and sheen, unless otherwise indicated.

### **3.5. MECHANICAL AND ELECTRICAL ITEMS**

- 3.5.1. Finish paint primed mechanical and electrical items with 2 coats of paint. Include for the following list unless otherwise indicated in the *Contract Documents*:
  - 3.5.1.1. Conduit
  - 3.5.1.2. Ductwork
  - 3.5.1.3. Grilles
  - 3.5.1.4. Hangers
  - 3.5.1.5. Louvres
  - 3.5.1.6. Stacks
  - 3.5.1.7. Vents
- 3.5.2. Prime and paint exposed insulated and bare pipes. Prime and paint exposed conduits and electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items. Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65°C.
- 3.5.3. Coordinate the painting of pipes, and coverings with mechanical contractor applying colour banding, flow arrows and pipe identification after the painting of pipes and coverings.
- 3.5.4. Paint work to match adjacent walls and ceilings unless directed otherwise.
- 3.5.5. Paint interior surfaces of air ducts and pipe trenches including heating pipes and elements that are visible through grilles and louvres with one coat of flat metal paint to limit of sight-line. Paint to be black or white as directed by the Consultant.
- 3.5.6. Gas pipes, whether concealed or exposed, shall be painted in yellow-orange colour, in accordance with gas code.
- 3.5.7. Paint fire protection piping for sprinklers with self priming rust paint, Para Paint colour 1133 Red in the following locations:

- 3.5.7.1. Apparatus bays.
- 3.5.7.2. Utility room.
- 3.5.7.3. Elsewhere where exposed.
- 3.5.8. Paint gas piping with self priming rust paint, yellow colour in the following locations:
  - 3.5.8.1. Apparatus bays.
  - 3.5.8.2. Utility room.
  - 3.5.8.3. Elsewhere where exposed.

### **3.6. FIELD QUALITY CONTROL**

- 3.6.1. Field quality control shall be in accordance with Section 01 45 00, as supplemented herein.
  - 3.6.1.1. Field tests and inspections:
    - (1) Paint and Coating Quality Assurance Inspections:
      - (A) Field quality control shall be in accordance with Section 01 45 00.
    - (2) Moisture and alkalinity testing:
      - (A) Check moisture content of surfaces to be painted using properly calibrated electronic moisture meter approved by paint manufacturer, and Consultant, or other approved method. Maximum moisture contents shall be in accordance with manufacturer's recommendations and as follows:
        - (a) Concrete and concrete masonry (clay and concrete brick/block): Maximum 12%.
        - (b) Gypsum board and plaster: Maximum 12%.
        - (c) Wood: Maximum 15%.
      - (B) Conduct moisture tests on concrete floors using cover patch test method.
      - (C) Test concrete, masonry and plaster surfaces for alkalinity.
    - (3) Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Consultant:
      - (A) Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
      - (B) Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
      - (C) Damage due to touching before paint is sufficiently dry or any other contributory cause.
      - (D) Damage due to application on moist surfaces or caused by inadequate protection from weather.
      - (E) Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
    - (4) Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces to the Consultant:
      - (A) Visible defects are evident on vertical and horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
      - (B) Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
      - (C) When final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area.
    - (5) Painted surfaces rejected by the Consultant shall be made good at the expense of the Subcontractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

- (6) Painting Subcontractor shall obtain from Contractor written confirmation of specific surface preparation procedures and primers used for fabricated steel items from the fabricator/Supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

### **3.7. PATCHING**

- 3.7.1. Do retouching to ensure that the work is handed over to the *Owner* in proper condition, free of runs, spatter, finger marks, rust, watermarks, scratches, blemishes or other disfiguration, with full, even coverage.
- 3.7.2. After fully painting, retouching and finishing a room or area, notify the *Consultant*. After review and acceptance by the *Consultant*, post sign "Painting Complete - No Admittance Without Permission".

### **3.8. EXTERIOR PAINT SYSTEMS**

- 3.8.1. System references listed are based on MPI Manual and are Premium Grade, High Performance Architectural, unless otherwise indicated:
- 3.8.2. Structural steel and metal fabrications:
  - 3.8.2.1. EXT 5.1D Alkyd (over alkyd primer).
- 3.8.3. Galvanized metal (not chromate passivated): (for high contact / high traffic area doors, frames, railings, misc. steel, pipes, etc.; for low contact / low traffic area overhead decking, ducts, gutters, flashing, etc.)
  - 3.8.3.1. EXT 5.3B Alkyd finish.
- 3.8.4. Formula 12 (Alkyd): for shop primed ferrous exterior metal surfaces noted for paint, apply:
  - 3.8.4.1. Touch-up with shop primer as provided by fabricator.
  - 3.8.4.2. One coat oil alkyd metal primer.
  - 3.8.4.3. Two coats exterior alkyd enamel.
- 3.8.5. Formula 13 (Alkyd): for galvanized and zinc coated exterior metal surfaces noted for paint:
  - 3.8.5.1. One coat cementitious primer.
  - 3.8.5.2. Two coats exterior alkyd enamel.
- 3.8.6.

### **3.9. INTERIOR PAINT SYSTEMS**

- 3.9.1. System references listed are based on MPI Manual and are Premium Grade, High Performance Architectural, Low VOC (Green Seal GS-11), unless otherwise indicated:
  - 3.9.1.1. Concrete vertical surfaces: (including ceilings)
    - (1) INT 3.1C High performance architectural latex.
  - 3.9.1.2. Concrete masonry unit assemblies:
    - (1) INT 4.2D High performance architectural latex (over latex block filler).
      - (A) Formula 1: for concrete block walls, except those noted for PWF:
        - (a) One coat latex block filler.
        - (b) Two coats latex semi-gloss.
      - (B) Formula 2: for concrete block walls noted to receive PWF gloss finish coat:
        - (a) One coat latex block filler.
        - (b) Two coats high build epoxy coating.
  - 3.9.1.3. Primed ferrous metal; touch-up and finish coats required under this section:
    - (1) Ferrous metal fabrications: Prepared and primed in accordance with Section 05 50 00.
    - (2) INT 5.1R High performance architectural latex.
      - (A) Formula for primed ferrous metal surfaces apply:
        - (a) One coat latex dryfall.
        - (b) High traffic surfaces – custom system:



- .1 One coat high performance primer (waterborne).
    - .2 Two coats latex S/G.
- 3.9.1.4. Sprinkler pipe:
  - (1) Prepare substrate in accordance with coating manufacturer's recommendations.
  - (2) Penetrating sealer: Akzonobel 'Devoe High Performance Coatings PRE-PRIME 167 Penetrating Sealer', 37.5 microns (1.5 mils) DFT.
  - (3) Finish coat: Akzonobel 'Devoe Devran 224HS High Solids Epoxy Coating', 100-200 microns (4-8 mils) DFT.
- 3.9.1.5. Galvanized metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.)
  - (1) INT 5.3M High performance architectural latex.
  - (2) Formula for galvanized and zinc coated metal apply:
    - (3) One coat galvanized primer (waterborne).
    - (4) Two coats latex S/G.
    - (5) For ceiling and ductwork areas apply:
      - (B) One coat galvanized primer (waterborne).
      - (C) One coat latex dryfall.
- 3.9.1.6. Plaster and gypsum board: (gypsum wallboard, drywall and textured finishes)
  - (1) INT 9.2B High performance architectural latex finish:
    - (A) Use high-hide primer sealer type at glass mat finished gypsum board.
      - (a) Formula for gypsum board walls apply:
        - .1 One coat latex primer sealer.
        - .2 Two coats latex semi-gloss.
      - (b) Formula for gypsum board ceilings apply:
        - .1 One coat latex primer sealer.
        - .2 Two coats latex semi-gloss.
- 3.9.1.7. Structural wood deck:
  - (1) Acceptable Product:
    - (A) Sansin 'Classic'.
- 3.9.1.8. Formula for wood to receive paint finish apply:
  - (1) One coat stain blocking/adhesion promoting primer (waterborne).
  - (2) Two coats latex semi-gloss.
- 3.9.1.9. Formula for woodwork to receive stained finish apply custom system:
  - (1) One coat stain.
  - (2) Three coats waterborne polyurethane clear.
- 3.9.1.10. Formula for woodwork to receive natural finish apply:
  - (1) Three coats waterborne polyurethane clear.
- 3.9.1.11. Formula 10: for insulation covering apply:
  - (1) One coat latex primer sealer.
  - (2) Two coats latex S/G.

### **3.10. ADJUSTING AND CLEANING**

- 3.10.1. Promptly as the work proceeds and on completion of the work, remove paint where spilled, splashed or spattered during the progress of the work keep the premises free from unnecessary accumulation of tools, equipment, surplus materials and debris; at the conclusion of the work leave the premises clean.

### **3.11. SCHEDULES**

- 3.11.1. Finish Schedule:
  - 3.11.1.1. Assume full responsibility for painting and varnishing of all materials of the contract exposed in the finished work which do not already have finished surfaces and that normally require paint or varnish finish. Inspect surfaces over which the work of this section is dependent for unevenness, cracks, surface defects, moisture, cleanliness, roughness and other irregularities detrimental to the application and performance of the work. Confirm conditions satisfactory

before proceeding. Failure in complying with above or failure to have unsatisfactory conditions corrected before proceeding, shall not relieve the Contractor of responsibility for required results.

- 3.11.1.2. Exposed means visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
- 3.11.1.3. In instances where materials specified are not suitable for particular application or are contrary to manufacturer's recommendations for use on particular surface, immediately bring to attention of the Consultant for clarification and instructions.
- 3.11.1.4. Where finishing formula for surfaces requiring paint is not specified, follow recommendations of MPI Manual as follows:
  - (1) Interior painting: Premium Grade.
  - (2) Exterior painting: Premium Grade.
- 3.11.1.5. The Consultant shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to the Owner.
- 3.11.1.6. Unless otherwise noted or scheduled in the Contract Documents, walls shall be painted the same colour within a given area.

### **3.12. SCHEDULE – COLOURS**

- 3.12.1. Refer to the Drawings for painting color and location.
- 3.12.2. All exposed exterior and interior Steel shall be painted. The *Contractor* shall confirm color with the *Consultant*.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Closeout Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, And Handling
- .8 1.8. Extended Warranty
- .9 2.1. Design/Performance Requirements
- .10 2.2. Tackboards
- .11 2.3. Marker Boards (Whiteboards)
- .12 2.4. Trim Components
- .13 2.5. Fastenings
- .14 3.1. Examination
- .15 3.2. Installation - Tackboards
- .16 3.3. Installation –Marker Boards
- .17 3.4. Installation – Trim Components
- .18 3.5. Installation Tolerances
- .19 3.6. Adjusting And Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Tackboards.
  - 1.3.1.2. Marker boards (whiteboards).
  - 1.3.1.3. Related trim, adhesives, and fastenings.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Show proposed system of anchorage and materials being supplied on shop drawings submitted for review.
  - 1.4.3.2. Show dimensional layouts, hardware items, anchorage devices, dimensions, description of materials and finishes, and all other pertinent information.
- 1.4.4. Samples:
  - 1.4.4.1. Submit 305 mm x 305 mm (12" x 12") samples of each Product specified, diagonally cut to show cross section through assembly, complete with accessories and trim.

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

## **1.6. QUALITY ASSURANCE**

### **1.6.1. Qualifications:**

#### **1.6.1.1. Installers / applicators / erectors:**

- (1) Erection of materials to be carried out by competent workers supervised by a foreperson with at least 10 years' experience in this specialized field and approved in writing by manufacturer for installation of their *Product*.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Package Products to prevent distortion in shipment and handling. Label and protect finish surfaces by sturdy wrappings.

## **1.8. EXTENDED WARRANTY**

- 1.8.1. Warrant work of this section in accordance with Section 01 78 36 for a period of 10 years.

## **2 PRODUCTS**

### **2.1. DESIGN/PERFORMANCE REQUIREMENTS**

#### **2.1.1. Trademarks and Labels**

- 2.1.1.1. No trademarks or labels will be accepted on exposed finished work.

### **2.2. TACKBOARDS**

#### **2.2.1. Krommenie cork tackboard:**

- 2.2.1.1. 12.7 mm (1/2") factory prelaminated consisting of 6 mm (1/4") thick Forbo 'Bulletin Board' linoleum cork laminated to 6 mm (1/4") particle board substrate under mechanical pressure in maximum panel sizes of 1219 mm x 2438 mm (4'-0" x 8'-0"). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.

- (1) Colour of tackboard to be selected by the Consultant from manufacturer's standard colour range.

#### **2.2.2. Acceptable manufacturers:**

- 2.2.2.1. Architectural School Products (a.s.p.).
- 2.2.2.2. Delta Products Ltd.
- 2.2.2.3. Or equivalent.

### **2.3. MARKER BOARDS (WHITEBOARDS)**

- 2.3.1. Porcelain enamel board with porcelain enamel writing surface on 0.8 mm (.03") (22 gauge) high quality enameling steel base, 11.1 mm (0.44") impregnated fibreboard core and 0.4 mm (0.02") (28 gauge) stretcher levelled zinc coated back sheet. Writing surface and back sheet laminated in one piece under mechanical or hydraulic pressure to core.

- 2.3.1.1. White colour writing surface, designed for long lasting heavy duty marker writing surface, free of permanent marker staining.

- 2.3.1.2. Joints shall be absolutely flush and level, plumb true with edges finished square and fitted as closely as possible. Concealed mechanical joining system: integral, slotted, PVC insert laminated into ends of panels and 25 mm (1") wide, 2 mm (0.08") thick, galvanized steel spline.

- 2.3.1.3. Particle board backing to CAN3-0188.1-M78, 6 mm (1/4") thick, with sanded faces.

- 2.3.1.4. Porcelain writing surface: 0.076 mm (0.003") thick porcelain enamel to Porcelain Enamel Institute Standards PEI 104. Gloss factor: 6-8 as measured by 45° glossmeter.

- 2.3.1.5. Aluminum trim: in accordance with Trim Components paragraph below.

- 2.3.1.6. Acceptable manufacturers:

- (1) Architectural School Products (a.s.p.).
- (2) Delta Products Ltd.
- (3) Global School Products Inc.
- (4) Or equivalent.

- 2.3.1.7. Skydesign 'Vitracolor Magnetic Markerglass'.

- 2.3.1.8. Substitutions: In accordance with Section 01 25 00.
- 2.3.1.9. Dimensions: Refer to the Drawings.
- 2.3.1.10. Options:
  - (1) Use screws of galvanized steel.

## **2.4. TRIM COMPONENTS**

- 2.4.1. Extruded aluminum components, AA6063 T5.
- 2.4.2. Tackboards:
  - 2.4.2.1. Aluminum trim and accessories:
    - (1) Perimeter: a.s.p. No. 505. or equivalent.
- 2.4.3. Marker boards:
  - 2.4.3.1. Acceptable Products:
    - (1) Perimeter: a.s.p. No. 505.
    - (2) Chalktray: a.s.p. No. 521.
    - (3) Or equivalent.

## **2.5. FASTENINGS**

- 2.5.1. Reinforcing anchor plates to be galvanized steel plates conforming to CSA G4-09(2014).
- 2.5.2. Use screws, bolts of galvanized steel or aluminum.
- 2.5.3. Ferrous metal not specified must be plated or baked enamel and treated with primer conforming to CAN/CGSB 1.140-M91.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Prior to commencement of erection by the installing Subcontractor, the Contractor shall ensure that the installing Subcontractor checks surfaces for irregularities, trueness and rigidity and projections and defects and immediately report any in writing to the Contractor.
- 3.1.2. Commencing installation implies acceptance of surface conditions.

### **3.2. INSTALLATION - TACKBOARDS**

- 3.2.1. Secured from behind and mounted in accordance with manufacturer's written instructions to satisfaction of the Consultant.
- 3.2.2. Install secure, plumb and square.
- 3.2.3. Secure wall brackets to blocking in stud walls, or with zinc plated metal expansion type anchors at masonry back-up.
- 3.2.4. Locate seams as directed by the Consultant.

### **3.3. INSTALLATION – MARKER BOARDS**

- 3.3.1. Install in accordance with manufacturer's written installation instructions.
- 3.3.2. Secure wall brackets to blocking in stud walls, or with zinc plated metal expansion type anchors at masonry back-up.
- 3.3.3. Join panels together by use of 14 gauge x 25.4 mm (1") wide steel spline and extruded polyvinyl slotted insert for flush butt joints, with a hairline appearance.
- 3.3.4. Locate seams as directed by the Consultant.

### **3.4. INSTALLATION – TRIM COMPONENTS**

- 3.4.1. Install in accordance with manufacturer's written installation instructions.
- 3.4.2. Attach aluminum trim, where applicable, in such a manner that fastenings shall be concealed. Fastening shall be accomplished by the use of #10 x 25.4 mm (1") steel wood screws with rawl plugs, attached to walls.
- 3.4.3. Leave trim and surfaces clean and free of stains or marks and completely cover finished surfaces with "Pliofilm" immediately after installation and remove only at time of final inspection.

**3.5. INSTALLATION TOLERANCES**

- 3.5.1. Install plumb, level, tight and secured. Comply with the following maximum tolerances:
  - 3.5.1.1. Plumb and level: 3 mm (1/8").
- 3.5.2. Variation from indicated position: plus/minus 3 mm (1/8").

**3.6. ADJUSTING AND CLEANING**

- 3.6.1. Verify under work of this section that installed Products function properly and adjust them accordingly to ensure satisfactory operation.
- 3.6.2. Do not remove protective coatings until final cleaning, or earlier if directed by the Consultant.
- 3.6.3. Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at the Place of the Work only if approved.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Section Summary
- .4 1.4. Samples
- .5 1.5. Shop Drawings
- .6 2.1. Materials
- .7 2.2. Lettering Style And Size
- .8 3.1. Installation
- .9 3.2. Protection

### **1.3. SECTION SUMMARY**

- 1.3.1. Provision of all labour, materials, equipment and incidental services necessary to provide exterior building signage.

### **1.4. SAMPLES**

- 1.4.1. Provide one sign letter representative of type specified inappropriate size and colour, in accordance with Section 01 30 00.

### **1.5. SHOP DRAWINGS**

- 1.5.1. Submit Shop Drawings as specified in Section 01 33 00.
- 1.5.2. Shop Drawings:
  - 1.5.2.1. Project-specific drawings, illustrating sign design and layout, materials, sizes, thicknesses, methods of attachment, and special details.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Aluminum Letters:
  - 2.1.1.1. 50mm letter depth, on stand-offs, secured to aluminum panel
  - 2.1.1.2. Acceptable Manufacture:
    - (1) Gemini Canada
    - (2) Or approved alternative.
  - 2.1.1.3. Refer to the drawings for details.
    - (1) Finish: brushed aluminum.
    - (2) Fasteners and hardware: Stainless steel

### **2.2. LETTERING STYLE AND SIZE**

- 2.2.1. Lettering style as selected by the Consultant.
- 2.2.2. Letter size as indicated on the drawings.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Letters to be installed square and level as indicated on shop drawings.
- 3.1.2. Replace Products that are bent, scratched or otherwise damaged.

### **3.2. PROTECTION**

- 3.2.1. Refer to Section 01 76 00.
- 3.2.2. Protect surfaces with removable protective coverings until Owner occupancy.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, And Handling
- .7 2.1. General
- .8 2.2. Corner Guard Protection
- .9 2.3. Fabrication
- .10 2.4. Finishes
- .11 3.1. Examination
- .12 3.2. Preparation
- .13 3.3. Installation

### **1.3 REFERENCES**

- 1.2.1. ASTM A123/A123M-17: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.2. ASTM A153/A153M-16a: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- 1.2.3. ASTM A307-14e1: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- 1.2.4. ASTM A563M-07(2013): Standard Specification for Carbon and Alloy Steel Nuts (Metric).
- 1.2.5. ASTM A1008/A1008M-16: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- 1.2.6. ASTM B456-11e1: Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- 1.2.7. ASTM F436M-11: Standard Specification for Hardened Steel Washers.

### **1.3. SHOP DRAWINGS**

- 1.3.1. Submit Shop Drawings as specified in Section 01 33 00.
- 1.3.2. Shop Drawings:
  - 1.3.2.1. Project-specific drawings, illustrating sign design and layout, materials, sizes, thicknesses, methods of attachment, and special details.

### **1.4. CLOSEOUT SUBMITTALS**

- 1.4.1. Submit closeout submittals as specified in Section 01 78 00
- 1.4.2. Maintenance Data:
  - 1.4.2.1. Manufacturer's standard installation and maintenance instructions, sufficient quantity for inclusion in the operation and maintenance manuals.

## **2 PRODUCTS**

### **2.1. DESCRIPTION**

- 2.1.1. Traffic and Emergency Signage:
  - 2.1.1.1. Sheet steel, conforming to local municipality standards; reflective baked enamel finish; sufficient quantity to conform to the requirements of the Authorities Having Jurisdiction; styles and designs as indicated on Drawings.



## **2.2. MATERIALS**

- 2.2.1. Sheet Steel:
  - 2.2.1.1. Cold-rolled steel sheet to ASTM A1008/A1008M, Commercial Steel (CS) Types A, B, and C; galvanized.
- 2.2.2. Bolts:
  - 2.2.2.1. Carbon and alloy steel, to ASTM A307, Grade A; hot dipped galvanized.
- 2.2.3. Nuts:
  - 2.2.3.1. Carbon and alloy steel, to ASTM A563M, Grade A, Hex Style; hot dipped galvanized.
- 2.2.4. Washers:
  - 2.2.4.1. Hardened steel washers, to ASTM F436M, Type 1 for interior applications, Type 3 for exterior applications; circular, beveled and clipped types as required.
- 2.2.5. Sign Posts:
  - 2.2.5.1. Galvanized steel, square-shaped stakes; complete with regularly spaced drilled holes for attachment of signage; suitable length to accommodate buried depth of not less than 1.0 metre and sign mounting height in accordance with the authority having jurisdiction; eg. Telespar Sign Post by Unistrut Service Company.
- 2.2.6. Adhesive:
  - 2.2.6.1. As recommended by sign manufacturer.

## **2.3. FINISHES**

- 2.3.1. Chrome/Nickel Plating on Metal Components:
  - 2.3.1.1. To ASTM B456, Type SC 2, Polished finish.
- 2.3.2. Galvanized Coating on Steel Components:
  - 2.3.2.1. Hot dipped, zinc alloy coating, to ASTM A123/A123M, Z275 coating designation.
- 2.3.3. Galvanized Coating on Steel Hardware:
  - 2.3.3.1. Hot dipped, zinc alloy coating, to ASTM A153/A153M, Class B2.
- 2.3.4. Reflective Coating on Metal Components:
  - 2.3.4.1. Clean and degrease metal surface; apply one coat of zinc oxide primer sprayed and baked; two coats of semi-gloss reflective enamel sprayed and baked; symbols and colours as required by authorities having jurisdiction.
- 2.3.5. Powder Coating on Metal Components:
  - 2.3.5.1. Electrostatic spray-applied polymer powder coating, minimum 0.05 mm dry film thickness; symbols and colours as required by authorities having jurisdiction.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Conform to requirements of the authority having jurisdiction.
- 3.1.2. Provide routing or mortising as required.
- 3.1.3. Bury support stakes minimum 1.0 metre below finished grade.
- 3.1.4. Replace Products that are bent, scratched or otherwise damaged.
- 3.1.5. Properly install and tighten fasteners to the full required complement.

### **3.2. PROTECTION**

- 3.2.1. Refer to Section 01 76 00.
- 3.2.2. Protect surfaces with removable protective coverings until Owner occupancy.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage, And Handling
- .7 2.1. General
- .8 2.2. Corner Guard Protection
- .9 2.3. Fabrication
- .10 2.4. Finishes
- .11 3.1. Examination
- .12 3.2. Preparation
- .13 3.3. Installation

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Corner guards.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Samples:
  - 1.4.2.1. Submit 3 samples, 300 mm (12") long or 300 x 300 mm (12 x 12") in size as applicable, for each *Product* in specified finish.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Submit shop drawings, and colour and finish samples for work of this section in accordance with Section 01 33 00.
  - 1.4.3.2. Clearly indicate fabrication details, plans, elevations, hardware and installation/fastening details.
- 1.4.4. Templates:
  - 1.4.4.1. The Contractor shall ensure that their *Subcontractors* submit templates for use by installers and fabricators as required for proper location and installation of hardware.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Installer qualifications:
  - 1.5.1.1. Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.
- 1.5.2. Manufacturer's qualifications:
  - 1.5.2.1. Not less than 5 years experience in the production of specified products and a record of successful in-service performance.
- 1.5.3. Single source responsibility:
  - 1.5.3.1. Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

### **1.6. DELIVERY, STORAGE, AND HANDLING**

- 1.6.1. Package or crate, and brace Products to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.
- 1.6.2. The Contractor shall ensure that their Subcontractors deliver Products to location at the Place of the Work.

## **2 PRODUCTS**

### **2.1. GENERAL**

- 2.1.1. Incorporate reinforcing, fastenings and anchorage required for building-in of Products.
- 2.1.2. Heights of corner guards are to be full wall heights.
- 2.1.3. Where end walls exposed two gypsum board corners Provide custom size wrap around corner guards.

### **2.2. CORNER GUARD PROTECTION**

- 2.2.1. Surface mounted, 90 mm x 90 mm (3.5" x 3.5"), 1.3 mm thick (0.05") (16 gauge) stainless steel angle in accordance with ASTM A276-15(2015), Type 304, AISI No. 4 satin finish, radius edge.
  - 2.2.1.1. Acceptable Products:
    - (1) CG-Type1 - Construction Specialties Acrovyn Model CO-8
    - (2) CG-Type 2 - Construction Specialties Acrovyn Model SCO-8
    - (3) Or equivalent
- 2.2.2. Mounting:
  - 2.2.2.1. Mounted with construction adhesive. Use of screws is not permitted

### **2.3. FABRICATION**

- 2.3.1. Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.
- 2.3.2. Preassemble components in shop as much as possible to minimize field assembly.

### **2.4. FINISHES**

- 2.4.1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applications and designations of finishes.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- 3.1.2. Do not proceed until unsatisfactory conditions have been corrected.

### **3.2. PREPARATION**

- 3.2.1. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- 3.2.2. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

### **3.3. INSTALLATION**

- 3.3.1. Install work to meet manufacturer's recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.
- 3.3.2. Clean substrates to remove dirt, debris and loose particles prior to installation.
- 3.3.3. Fit joints and junction between components tightly and in true planes.
- 3.3.4. Install units on solid backing as indicated, and erect with materials and components straight, tight and in alignment.
- 3.3.5. Corner guards:
  - 3.3.5.1. Corner guard edges shall be smooth.
  - 3.3.5.2. Mechanically fasten corner guards using M1 Structural Adhesive (or equivalent) in strict accordance with guard manufacturer's written instructions..
  - 3.3.5.3. Install corner guard shall be tightly fitted without gaps.
  - 3.3.5.4. Corner Guard Height: Full height.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Delivery, Storage, and Handling
- .7 2.1. Manufacturers
- .8 2.2. Accessories
- .9 2.3. Fabrication
- .10 3.1. 3.1 Preparation
- .11 3.2. Installation of washroom and janitors accessories
- .12 3.3. Barrier Free Installation Heights
- .13 3.4. Installation of Washroom Accessories
- .14 3.5. Installation Tolerances
- .15 3.6. Adjusting and Cleaning

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Washroom accessories.
  - 1.3.1.2. Janitor room accessories.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination:
  - 1.4.1.1. Supply manufacturer's handling instructions, anchorage information, roughing-in dimensions, templates, and service requirements for installation of the work of this section, and assist or supervise, or both, the setting of anchorage devices and construction of other work incorporated with Products specified in the Contract Documents in order that they function as intended.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products proposed for use in the work of this section.
- 1.5.3. Samples:
  - 1.5.3.1. Submit duplicate samples of each finish specified.
- 1.5.4. Shop drawings:
  - 1.5.4.1. Clearly indicate fabrication details, plans, elevations, hardware and installation details.
- 1.5.5. Templates:
  - 1.5.5.1. The Contractor shall ensure that their *Subcontractors* submit templates for use by their installers and fabricators as required for proper location and installation of hardware.

### **1.6. DELIVERY, STORAGE, AND HANDLING**

- 1.6.1. Package or crate, and brace products to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.

- 1.6.2. The Contractor shall ensure that their Subcontractors deliver products to location at the Place of the Work

## **2 PRODUCTS**

### **2.1. MANUFACTURERS**

- 2.1.1. Specified manufacturer's catalogue references are the minimum acceptable standards for work of this section. Where two manufacturers or Products are specified for a given accessory, select one or the other for installation in the *Work*, but not both.
- 2.1.2. Acceptable product manufacturers: Subject to compliance with requirements, *Provide* products by one of the following:
- 2.1.2.1. ASI Watrous Inc.
  - 2.1.2.2. Bobrick Washroom Equipment, Inc.
  - 2.1.2.3. Swish Maintenance Ltd.
  - 2.1.2.4. Uline Canada
  - 2.1.2.5. Frost Products Ltd.
  - 2.1.2.6. Wet Style.
  - 2.1.2.7. GAMCO Commercial Restroom Accessories
  - 2.1.2.8. Or as noted on the drawings
  - 2.1.2.9. Or equivalent

### **2.2. ACCESSORIES**

- 2.2.1. Incorporate reinforcing, fastenings and anchorage required for building-in of Products.
- 2.2.2. Washroom Accessory Schedule
- 2.2.2.1. Locations as indicated or scheduled in the Contract Documents
- 2.2.3. Lettering:
- 2.2.3.1. for identification of accessories and operation instructions shall be silk screened using international symbols unless otherwise specified.

### **2.3. FABRICATION**

- 2.3.1. Fabricate Products with materials and component sizes, metal gauges, hardware, reinforcing, anchors, and fastenings of adequate strength to ensure that washroom accessories will remain free of warping, buckling, opening of joints and seams, and distortion within limits of intended use.

## **3 EXECUTION**

### **3.1. 3.1 PREPARATION**

- 3.1.1. Ensure that rough-in dimensions and blocking or back-up has been provided to comply with product manufacturer's written requirements.

### **3.2. INSTALLATION OF WASHROOM AND JANITORS ACCESSORIES**

- 3.2.1. Supply manufacturer's handling instructions, anchorage information, roughing-in dimensions, templates and service requirements for installation of the work of this section, and assist or supervise, or both, the setting of anchorage devices and construction of other work incorporated with Products specified in the Contract Documents in order that they function as intended.
- 3.2.2. Comply with product manufacturers written requirements.
- 3.2.3. Install and secure fixtures rigidly in place using expansion shields in solid masonry or concrete, toggle bolts in hollow masonry or sheet metal screws at metal studs and as noted in the Architectural drawings.
- 3.2.4. Insulate surfaces to prevent electrolytic action due to contact with dissimilar metals, or concrete or masonry as applicable. Use bituminous paint or other approved means.
- 3.2.5. Install on built-in concealed solid backing materials. Grab bar installation shall be able to withstand 250 kg downward force.
- 3.2.6. Verify locations and mounting heights with Consultant before roughing-in.
- 3.2.7. Install work to meet manufacturers' recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.

- 3.2.8. Include reinforcing, anchorage and mounting devices required for the installation of each Product.
- 3.2.9. Fit joints and junction between components tightly and in true planes, conceal and weld joints where possible.

### **3.3. BARRIER FREE INSTALLATION HEIGHTS**

- 3.3.1. Install accessories to permit operable parts and controls to be accessed in accordance with authorities having jurisdiction

### **3.4. INSTALLATION OF WASHROOM ACCESSORIES**

- 3.4.1. Install and secure fixtures rigidly in place using expansion shields in solid masonry or concrete, toggle bolts in hollow masonry or sheet metal screws at metal studs.
- 3.4.2. Insulate surfaces to prevent electrolytic action due to contact with dissimilar metals, or concrete or masonry if required. Use bituminous paint or other approved means.
- 3.4.3. Install in accordance with manufacturer's installation instructions, on built-in concealed solid backing materials. Grab bar installation shall be able to withstand 250 kg downward force.
- 3.4.4. Verify locations and mounting heights with the Consultant before roughing-in.
- 3.4.5. Install plumb, level, straight, tight and secured.

### **3.5. INSTALLATION TOLERANCES**

- 3.5.1. Install plumb, level, tight and secured. Comply with the following maximum tolerances:
  - 3.5.1.1. Plumb and level: 3 mm (1/8").
  - 3.5.1.2. Variation from indicated position: 3 mm (1/8").

### **3.6. ADJUSTING AND CLEANING**

- 3.6.1. Verify under work of this section that installed Products function properly and adjust them accordingly to ensure satisfactory operation. Test mechanisms, hinges, locks, and latches and adjust and lubricate to ensure washroom accessories are in perfect working order.
- 3.6.2. Do not remove protective coatings until final cleaning, or earlier if directed by the Consultant.
- 3.6.3. Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish work at the Place of the Work only if approved.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SECTION INCLUDES**

- 1.1.1 Fire extinguishers.
- 1.1.2 Fire extinguisher cabinets.

### **1.2 SUBMITTALS**

- 1.2.1 Submit product data sheets for all products specified in this Section.

### **1.3 REFERENCES**

- 1.3.1 Fire extinguishers are to be in accordance with following Codes and Standards:
  - 1.3.1.1 National Fire Code of Canada;
  - 1.3.1.2 NFPA 10, Standard for Portable Fire Extinguishers;
  - 1.3.1.3 CAN/ULC S508, Standard for the Rating and Testing of Fire Extinguishers.

## **2 PRODUCTS**

### **2.1 GENERAL**

- 2.1.1 Fire extinguishers are to be pressurized (stored pressure) rechargeable type, in accordance with NFPA 10, and UL and/or ULC listed and labelled for the class of fires and hazard locations for which they are specified.
- 2.1.2 Each extinguisher is to be complete with:
  - 2.1.2.1 manufacturer's identification label indicating extinguisher model number, rating, and operating instructions;
  - 2.1.2.2 anodized aluminum or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock;
  - 2.1.2.3 discharge hose with nozzle or horn and hose securing clip;
  - 2.1.2.4 for wall mounting extinguishers, a wall mounting bracket.

### **2.2 2A RATED WATER EXTINGUISHERS**

- 2.2.1 Water extinguishers rated 2A are to be 175 mm (6-½") dia., 9.5 L (2 gallon) capacity, each complete with a polished stainless steel cylinder with tire valve for pressuring and a waterproof stainless steel pressure gauge.

### **2.3 10B:C. RATED CARBON DIOXIDE EXTINGUISHERS**

- 2.3.1 10B:C carbon dioxide extinguishers are to be 175 mm (6-½") dia., 6.8 kg (15 lb), each complete with a steel cylinder with a safety red baked enamel finish.

### **2.4 3A10B:C RATED DRY CHEMICAL EXTINGUISHERS**

- 2.4.1 Multi-purpose 3A10B:C dry chemical extinguishers are to be 100 mm (4") dia., 2.27 kg (5 lb.), each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.

### **2.5 4A60B:C AND 4A80B:C RATED DRY CHEMICAL EXTINGUISHERS**

- 2.5.1 Multi-purpose 4A60B:C dry chemical extinguishers are to be 125 mm (5") dia., 4.5 kg (10 lb.), each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.
  - 2.5.2 Multi-purpose 4A80B:C dry chemical extinguishers are to be as above but 175 mm (7") dia., 9 kg (20 lb).
-

## **2.6 CLEAN AGENT FIRE EXTINGUISHERS**

- 2.6.1 Ansul Inc. model CleanGuard FE13 clean agent extinguisher, 6 kg (13.25 lb), ULC listed and labelled to 2-A:10-B:C, suitable for fires involving live electrical equipment and will not damage the equipment, each complete with required wall mounting brackets and securing hardware.
- 2.6.2 Acceptable manufacturers are:
  - 2.6.2.1 Ansul Inc.;
  - 2.6.2.2 Pyro Chem.

## **2.7 FIRE EXTINGUISHER CABINETS**

- 2.7.1 Surface Mounted: Rectangular break-glass type enclosures sized to suit the extinguishers to be housed, constructed of 18 gauge corrosion resistant steel with a baked white enamel finish, front glass panel, break-glass mechanism, and keyed alike cylinder lock.
- 2.7.2 Recessed: Rectangular cabinets sized to suit the extinguishers to be housed, with an 18 gauge corrosion resistant white enamelled steel tub, 14 gauge cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch.

## **2.8 FIRE BLANKETS**

- 2.8.1 Equal to National Fire Equipment Ltd. Model #FB-6078-MC 300 mm x 400 mm (12" x 16") red enamelled 16 gauge surface mounting steel cabinet identified "FIRE BLANKET" and "PULL TAB TO REMOVE", complete with non-combustible glass fibre fire blanket pressure fit into the cabinet and equipped with pull-back release straps.

# **3 EXECUTION**

## **3.1 INSTALLATION OF FIRE EXTINGUISHERS**

- 3.1.1 Provide fire extinguishers of type(s) in accordance with requirements of NFPA 10.
- 3.1.2 Unless otherwise shown or specified, wall mount extinguishers using wall brackets supplied with extinguishers.
- 3.1.3 Do not install extinguishers until after wall finishing work is complete.
- 3.1.4 Be responsible for maintaining fire extinguishers until Substantial Completion of the Work.
- 3.1.5 If extinguishers are indicated adjacent to a door, locate extinguishers at the strike side of the door.

## **3.2 INSTALLATION OF FIRE EXTINGUISHER CABINETS**

- 3.2.1 Provide wall cabinets for fire extinguishers where required.
- 3.2.2 Unless otherwise shown or specified, locate cabinets so centerline is approximately 1.2 m (4') above finished floor.
- 3.2.3 Confirm exact locations prior to installation.

## **3.3 INSTALLATION OF FIRE BLANKETS**

- 3.3.1 Provide fire blankets in wall mounted cabinets in the Kitchen. Confirm exact locations prior to installation.

**END OF SECTION**

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## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, And Handling
- .8 1.8. Project Conditions
- .9 1.9. Warranty
- .10 2.1. Performance And Design Requirements
- .11 2.2. Manufacturers
- .12 2.3. Product
- .13 2.4. Fabrication
- .14 3.1. Examination
- .15 3.2. Preparation
- .16 3.3. Installation
- .17 3.4. Installation Tolerances
- .18 3.5. Adjustment
- .19 3.6. Cleaning And Protection

### **1.3. SUMMARY**

- 1.3.1. Section Includes  
1.3.1.1. Prefinished metal lockers.

### **1.4. REFERENCES**

- 1.4.1. Americans with Disabilities Act (ADA):  
1.4.1.1. ADA AG - Americans with Disabilities Act, Accessibility Guidelines.
- 1.4.2. ASTM International (ASTM):  
1.4.2.1. ASTM A366 - Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled).
- 1.4.3. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets: Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
- 1.5.3. Shop drawings:  
1.5.3.1. Indicate thicknesses of metal, fabricating methods, assembled banks of lockers, bases, trim, numbering, filler panels, end panels and sloped tops.  
1.5.3.2. Verified Installation Field Dimensions:  
.1 Drawings with the actual dimensions of the areas receiving the lockers but be submitted to the manufacturer prior to fabrication of the lockers and accessory equipment.
- 1.5.4. Samples: Submit sample of colour and finish on actual base metal.

### **1.6. QUALITY ASSURANCE**

- 1.6.1. Manufacturer Qualifications:

- 1.6.1.1. Company specializing in manufacturing products specified in this section with a minimum five years documented experience.
- 1.6.2. Installer Qualifications:
  - 1.6.2.1. Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
- 1.6.3. Source Limitations:
  - 1.6.3.1. Provide each type of product from a single manufacturing source to ensure uniformity.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- 1.7.2. Protect from damage due to weather, excessive temperature, and construction operations.
- 1.7.3. Store lockers in a manner that protects them from marks, scratches, and scuffs.
- 1.7.4. Damaged lockers caused by Contractor shall be replaced at not additional cost to the Owner.

## **1.8. PROJECT CONDITIONS**

- 1.8.1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

## **1.9. WARRANTY**

- 1.9.1. Manufacturer's standard limited warranty unless indicated otherwise.
- 1.9.2. Lockers are warranted against defects in quality of materials and workmanship (including finish) for a period of 5 years from the date of Substantial Performance.

# **2 PRODUCTS**

## **2.1. PERFORMANCE AND DESIGN REQUIREMENTS**

- 2.1.1. Verified Installation Field Dimensions: Drawings with the actual dimensions of the areas receiving the lockers must be submitted to the manufacturer prior to fabrication of the lockers and accessory equipment.

## **2.2. MANUFACTURERS**

- 2.2.1. Acceptable Manufacture:
  - 2.2.1.1. Lincora Group  
6265 Notre-Dame St. E.; Montreal, QC  
H1N 2E9; Toll Free: 1-800-564-9001;  
Phone: 514-253-5700; Email:  
[info@lincora.com](mailto:info@lincora.com);  
Web: <https://www.lincora.com>

## **2.3. PRODUCT**

- 2.3.1. Acceptable Product:
  - 2.3.1.1. First Responder Locker: Series 61 Lockers
  - 2.3.1.2. Substitution Procedures: Refer to Section 01 25 00.
- 2.3.2. Locker Size:
  - 2.3.2.1. Single Tier Full-Height Lockers
    - .1 Width: 452 (18")
    - .2 Depth: 610mm (24")
    - .3 Height: 1830mm (72")

## **2.4. FABRICATION**

- 2.4.1. Locker Body Construction:
  - 2.4.1.1. Robustness: Ultra Heavy Duty.

- 2.4.1.2. Material: Premium quality cold rolled standard steel ASTM A366. No surface imperfections.
- 2.4.1.3. Frame: 16 ga (1.52 mm) sheet steel. A steel strip folded to form a 90 degree triple fold edge. The four corners are assembled by means of spot welds.
- 2.4.1.4. Bottom: Galvanneal sheet steel, A653 CS TY B.
  - .1 Sheet Steel Material: 16 ga (1.52 mm).
  - .2 Sloped and perforated for drainage at exterior of recessed base.
  - .3 Lateral and Back Flanges: Bent 90 degrees downward.
  - .4 Front Flange: Double layered. Equivalent to a 16 ga (1.52 mm) lower frame.
  - .5 The bottom is welded to the body.
- 2.4.1.5. Top: Galvanneal sheet steel, A653 CS TY B. Lateral and back flanges bent 90 degrees downward and welded to the body.
  - .1 Sheet Thickness: 16 ga (1.52 mm).
- 2.4.1.6. Back and Sides: 16 ga (1.52 mm) metal sheet.
- 2.4.1.7. Top Shelf: 20 ga (0.91 mm) steel with 3 front folds. Third fold is flattened to eliminate sharp edge.
  - .1 Top Shelf Location: Welded 12 inch (305 mm) from the top of locker.
- 2.4.1.8. Coat Bar: 0.75 inch (19 mm) diameter, full width, made of galvanized metal.
- 2.4.1.9. Hooks: Flat 1/2 inch (13 mm) by 1/8 inch (3 mm) welded on plates which are then spot-welded to the sides.
  - .1 Hook Quantity: 2.
- 2.4.2. Door Construction: Perforated for ventilation.
  - 2.4.2.1. Door Robustness: Ultra Heavy Duty. Front Panel: 14 ga (1.90 mm). Interior Panel: 16 ga (1.52 mm) folded into a box. Welded onto front door panel.
    - .1 Ventilation perforations at top and bottom.
  - 2.4.2.2. Outer Panel:
    - .1 Hinge Side: Ends with two 90 degree folds.
      - (A) Hinge on the right.
    - .2 Handle Side: Three 90 degree folds.
    - .3 One 90 degree fold terminates at top and bottom edge of door.
  - 2.4.2.3. Door Perforations:
    - .1 Rectangular. Top and Bottom: 0.812 x 0.250 inches (21 x 6 mm).
  - 2.4.2.4. Hinge: 14 ga (1.90 mm), five knuckles. Opening: 180 degrees.
    - .1 Doors Height: 43 inches (1092 mm) and Higher. 3 hinges.
  - 2.4.2.5. Hinge Location: On the Right.
  - 2.4.2.6. Recessed Handle: Tamper proof nylon latch, embedded in handle to retain door while closed with one point of contact on the hasp to allow use with a padlock.
    - .1 Material: Black powder coated steel.
- 2.4.3. Bottom Compartment Construction:
  - 2.4.3.1. Bottom Compartment: Closed with ventilation.
    - .1 Door Perforations: Diamond. 0.812 x 0.375 inches (21 x 9.5 mm). For ventilation on the sides and front when bottom compartment is closed.
  - 2.4.3.2. Bottom Compartment: Open.
  - 2.4.3.3. Opening Bench: Full length piano hinge with hasp for standard padlock if compartment is closed.
  - 2.4.3.4. Bench Material: Selection from full range of options by the Consultant.
- 2.4.4. Accessories:
  - 2.4.4.1. Recessed Base: 18 ga (1.21 mm) galvanized steel, ASTM A653 / A653M G30.
    - .1 Finish: Black.
    - .2 Height: 4 inches (101 mm).
    - .3 Recessed: 3 inches (76 mm).
  - 2.4.4.2. Number Plates: Aluminum.
  - 2.4.4.3. Locking Mechanism: Padlock.
- 2.4.5. Finishes:

- 2.4.5.1. Preparation:
  - .1 Polish steel until imperfections affecting appearance and paint application are removed.
  - .2 Clean steel and protect against corrosion with a phosphate treatment.
- 2.4.5.2. Finish: Powder coated.
  - .1 Dry Thickness Exposed Surfaces: Minimum of 1 mil (0.025 mm).
  - .2 Dry Thickness Other Surfaces: Minimum of 0.6 mil (0.015 mm).
  - .3 Color: Color to later selection by the Consultant.

### **3 EXECUTION**

#### **3.1. EXAMINATION**

- 3.1.1. Do not begin installation until substrates have been properly constructed and prepared.
- 3.1.2. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.
- 3.1.3. Verify field dimensions match data that was sent to Manufacturer for fabrication of lockers.
- 3.1.4. If dimensions do not match, notify the Architect in writing before proceeding.

#### **3.2. PREPARATION**

- 3.2.1. Clean surfaces thoroughly prior to installation.
- 3.2.2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.3. INSTALLATION**

- 3.3.1. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
- 3.3.2. Securely fasten at least every third locker through to wall studs, masonry or concrete substrate.
- 3.3.3. Install number plates and locking devices.
- 3.3.4. Install trim and filler panels where required for continuous appearance and where obstructions occur. Specific conditions as indicated in the Contract Documents.
- 3.3.5. Install finished end panels to exposed ends of locker banks.

#### **3.4. INSTALLATION TOLERANCES**

- 3.4.1. Install plumb, level, tight and secured. Comply with the following tolerances:
  - 3.4.1.1. Plumb and level: 3 mm (1/8").
  - 3.4.1.2. Variation from indicated position: plus/minus 3 mm (1/8").

#### **3.5. ADJUSTMENT**

- 3.5.1. Adjust the lockers and their components to work properly, in accordance with the manufacturer's written instructions.
- 3.5.2. Precisely adjust and lubricate moving parts for smooth operation.

#### **3.6. CLEANING AND PROTECTION**

- 3.6.1. Perform cleaning work in accordance with the requirements of the General and Special Conditions.
  - 3.6.1.1. Leave the premises clean at the end of each working day.
  - 3.6.1.2. Clean surfaces with a damp cloth and an approved non-abrasive cleaning product in accordance with manufacturer's instructions.
- 3.6.2. Final Cleaning:
  - 3.6.2.1. Remove excess materials, waste, tools, and equipment from the job site in accordance with the requirements of the general and special conditions.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 1.6. Delivery, Storage And Handling
- .7 2.1. Manufacturer
- .8 2.2. Racking Systems
- .9 2.3. Accessories
- .10 2.4. Finish
- .11 3.1. Examination
- .12 3.2. Installation

### **1.3. SUMMARY**

- 1.3.1. Design, fabrication and installation of wall mounted turnout gear lockers as specified herein.

### **1.4. SUBMITTALS**

- 1.4.1. Product Data:
  - 1.4.1.1. Submit manufacturer's product data and installation instructions.
- 1.4.2. Shop Drawings:
  - 1.4.2.1. Submit manufacturer's shop drawings for each individual run of lockers.
- 1.4.3. Samples:
  - 1.4.3.1. Submit manufacturer's standard color samples.
- 1.4.4. Owner's Manual:
  - 1.4.4.1. Provide maintenance manual at closeout.
- 1.4.5. Warranty:
  - 1.4.5.1. Submit manufacturer's standard warranty.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Manufacturer shall have a minimum of five years' experience in the direct manufacture of lockers.
- 1.5.2. Installer shall have experience in locker installation.

### **1.6. DELIVERY, STORAGE AND HANDLING**

- 1.6.1. Delivery:
  - 1.6.1.1. Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.
- 1.6.2. Storage:
  - 1.6.2.1. Store materials in a clean dry area.
- 1.6.3. Handling:
  - 1.6.3.1. Protect materials and finish during installation and handling to prevent damage.

## **2 PRODUCTS**

### **2.1. MANUFACTURER**

- 2.1.1. Acceptable Manufacturer:
  - 2.1.1.1. Ready Rack  
818 Trakk Lane Woodstock, IL

60098, USA  
(800) 991-2120  
<https://readyrack.com/>

## **2.2. RACKING SYSTEMS**

### **2.2.1. Wall Mounted Racking**

#### **2.2.1.1. Acceptable Product:**

- .1 Wall Mounted Red Rack
- .2 Qty: 27 Total
- .3 Run Lengths Item Numbers:
  - (A) RRWM-4/24
    - (a) Qty: 4
  - (B) RRWM-5/24
    - (a) Qty: 1
  - (C) RRWM-6/24
    - (a) Qty: 1

### **2.2.2. Free Standing Racking**

#### **2.2.2.1. Acceptable Product:**

- .1 Freestanding Red Rack, Double Sided Units
- .2 Item Number: RFDS-4/24
  - (A) Qty:3
- .3 Required Locker Count:
  - (A) 14
- .4 Connect 2 Free Standing racking to ensure required locker count is provided.
- .5 Size Requirements:
  - (A) Width: 24"
  - (B) Depth 20"
  - (C) Height: 82"

### **2.2.3. Construction:**

- 2.2.3.1. Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.
- 2.2.3.2. Vertical Dividers:
  - .1 Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
  - .2 Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
- 2.2.3.3. Back Panel:
  - .1 Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
- 2.2.3.4. Shelves:
  - .1 (1) Top, (1) Bottom. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Top shelf includes a 20 gauge steel bracket to accept a 2" x 16" name placard.
- 2.2.3.5. Apparel Hooks:
  - .1 (3) per opening. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed.

## **2.3. ACCESSORIES**

### **2.3.1. Horizontal Hang Bar:**

#### **2.3.1.1. Tube:**

- .1 1.25"O.D. x 16 gauge 304 stainless steel tubing.

#### **2.3.1.2. Brackets:**

- .1 Attach to side mesh, powder coated.

- 2.3.2. Gear Hangers:
  - 2.3.2.1. All lockers shall receive the following:
    - .1 FDH: Flat dry Hanger
    - .2 DKH-O: Dry Kwik Coat Hanger – Open Loop
    - .3 GDH: Glove Dry Hanger
    - .4 PPH-12: Proximity Pant Hanger
    - .5 BPH: Hanging Apparel Hook
- 2.3.3. Label Holder / Name Plate
  - 2.3.3.1. Each locker shall be provided a label holder
    - .1 Item: MLH: Red Metal Label Holder

## **2.4. FINISH**

- 2.4.1. General:
  - 2.4.1.1. All system components excluding assembly and mounting hardware and stainless-steel components are to receive the standard finish.
- 2.4.2. Standard Finish:
  - 2.4.2.1. Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable TGIC powder coating.
- 2.4.3. Color:
  - 2.4.3.1. Red Baron

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine areas to receive lockers.
- 3.1.2. Notify architect if areas are not acceptable.
- 3.1.3. Do not begin installation until unacceptable conditions have been corrected.

### **3.2. INSTALLATION**

- 3.2.1. Install lockers in accordance with manufacturer's instructions.
- 3.2.2. Use manufacturer's hardware for assembly.
- 3.2.3. Anchor to mounting surface with proper hardware.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 1.6. Closeout Submittals
- .7 2.1. Manufacturers
- .8 2.2. Materials
- .9 2.3. Aluminum Finishes
- .10 2.4. Fabrication
- .11 3.1. Installation

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Ground-set flagpoles.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Coordination
  - 1.4.1.1. Coordinate with work of other sections to ensure satisfactory and expeditious completion of the work of this section.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Product data sheets:
  - 1.5.2.1. Submit manufacturer's *Product* data sheets for Products and equipment proposed for use in the work of this section.
- 1.5.3. Shop drawings:
  - 1.5.3.1. Indicate dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.
- 1.5.4. Samples:
  - 1.5.4.1. Submit duplicate samples of each finish specified.

### **1.6. CLOSEOUT SUBMITTALS**

- 1.6.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.6.2. Operation and maintenance data:
  - 1.6.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

## **2 PRODUCTS**

### **2.1. MANUFACTURERS**

- 2.1.1. Approved Manufacturer
  - 2.1.1.1. Ewing Flagpole Co. Inc.
  - 2.1.1.2. Or equivalent

### **2.2. MATERIALS**

- 2.2.1. Aluminum: Aluminum Association alloy AA 6063-T6 seamless extruded aluminum tubing.
- 2.2.2. Flagpole; cone tapered:
  - 2.2.2.1. Seamless, uniform, straight line tapered section above cylindrical butt section.
  - 2.2.2.2. Height above mounting base:



- (1) 12192 mm (40'-0")
- 2.2.2.3. Flagpole, bases and anchorage devices, complete with flag to resist minimum wind gust velocity of:
  - (1) 145 km/h (90 ml/h)
- 2.2.2.4. Acceptable *Product*:
  - (1) Flagpole; Ewing Flagpoles 'SCA-40NS2' Architectural Series.
  - (2) Base: Ewing Flagpoles Co. Inc. 'B5 Fixed'.
  - (3) Halyard: Ewing Flagpoles Co. Inc. 'External' System'.
  - (4) Or equivalent.
  - (5) Substitutions: Refer to Section 01 25 00.
  - (6) Finish: Clear anodized to AA Designation AA-M12C22A31.
  - (7) Finial; ball: Ball of 1.6 mm (3/5") minimum thick, gold colour, 150 mm (6"), spun from aluminum with watertight seams and mounted to rod fitted to revolving truck.
  - (8) Cleats: 230 mm (9") size, 2 per halyard, cast aluminum finish to match flagpole.
  - (9) Halyard, internal:Stainless steel gearless winch, mounted inside flagpole shaft, accessible by removable locking access door, self-locking winch, lockable at any point operable with a removable crank handle through access hole in shaft. Stainless steel cabling throughout, routed through shaft interior and wound on winch.
  - (10) Swivel snaps: 2 per halyard; aluminum with neoprene or vinyl covers.
  - (11) Cleat box: One per cleat; cast aluminum finish to match flagpole. Furnish hasp for padlock, hinged cover, and tamperproof screws. Include lockable cleat box.
  - (12) Base cover: Spun aluminum base cover, finish to match flagpole.
  - (13) Lightning protection:Copper-plated steel with copper wire bolted to flagpole with stainless steel bolt and galvanized steel washer to insulate cable lug from flagpole.
  - (14) Steel ground spike welded to baseplate is an acceptable alternative.
  - (15) Concrete base: under work of Section 32 13 13.

### **2.3. ALUMINUM FINISHES**

- 2.3.1. Finish exposed surfaces of aluminum components:
  - 2.3.1.1. Clear anodized to AA Designation AA-M12C22A31.

### **2.4. FABRICATION**

- 2.4.1. Supply flagpole as complete unit including mounting brackets anchorage and fittings.
- 2.4.2. Fabricate mountings of same metal as flagpoles where exposed and of galvanized steel where concealed.

## **3 EXECUTION**

### **3.1. INSTALLATION**

- 3.1.1. Submit manufacturer's information and templates required for installation of work of this section, and assist or supervise, or both, the setting of anchorage devices, and construction of other Work incorporated with Products specified in this section in order that they function and perform as intended.
- 3.1.2. Install flagpoles, mounting brackets and fittings to reviewed shop drawings and manufacturer's written instructions.
- 3.1.3. Check and adjust installed fittings for smooth operation of halyards.
- 3.1.4. Provide ground stakes, for positive lightning ground for each ground set flagpole installation.

**END OF SECTION**

## **1 GENERAL**

### **1.1 SECTION INCLUDES**

- 1.1.1 Outdoor public use EV charging stations.
  - 1.1.1.1 Electric Vehicle Supply Equipment (EVSE).
- 1.1.2 This section does not include fire truck charging station.

### **1.2 REFERENCES**

- 1.2.1 The equipment and components in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted).
  - 1.2.1.1 CSA Group:
    - (1) CSA C22.2 No. 281.2-12 - Standard for safety for personnel protection systems for electric vehicle (EV) supply circuits: Particular requirements for protection devices for use in charging systems (Tri-national standard, with UL 2231-2 and NMX-J-668/2-ANCE).
    - (2) CSA C22.2 No. 282-13 - Plugs, receptacles, and couplers for electric vehicles (Tri-national standard, with UL 2251 and NMX-J-678-ANCE-2013).
    - (3) CSA C22.2 No. 280-13 - Electric vehicle supply equipment (Tri-national standard, with UL 2594 and NMX-J-677-ANCE-2013).
  - 1.2.1.2 ISO 15693.
  - 1.2.1.3 Ontario Electrical Safety Code, Section 86 – Electric Vehicle Charging Systems.
  - 1.2.1.4 Open Charge Alliance:
    - (1) Open Charge Point Protocol, v2.0.1., or latest edition.
  - 1.2.1.5 SAE J1772 - Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler.

### **1.3 ALTERNATES**

- 1.3.1 Submit bid based on equipment manufactured by Chargepoint.
- 1.3.2 The bidder may submit with bid an alternative price indicating the credit to substitute with another manufacturer. Indicate the proposed manufacturer on the bid form if the alternative price is submitted.

### **1.4 ACTION SUBMITTALS**

- 1.4.1 Manufacturer shall provide the following documents to Owner for review and evaluation in accordance Section 01 33 00:
  - 1.4.1.1 Product Data on specified product.
  - 1.4.1.2 Shop Drawings on specified product.

### **1.5 CLOSEOUT SUBMITTALS**

- 1.5.1 Manufacturer shall provide three copies of installation, operation and maintenance procedures to Owner in accordance with Section 01 77 00.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- 1.6.1 Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
  - 1.6.2 Contractor shall inspect and report concealed damage to carrier within 48 hours.
-

- 1.6.3 Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
- 1.6.4 Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.
- 1.6.5 Follow (standards) service conditions before, during and after EVSE installation.

## **1.7 WARRANTY**

- 1.7.1 Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of purchase, whichever occurs first.

## **1.8 FIELD MEASUREMENTS**

- 1.8.1 Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in the Ontario Electrical Safety Code.

## **2 PRODUCTS**

### **2.1 MANUFACTURERS**

- 2.1.1 Chargepoint. Owner's standard.
- 2.1.2 Substitutions: in accordance with PART 1 article "ALTERNATES".

### **2.2 ELECTRIC VEHICLE ENERGY MANAGEMENT SYSTEM (EV EMS)**

- 2.2.1 EV EMS is defined as a means used to control electric vehicle supply equipment loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads. The system may consist of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable devices.
- 2.2.2 Provide a hardware-agnostic electric vehicle energy management system (EV EMS) in order to reduce the overall electrical EV demand on the building.
- 2.2.3 System to monitor loads and automatically control EVSE loads. System to be sized based on a nominal 2 kW per parking stall equipped with EV charging (20% of total parking spaces).

### **2.3 LEVEL 2 CHARGING STATIONS, GENERAL**

- 2.3.1 Level 2 charging.
  - 2.3.1.1 208-240 V, single phase, 30 A, 7.2 kW, 60 Hz power system equipped with earth ground supplied by a dedicated 2-pole 40 A 80% rated breaker.
- 2.3.2 Nuisance tripping avoidance and auto re-closing.
- 2.3.3 Network communication protocol TCP/IP.
- 2.3.4 LED light with multiple colors displaying charging status.
- 2.3.5 Vacuum Fluorescent Display (VFD) screen showing EVSE communications including single phase metering.
- 2.3.6 Radio Frequency identification (RFID) option to control user authorization for EVSE.
- 2.3.7 Software:
  - 2.3.7.1 RFID supporting software application.
  - 2.3.7.2 Support Open Charge Point Protocol (OCPP).
- 2.3.8 Enclosure:
  - 2.3.8.1 NEMA 3R enclosure for wall, pole, single and double pedestal mounting options. Exact configuration as noted on plans.

- 2.3.9 Charging port: SAE J1772.
- 2.3.10 Be network or internet addressable and be capable of participating in a demand-response program or time-of-use pricing to encourage off-peak charging.
- 2.3.11 Components
  - 2.3.11.1 6.1 m (20 ft) connected charging cord.
  - 2.3.11.2 RFID Module.
  - 2.3.11.3 Ethernet and WiFi to support RFID communication.
  - 2.3.11.4 LED charging status display.
  - 2.3.11.5 VFD screen displays greeting, instructions, and message.
  - 2.3.11.6 Integrated ground fault protection (20 mA CCID).
  - 2.3.11.7 Vehicle ground monitor interrupter.
  - 2.3.11.8 Single phase integrated meter.

## **2.4 LEVEL 2 CHARGING STATIONS, PUBLIC ACCESS**

- 2.4.1 Chargepoint CT4000 series (basis of design), dual-port.
- 2.4.2 Compatible with PlugShare.

## **2.5 FINISH**

- 2.5.1 Hot-rolled, Low Carbon Steel with powder coat finish.

# **3 EXECUTION**

## **3.1 EXAMINATION**

- 3.1.1 The following procedures shall be performed by the Contractor.
  - 3.1.1.1 Examine installation area to assure there is enough clearance to install EVSE.
  - 3.1.1.2 Check concrete pads for uniformity and level surface.
  - 3.1.1.3 Verify that equipment is ready to install.
  - 3.1.1.4 Verify field measurements are as instructed by manufacturer.
  - 3.1.1.5 Verify that required utilities are available, in proper location and ready for use.
  - 3.1.1.6 Beginning of installation means installer accepts conditions.
  - 3.1.1.7 Verify proper IT infrastructure provisions are installed.
  - 3.1.1.8 Verify required ventilation infrastructure for indoor use.

## **3.2 INSTALLATION**

- 3.2.1 Installation shall be performed by the Contractor.
- 3.2.2 Install equipment per manufacturer's instructions.
- 3.2.3 Install gateway if require by the manufacturer.
- 3.2.4 Install additional safety labels if needed per district.
- 3.2.5 Mechanical protection:
  - 3.2.5.1 Provide mechanical protection at each EV charger in accordance with OESC rule 2-200, and ESA Bulletin 86-1-latest version.
  - 3.2.5.2 Protection of EVSE can be achieved by locating the equipment where it is unlikely to be struck by a vehicle, such as:
    - (1) EVSE installed on a raised curb or sidewalk, at a sufficient distance back from the edge of the curb.
    - (2) Installing guards such as bollards or parking stops.
    - (3) Mounting wall mounted units at a height where it unlikely to be struck by a vehicle.

- 3.2.6 Provide signage at each EV charging space. Language used on reserved parking signage must reflect the spirit of the American Council for an Energy Efficient Economy (ACEEE) Green Book methodology (or a local equivalent for projects outside the U.S.).

### **3.3    *STARTUP***

- 3.3.1 Setup charging stations for free charging, with Owner's option in future to activate billing to the user for use of the charging station.
- 3.3.2 Connect to Owner's LAN or EV EMS for billing.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Closeout Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, And Handling
- .8 1.8. Extended Warranty
- .9 2.1. Acceptable Manufacturers
- .10 2.2. Hardware – Manual Controlled Shades
- .11 2.3. Assembly
- .12 2.4. Shade Mounting System
- .13 2.5. Aluminum Finish
- .14 2.6. Shade Fabric Types
- .15 2.7. Fabrication
- .16 3.1. Installation
- .17 3.2. Adjusting And Cleaning
- .18 3.3. Closeout Activities

### **1.3. SUMMARY**

- 1.3.1. Section Includes
  - 1.3.1.1. Roller window sunshades at interior locations.
  - 1.3.1.2. Roller window room darkening (black-out) shades at interior locations.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this section.
  - 1.4.2.2. Submit flammability performance data.
  - 1.4.2.3. Submit manufacturers' installation instructions.
- 1.4.3. Shop drawings:
  - 1.4.3.1. Submit shop drawings or fully dimensioned catalogue cuts.
  - 1.4.3.2. Window treatment schedule: Use same designations indicated on the Contract Documents.
  - 1.4.3.3. Clearly indicate general construction, configurations, jointing methods and locations, fastening methods, handing of controls, required blocking locations, banding (tandem shades), and installation details.
- 1.4.4. Samples:
  - 1.4.4.1. Submit samples of each material and finish colour selected and each accessory.

### **1.5. CLOSEOUT SUBMITTALS**

- 1.5.1. Submit closeout submittals in accordance with Section 01 77 00.
- 1.5.2. Operation and maintenance data:
  - 1.5.2.1. Submit manufacturer's operation and maintenance instructions for inclusion in the operation and maintenance manuals.

## **1.6. QUALITY ASSURANCE**

### **1.6.1. Qualifications:**

#### **1.6.1.1. Manufacturers:**

- (1) Company specializing in manufacturing the Products specified in this section, with a minimum of 10 years' experience.

#### **1.6.1.2. Installers / applicators / erectors:**

- (1) Work of this section shall be by forces in the direct employ or under control of the system manufacturer, skilled, trained, and experienced in work of similar scope and complexity.

### **1.6.2. Mock-ups:**

- 1.6.2.1. Erect 1 full size mock-up each roller shade type at the *Place of the Work* for review. Completed and accepted mock-up shall act as the standard to which balance of the work of this section will be judged.

## **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Before delivery to the Place of the Work, check each shade for operation; remove finger marks and smudges.

- 1.7.2. Package Products to prevent distortion in shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings.

## **1.8. EXTENDED WARRANTY**

- 1.8.1. Warrant work of this section in accordance with Section 01 78 36 for a period of 2 years.

## **2 PRODUCTS**

### **2.1. ACCEPTABLE MANUFACTURERS**

- 2.1.1. Subject to compliance with requirements, *Provide* products by one of the following manufacturers:

#### **2.1.1.1. Altex**

#### **2.1.1.2. Elite Window Fashions**

#### **2.1.1.3. MechoShade Systems, Inc.**

#### **2.1.1.4. Solarfective Products by Legrand Global**

#### **2.1.1.5. SunProject Inc.**

#### **2.1.1.6. Sun Glow Window Covering Products of Canada Ltd.**

#### **2.1.1.7. Or equivalent**

### **2.2. HARDWARE – MANUAL CONTROLLED SHADES**

- 2.2.1. Chain operated, with infinite positioning. Left or right hand operation and banding as applicable to suit *Place of the Work* condition.

#### **2.2.1.1. Drive assembly:**

- (1) Must allow finger tip control and include a built in shock absorber system to prevent chain breakage under normal operating conditions;
- (2) Factory set for the size and travel of the shades;
- (3) Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.
- (4) Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have passed a 40 kg (90 lb) load test. Chain may be positioned at either, or both, ends of the shade without disassembly of the shade unit.
- (5) Provide counter balancing mechanism designed to offset the weight of the shade and give fingertip control.

- 2.2.2. Control shades and room darkening shades independently.

### **2.3. ASSEMBLY**

- 2.3.1. Provide fully factory assembled shade unit consisting of 2 shade brackets, one piece extruded aluminum shade tube, extruded aluminum fascia, aluminum profile hembars, extruded vinyl fabric spline, and fabric as specified.

- 2.3.2. Fabric shall hang straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
- 2.3.3. Factory modify housings where necessary to bypass columns.
- 2.3.4. End brackets:
  - 2.3.4.1. A two piece molded ABS construction with nylon drive sprocket. Bracket colour shall coordinate with the fascia colour.
- 2.3.5. Shade tube:
  - 2.3.5.1. Minimum 1.52 mm (0.060") thick extruded aluminum with three equally spaced continuous stiffening fins, non-sag design, maximum deflection under full load of fabric L/700.
- 2.3.6. Fascia:
  - 2.3.6.1. Minimum 1.5 mm (1/6") thick extruded aluminum.
- 2.3.7. Hembar:
  - 2.3.7.1. Extruded aluminum with matching plastic end finials.
- 2.3.8. Mounting:
  - 2.3.8.1. Removal of shade system shall not require the disassembly of the shade unit.
- 2.3.9. Room darkening shade features:
  - 2.3.9.1. 13 mm (1/2") pile mounted in prefinished 38 mm x 28 mm (1-1/2" x 1-1/8") extruded aluminum side and bottom channels finished to match mullions. Include Dynamic hembar to allow for variance in window sill level.

## **2.4. SHADE MOUNTING SYSTEM**

- 2.4.1. Design extruded aluminum bracket to accept preassembled shade system.
  - 2.4.1.1. Use brackets to facilitate the alignment with shade opening.
- 2.4.2. Modular construction:
  - 2.4.2.1. Shades shall be removable as a complete modular unit without any component disassembly required.

## **2.5. ALUMINUM FINISH**

- 2.5.1. Exposed aluminum: Clear anodized AA-M12C22A31.
- 2.5.2. Unexposed aluminum: Mill finish.

## **2.6. SHADE FABRIC TYPES**

- 2.6.1. Sun control fabric; dimensionally stable shade fabric:
  - 2.6.1.1. Acceptable Products; 3% open area:
    - (1) Solarfactive 'Solarblock 300 Series'
    - (2) or equivalent.
  - 2.6.1.2. Colour: as selected by the *Consultant* from the manufacturer's full range.
- 2.6.2. Performance:
  - 2.6.2.1. Fabric shall hang flat, without buckling or distortion. Edge, where trimmed, shall hang true and straight, without shifting sideways more than 3 mm (1/8") in either direction due to warp distortion or weave design.
  - 2.6.2.2. Colour fast, retain its shape, and not be affected by moisture or heat.
- 2.6.3. Flammability:
  - 2.6.3.1. Certified by an independent Laboratory to pass CAN/ULC S109-14.

## **2.7. FABRICATION**

- 2.7.1. Finished assemblies shall be, square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance.
- 2.7.2. Factory applied finish shall be uniform, smooth and without blemishes.
- 2.7.3. The fabric shall be colour fast, retain its shape, not be affected by moisture or heat, and shall be non-flammable. Cut fabric to eliminate glare and reflection from shining surfaces while maintaining exterior view. The top of the fabric is retained in recessed spline of the shade roller and the bottom of the fabric is retained by the hem bar.



### **3 EXECUTION**

#### **3.1. INSTALLATION**

- 3.1.1. Install shade systems in plumb, squared, adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (1/8") in either direction within channels after installation.
- 3.1.2. Fabric shall be pre-measured and manufactured off-Site.
- 3.1.3. Shades shall be snapped into place without screws or visible fasteners.
- 3.1.4. Incorporate reinforcing, fastening and anchorage required for installation of shades.
- 3.1.5. Securely attach installation fittings to their mounting surfaces with stainless steel or hardened aluminum screws of proper length and type, and durable anchors.
- 3.1.6. Install shade roller true and level, and with cloth to hang flat without buckling or distortion.
- 3.1.7. Room darkening shades (black-out) to be installed to eliminate passage of light from exterior.

#### **3.2. ADJUSTING AND CLEANING**

- 3.2.1. Verify that installed shade system functions properly and adjust it accordingly to ensure satisfactory operation.
- 3.2.2. Refinish damaged or defective work so that no variation in surface appearance is discernible.

#### **3.3. CLOSEOUT ACTIVITIES**

- 3.3.1. Demonstration
  - 3.3.1.1. Before acceptance of system, arrange for demonstration of equipment with authorized representatives of the Owner, to be performed by representative of shade manufacturer to assure proper function, operation and explanation.
  - 3.3.1.2. Conduct comprehensive demonstration for the Owner's staff on operation and care of interior window treatments.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Requirments
- .4 1.4. Section Included
- .5 1.5. References
- .6 1.6. Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Project Conditions
- .10 1.10. Warranty
- .11 1.11. Maintenance
- .12 2.1. Materials
- .13 2.2. Construction
- .14 3.1. General
- .15 3.2. Installation
- .16 3.3. Protection

### **1.3. REQUIRMENTS**

- 1.3.1. The Contractor shall, together with any and all Subcontractors involved in the work of this section, examine all surfaces or conditions relating to the Work, in order to determine the acceptability of such surfaces or conditions for the work of this section to commence.
- 1.3.2. Subcontractors shall report in writing, any observed defects or deficiencies in any surfaces or conditions that would adversely affect the work of this section, to the Contractor for correction prior to commencing the work of this section.
- 1.3.3. Commencement of the work of this section shall imply acceptance of all surfaces and conditions.

### **1.4. SECTION INCLUDED**

- 1.4.1. Provision of all labour, materials, equipment and incidental services necessary to provide custom fabricated stainless steel casework and associated hardware.
- 1.4.1.1. Stainless steel counters.
  - 1.4.1.2. Stainless steel backsplashes.

### **1.5. REFERENCES**

- 1.5.1. SEFA 8: Laboratory Furniture – Casework, Shelving and Tables Guidelines
- 1.5.2. ADA (ATBCB ADAAG) Americans with Disabilities Act Accessibility Guidelines
- 1.5.3. Americans with Disabilities Act (ADA)

### **1.6. SUBMITTALS**

- 1.6.1. Submit under provisions of Section 01 30 00 - Submittals.
- 1.6.2. Product Data:
- 1.6.2.1. Drawings shall include data and details for construction of the laboratory casework as well as information regarding the name, quantity, type and construction of materials (such as hardware, gauges, etc), that will be used to complete the project.
- 1.6.3. Shop Drawings:
- 1.6.3.1. The laboratory casework manufacturer shall furnish shop drawings illustrating the layout and placement of all laboratory casework shelving and countertops.

- 1.6.3.2. Indicate full details of all brackets and supports.
- 1.6.3.3. Indicate the type and location of all service fittings and associated supply connections.
- 1.6.3.4. Preparation instructions and recommendations.
- 1.6.3.5. Storage and handling requirements and recommendations.
- 1.6.3.6. Installation methods
- 1.6.4. Selection Samples:
  - 1.1.1.1. Submit the following:
    - (1) Manufacturer's standard stainless steel finish, minimum sample size (2 inches by 3 inches) 50mm x 76mm.
    - (2) One Countertop backsplash and finished edge.
- 1.6.5. Quality Assurance Submittals:
  - 1.6.5.1. Design Data/Test Reports:
    - (1) Manufacturer shall submit test data and design criteria which are in compliance with the project specifications.
  - 1.6.5.2. Certificates:
    - (1) All certifications required in the specifications shall be submitted with the original submittal package under separate cover. Certificates must be provided with the signature of a qualified individual of the supplier.
  - 1.6.5.3. Manufacturers' Instructions:
    - (1) Provide manufacturer's instructions for installation and maintenance of all products provided and installed within this section. Instructions will be in bound form, tabbed and organized by section number.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Manufacturer/Fabricator
  - 1.7.1.1. Manufacturers or fabricators providing Products under this Section shall have sufficient plant, equipment and competent personnel to provide the Products, in accordance with the Contract Documents. Firm(s) shall have past experience in the manufacture or fabrication of the Products specified herein, and shall have successfully completed Projects of similar scope and type.
- 1.7.2. Installation/Application
  - 1.7.2.1. Installers or applicators of the Products specified herein, shall be competent in the skills required to perform such tasks. Installation shall be performed in accordance with industry standards specified herein, warranty requirements, and in accordance with generally accepted, industry best practices.
- 1.7.3. Documentation
  - 1.7.3.1. If requested by the Consultant, submit documentation to support the competency of firms and personnel..

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Packaging, Shipping, Handling and Unloading
  - 1.8.1.1. Packaging:
    - (1) Products shall have packaging adequate enough to protect finished surfaces from soiling or damage during shipping, delivery and installation.
  - 1.8.1.2. Delivery:
    - (1) Casework delivery shall only take place after painting, utility rough-ins and related activities are completed that could otherwise damage, soil or deteriorate casework in installation areas.
  - 1.8.1.3. Handling:
    - (1) Care, such as the use of proper moving equipment, experienced movers, etc., shall be used at all times to avoid damaging the casework. Until installation takes place, any wrapping, insulation or other method of protection applied to products from the factory will be left in place to avoid accidental damage.
- 1.8.2. Acceptance at Site:

- 1.8.2.1. Casework will not be delivered or installed until the conditions specified under Part 3, Installation section of this document have been met.
- 1.8.3. Storage:
  - 1.8.3.1. Casework shall be stored in the area of installation. If, prior to installation, it is necessary for casework to be temporarily stored in an area other than the installation area, the environmental conditions shall meet the environmental requirements specified under the Project Site Conditions article of this section.
- 1.8.4. Waste Management and Disposal:
  - 1.8.4.1. The supplier of the laboratory casework is responsible for removing any waste or refuse resulting from the installation of, or work pertaining to laboratory casework; thereby leaving the project site clean and free of debris. Trash container(s) to be provided by others.

## **1.9. PROJECT CONDITIONS**

- 1.9.1. Field Measurements:
  - 1.9.1.1. Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings.
  - 1.9.1.2. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

## **1.10. WARRANTY**

- 1.10.1. Provide manufacturer's warranty against defects in materials.
  - 1.10.1.1. Warranty shall provide for all material and labor to repair or replace defective materials.
- 1.10.2. Warranty period:
  - 1.10.2.1. 2 years from date of substantial completion.

## **1.11. MAINTENANCE**

- 1.11.1. Provide maintenance requirements as specified by the manufacturer.

# **2 PRODUCTS**

## **2.1. MATERIALS**

- 2.1.1. Stainless Steel:
  - 2.1.1.1. Sheet: ASTM A240, Type 304 or 316 alloy.
  - 2.1.1.2. Finish: Unless otherwise indicated, AISI No. 4 Brushed Finish.
- 2.1.2. Galvanized Sheet Steel:
  - 2.1.2.1. Commercial quality galvanized sheet steel to ASTM 653, Designation Z275.
- 2.1.3. Sealant:
  - 2.1.3.1. One component, RTV silicone sealant. Colour to suit application.

## **2.2. CONSTRUCTION**

- 2.2.1. Use the following minimum steel thicknesses for manufacturing:
  - 2.2.1.1. (11 Ga) 3mm leveling bolt gusset plates.
  - 2.2.1.2. (16 Ga) 1.5mm for tubular rails, legs for tables, gusset plates, cabinet top and intermediate horizontal rails.
  - 2.2.1.3. (16 Ga) 1.5mm for counter tops and support brackets.
- 2.2.2. Countertops & Backsplashes
  - 2.2.2.1. Fabrication:
    - (1) All factory welds shall be made using the TIG process. Filler rod shall be of the same composition as the base material.
  - 2.2.2.2. Tops:
    - (1) Form tops with 1.25" high (32mm) edges with 0.5" (12mm) return flange. Reinforce with particleboard wood core or metal hat channels as required. Form edges, flanges and backsplashes integrally from one sheet of steel. Intersections between backsplashes and work surface shall be radiused a minimum of 0.375" (9mm).

- 2.2.2.3. Sink Tops:
  - (1) Form tops with 1.25" high (32mm) edges with 0.5" (12mm) return flange. Marine edges shall integrally formed on all edges. Marine edges shall be 1" (25mm) wide and 0.25" (6mm) high. Work surface shall be reinforced with wood core or metal hat channels as required. Form edges, flanges and backsplashes integrally from one sheet of steel. Intersections between backsplashes and work surface shall be radiused a minimum of 0.375" (9mm).
- 2.2.2.4. Sink Bowls:
  - (1) Sink bowls shall be made of the same material as the work surface and shall be of equal or greater thickness. Sinks bowls shall be formed from one piece of steel with all inside corners radiused. Welds shall be hammered, ground and polished to produce a smooth, invisible joint. Sinks shall be welded into the work surface and welds shall be ground and polished to produce a smooth, invisible joint.
- 2.2.2.5. Joints:
  - (1) Factory welds shall be ground and polished to provide an invisible joint. Field connections shall be mechanical "tongue and groove" interlocking design with concealed bolts to provide a hairline seam.
- 2.2.2.6. Sound Deadener:
  - (1) Countertops and sinks shall have sound deadening material applied as required to the underside. Nominal thickness shall be 0.062" (1.5mm). Sound deadener shall be waterborne, non-flammable and shall contain no volatile organic compounds.
- 2.2.3. Service Fittings and Fixtures:
  - 2.2.3.1. Refer to Mechanical Drawings and Specifications.

### **3 EXECUTION**

#### **3.1. GENERAL**

- 3.1.1. Examine the site and take all measurements necessary to ensure accurate and proper fitting of this work into the building.

#### **3.2. INSTALLATION**

- 3.2.1. Countertop *Installation*:
  - 3.2.1.1. Fabricate countertops in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.
  - 3.2.1.2. Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.
  - 3.2.1.3. Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.
  - 3.2.1.4. Joints shall be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.

#### **3.3. PROTECTION**

- 3.3.1. Cover finished surfaces with heavy kraft paper or put in cartons during shipment.
- 3.3.2. Protect installed laminated surfaces by approved means.
- 3.3.3. Do not remove until immediately before final inspection.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including Sections of Division 01.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Definition
- .4 1.4. Section Included
- .5 1.5. Submittals
- .6 1.6. Quality Assurance
- .7 1.7. Delivery, Storage, And Handling
- .8 1.8. Project Conditions
- .9 1.9. Warranty
- .10 1.10. Maintenance
- .11 2.1. Manufacturers
- .12 2.2. Solid Surface Material – Countertops / Millwork
- .13 2.3. Solid Surface Material – Window Sills
- .14 2.4. Accessories
- .15 2.5. Fabrication
- .16 3.1. Examination
- .17 3.2. Countertop Installation
- .18 3.3. Window Sill Installation
- .19 3.4. Repair
- .20 3.5. Cleaning And Protection

### **1.3. DEFINITION**

- 1.3.1. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

### **1.4. SECTION INCLUDED**

- 1.4.1. Solid surfacing countertops.
- 1.4.2. Solid surfacing millwork and window sills.
- 1.4.3. Adhesives and sealants

### **1.5. SUBMITTALS**

- 1.5.1. Submit under provisions of Section 01 30 00 - Submittals.
- 1.5.2. Product Data:
  - 1.5.2.1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.
  - 1.5.2.2. Submit Material Safety Data Sheets (MSDS) for adhesives and sealants.
- 1.5.3. Shop Drawings:
  - 1.5.3.1. Submit fully dimensioned shop drawings showing countertop and window sill layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.
- 1.5.4. Samples:
  - 1.5.4.1. Submit selection and verification samples for each color, pattern, and finish required.
- 1.5.5. Quality Assurance Submittals:
  - 1.5.5.1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
  - 1.5.5.2. Warranty: Specimen copy of specified warranty.

- 1.5.6. Maintenance Data:
  - 1.5.6.1. Submit manufacturer's published maintenance manual with closeout submittals.

## **1.6. QUALITY ASSURANCE**

- 1.6.1. Qualifications:
  - 1.6.1.1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- 1.6.2. Fabricator / installer qualifications:
  - 1.6.2.1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
- 1.6.3. Applicable standards:
  - 1.6.3.1. Standards of the following, as referenced herein:
    - (1) American National Standards Institute (ANSI)
    - (2) American Society for Testing and Materials (ASTM)
    - (3) National Electrical Manufacturers Association (NEMA)
    - (4) NSF International
  - 1.6.3.2. Fire test response characteristics:
    - (1) Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
      - (A) Flame Spread Index: 25 or less.
      - (B) Smoke Developed Index: 450 or less.
- 1.6.4. Coordination drawings:
  - 1.6.4.1. Shall be prepared indicating:
    - (1) Plumbing work.
    - (2) Electrical work.
    - (3) Miscellaneous steel for the general work.
    - (4) Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
  - 1.6.4.2. Content:
    - (1) Project-specific information, drawn accurately to scale.
    - (2) Do not base coordination drawings on reproductions of the contract documents or standard printed data.
    - (3) Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
    - (4) Provide alternate sketches to designer for resolution of such conflicts.
      - (C) Minor dimension changes and difficult installations will not be considered changes to the contract.
  - 1.6.4.3. Drawings shall:
    - (1) Be produced in 1/2-inch scale for all fabricated items.
  - 1.6.4.4. Drawings must be complete and submitted to the Consultant within 60 days after award of contract for record only.
  - 1.6.4.5. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.
- 1.6.5. Mock-up:
  - 1.6.5.1. Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.
  - 1.6.5.2. Build mock-up to comply with the contract documents and install in a location as directed by the Consultant.
  - 1.6.5.3. Notify the architect two weeks in advance of the date of when the mock-up will be delivered.

- 1.6.5.4. Should mock-up not be approved, re-fabricate and reinstall until approval is secured.
  - (1) Remove rejected units from project site.
- 1.6.5.5. After approval, the mock-up may become a part of the project
- 1.6.5.6. This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.

#### **1.7. DELIVERY, STORAGE, AND HANDLING**

- 1.7.1. Deliver no components to project site until areas are ready for installation.
- 1.7.2. Store components indoors prior to installation.
- 1.7.3. Handle materials to prevent damage to finished surfaces.
- 1.7.4. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

#### **1.8. PROJECT CONDITIONS**

- 1.8.1. Field Measurements:
  - 1.8.1.1. Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings.
  - 1.8.1.2. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
- 1.8.2. Adhesive:
  - 1.8.2.1. Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F

#### **1.9. WARRANTY**

- 1.9.1. Provide manufacturer's warranty against defects in materials.
  - 1.9.1.1. Warranty shall provide for all material and labor to repair or replace defective materials.
  - 1.9.1.2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- 1.9.2. Warranty period:
  - 1.9.2.1. 10 years from date of substantial completion.

#### **1.10. MAINTENANCE**

- 1.10.1. Provide maintenance requirements as specified by the manufacturer.

### **2 PRODUCTS**

#### **2.1. MANUFACTURERS**

- 2.1.1. Acceptable Manufacturer:
  - 2.1.1.1. Caesarstone Quartz Surfacing
  - 2.1.1.2. or Equivalent.

#### **2.2. SOLID SURFACE MATERIAL – COUNTERTOPS / MILLWORK**

- 2.2.1. Acceptable Product:
  - 2.2.1.1. CaesarStone Quartz Surfacing Premium Collection
  - 2.2.1.2. or Equivalent.
- 2.2.2. Composition: 93% crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
- 2.2.3. Thickness: as indicated in the Contract Documents.
- 2.2.4. Colour Group: Greys
- 2.2.5. Colour: Caesarstone #4043 Primordia
- 2.2.6. Finish: Polished.
- 2.2.7. Edge Profile: Miter
- 2.2.8. Flame Spread Value (FSV): Maximum 25.
- 2.2.9. Smoke Developed Value (SDV): Maximum 50.
- 2.2.10. Performance Characteristics



PROPERTY	TEST STANDARD	RESULTS
Water Absorption	ASTM C97 & EN-14617-1	≤0.05%
Density	ASTM C97 & EN 14617-1	≥2.1 gr/cm <sup>3</sup>
Flexural Strength	ASTM C880/C880M-15 EN14617-2	> 35 MPa > 40 MPa
Dimensional Stability	EN 14617-12	Class A
Impact Resistance	EN 14617-9	> 4.9L (J)
Compressive Strength	ASTM C170 EN 14617-15	Dry: 219-299 MPa; Wet: 203-274 MPa 157-243 MPa
Abrasion	ASTM C1243-93 EN 14617-4	Volume of chord: V<130 mm <sup>3</sup> Chord length: <25 mm
Freeze-Thaw Resistance	ASTM C1026	No obvious damage after 20 freeze-thaw cycles
Stain Resistance	ANSI Z 124.6	Pass
Chemical Resistance	ANSI Z 124.6 EN 14617-10	Pass Class C4
Linear Thermal Expansion	ASTM 372 EN 14617-11	<52 x 10 <sup>-6</sup> per C
Thermal Conductivity	EN 12664	<1 W/(m K)
Thermal Shock	EN 14617-6	No visual defects after 20 cycles %
Boiling Water Resistance	ANSI NEMA LD3-3.5	No effect
High Temperature Resistance	ANSI NEMA LD3-2005	No effect
Surface Burning	ASTM E84	Class A - FSI: 0-25 ; SDI: 0-450
Fire Performance	AS 1530.3:1999	Ignitability Index (0-20): 6-8 Spread of Flame Index (0-10): 0-3 Heat Developed Index (0-10): 2-3 Smoke Developed Index (0-10): 6-7
Fire Classification	EN 13501-1	Wall cladding: B-s1-d0 Flooring and stairs: B-fl-s1

### 2.3. SOLID SURFACE MATERIAL – WINDOW SILLS

- 2.3.1. Acceptable Product:
  - 2.3.1.1. CaesarStone Quartz Surfacing Classico Collection
  - 2.3.1.2. or Equivalent.
- 2.3.2. Composition: 93% crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
- 2.3.3. Thickness: as indicated in the Contract Documents.
- 2.3.4. Colour Group: Whites
- 2.3.5. Colour: Caesarstone #2141.
- 2.3.6. Finish: Polished.
- 2.3.7. Edge Profile: Miter
- 2.3.8. Flame Spread Value (FSV): Maximum 25.
- 2.3.9. Smoke Developed Value (SDV): Maximum 50.
- 2.3.10. Performance Characteristics

PROPERTY	TEST STANDARD	RESULTS
Water Absorption	ASTM C97 & EN-14617-1	≤0.05%
Density	ASTM C97 & EN 14617-1	≥2.1 gr/cm <sup>3</sup>
Flexural Strength	ASTM C880/C880M-15 EN14617-2	> 35 MPa > 40 MPa
Dimensional Stability	EN 14617-12	Class A
Impact Resistance	EN 14617-9	> 4.9L (J)
Compressive Strength	ASTM C170 EN 14617-15	Dry: 219-299 MPa; Wet: 203-274 MPa 157-243 MPa
Abrasion	ASTM C1243-93 EN 14617-4	Volume of chord: V<130 mm <sup>3</sup> Chord length: <25 mm

Freeze-Thaw Resistance	ASTM C1026	No obvious damage after 20 freeze-thaw cycles
Stain Resistance	ANSI Z 124.6	Pass
Chemical Resistance	ANSI Z 124.6 EN 14617-10	Pass Class C4
Linear Thermal Expansion	ASTM 372 EN 14617-11	<52 x 10 <sup>-6</sup> per C
Thermal Conductivity	EN 12664	<1 W/( m K
Thermal Shock	EN 14617-6	No visual defects after 20 cycles %
Boiling Water Resistance	ANSI NEMA LD3-3.5	No effect
High Temperature Resistance	ANSI NEMA LD3-2005	No effect
Surface Burning	ASTM E84	Class A - FSI: 0 25 ; SDI: 0 450
Fire Performance	AS 1530.3:1999	Ignitability Index (0-20): 6-8 Spread of Flame Index (0-10): 0-3 Heat Developed Index (0-10): 2-3 Smoke Developed Index (0-10): 6-7
Fire Classification	EN 13501-1	Wall cladding: B-s1-d0 Flooring and stairs: B-fl-s1

## 2.4. ACCESSORIES

### 2.4.1. Mounting Adhesives

2.4.1.1. Provide structural-grade silicone, or epoxy adhesives, as recommended by manufacturer for application and per conditions of use.

#### 2.4.1.2. Acceptable Silicone Manufacturers

- (1) Dow Corning®
- (2) GE Sealants and Adhesives
- (3) Or equivalent

#### 2.4.1.3. Acceptable Epoxy Manufacturers

- (1) Akemi North America
- (2) Bonstone Materials Corporation
- (3) Tenax U.S.A.
- (4) Or equivalent

2.4.1.4. Provide spacers, if required, recommended by adhesive manufacturer

### 2.4.2. Stone Adhesive

2.4.2.1. Provide epoxy, or polyester adhesive, recommended by manufacturer for application and conditions of use.

#### 2.4.2.2. Acceptable Manufacturers

- (1) Akemi North America
- (2) Bonstone Materials Corporation
- (3) Tenax U.S.A.
- (4) or equivalent

2.4.2.3. Color: Adhesive that will be visible in finished work should be tinted to match quartz surfacing.

### 2.4.3. Joint Sealants

2.4.3.1. Clear silicone sealant, as recommended by manufacturer for application and per conditions of use.

2.4.3.2. Provide anti-bacterial type where required.

#### 2.4.3.3. Acceptable Manufacturers:

- (1) Dow Corning®
- (2) GE Sealants and Adhesives

### 2.4.4. Solvent:

2.4.4.1. Product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives and sealants.

### 2.4.5. Cleaning Agents:

2.4.5.1. Non-abrasive, low pH cleansers.

## **2.5. FABRICATION**

- 2.5.1. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to reviewed shop drawings and manufactures published fabrication requirements.
- 2.5.2. Form joint seams between solid surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.
- 2.5.3. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine substrates and conditions that could adversely affect the work of this Section.
- 3.1.2. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.
- 3.1.3. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

### **3.2. COUNTERTOP INSTALLATION**

- 3.2.1. Install solid surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.
  - 3.2.1.1. Provide product in the largest pieces available.
  - 3.2.1.2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
  - 3.2.1.3. Exposed joints/seams shall not be allowed.
- 3.2.2. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.
- 3.2.3. Provide minimum 1/2 inch radius for countertop inside corners.
- 3.2.4. Fill gaps between countertop and terminating substrates with specified silicone sealant.
- 3.2.5. Rout sink cutouts to manufacturer's template. Adhere solid surface cast sink units to countertops with specified adhesive.
- 3.2.6. Install backsplashes and end splashes where indicated on Drawings. Adhere to countertops with specified construction adhesive.
- 3.2.7. Vanities:
  - 3.2.7.1. Secure front panels to solid substrate with specified construction adhesive. Maintain 1/16 inch gap between fixed and removable panels.
  - 3.2.7.2. ADA Vanities: Angled front panel to permit wheelchair access to comply with referenced accessibility standard.
- 3.2.8. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
- 3.2.9. Cut and finish component edges with clean, sharp returns.
- 3.2.10. Anchor securely to base cabinets or other supports.
- 3.2.11. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
- 3.2.12. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- 3.2.13. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- 3.2.14. Coved backsplashes and applied side splashes:
  - 3.2.14.1. Install applied side splashes using manufacturer's standard color- matched silicone sealant.
  - 3.2.14.2. Adhere applied side splashes to countertops using manufacturer's standard color-matched silicone sealant

**3.3. WINDOW SILL INSTALLATION**

- 3.3.1. Install window sills for full length of each window unit, securing to substrates with concealed fasteners and specified adhesive.
- 3.3.2. Provide minimum 1/8 inch expansion gap on both sides of window sills. Fill gap with specified joint sealant.
- 3.3.3. Completed work shall be plumb, level, and true, with edges eased and sanded smooth.

**3.4. REPAIR**

- 3.4.1. Repair or replace damaged work which cannot be repaired to Consultants satisfaction.

**3.5. CLEANING AND PROTECTION**

- 3.5.1. Clean solid surfacing components according to manufacturer's published maintenance instructions.
- 3.5.2. Completely remove excess adhesives and sealants from finished surfaces.
- 3.5.3. Protect completed work from damage during remainder of construction period..

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. DESCRIPTION**

- 1.2.1. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of non-structural components of the building so that they remain safe and functional in case of seismic event.
- 1.2.2. Individual specification sections are responsible, including Division 15 & 16, for compliance with seismic requirements.
- 1.2.3. Refer to Mechanical and Electrical specifications for all other requirements for seismic restraint requirements for a post disaster building.

### **1.3. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Description
- .3 1.3. Section Includes
- .4 1.4. Quality Control
- .5 1.5. Submittals
- .6 2.1. Equipment Requirements:
- .7 2.2. Bolts And Nuts
- .8 2.3. Sway Bracing
- .9 3.1. Equipment Restraint And Bracing

### **1.4. QUALITY CONTROL**

- 1.4.1. Shop Drawing Preparation:
  - 1.4.1.1. Have seismic-force-restraint shop drawings and calculations prepared and sealed by a professional structural engineer licensed in the Province of Ontario, experienced in the area of seismic force restraints.
  - 1.4.1.2. Submit seismic data to meet the force requirements specified for all materials and products used in the vertical or lateral restraint connections related to each building component.
- 1.4.2. Coordination:
  - 1.4.2.1. Do not install seismic restraints until seismic restraint submittals are reviewed by the Consultant.
  - 1.4.2.2. As part of interference drawings and scheduling, coordinate all seismic hangers and braces with the installation sequence, required clearances and dimensions for each component to not interfere with other building components or systems, etc.

### **1.5. SUBMITTALS**

- 1.5.1. Submit a coordinated set of equipment anchorage drawings prior to installation including:
  - 1.5.1.1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
  - 1.5.1.2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
  - 1.5.1.3. Numerical value of design seismic brace loads.
  - 1.5.1.4. For expansion bolts, include design load and capacity if different from those specified.

- 1.5.2. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
  - 1.5.2.1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
  - 1.5.2.2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  - 1.5.2.3. Pipe contents.
  - 1.5.2.4. Structural framing.
  - 1.5.2.5. Location of all gravity load pipe supports and spacing requirements.
  - 1.5.2.6. Numerical value of gravity load reactions.
  - 1.5.2.7. Location of all seismic bracing.
  - 1.5.2.8. Numerical value of applied seismic brace loads.
  - 1.5.2.9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  - 1.5.2.10. Seismic brace reaction type (tension or compression). Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- 1.5.3. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
  - 1.5.3.1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  - 1.5.3.2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  - 1.5.3.3. Maximum spacing of hangers and bracing.
  - 1.5.3.4. Seal of registered structural engineer responsible for design.
- 1.5.4. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraphs.

## **2 PRODUCTS**

### **2.1. EQUIPMENT REQUIREMENTS:**

- 2.1.1. Rigidly (Base and Suspended) Mounted Equipment
  - 2.1.1.1. Equipment furnished under this contract must be rigidly mounted. For any rigid equipment which is rigidly anchored, provide flexible joints for piping, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.
  - 2.1.1.2. Suspended equipment bracing attachments should be located just above the center of gravity to minimize swinging. Mission critical base mounted and suspended equipment for Risk Category, and Designated Seismic Systems (DSS) RC IV buildings assigned to Seismic Design Category Coefficient (SDC) C, D, E, or F and Risk Category IV components needed for continued operation after an earthquake must have two nuts provided on each anchor bolt.
- 2.1.2. Nonrigid or Flexibly-Mounted Equipment
  - 2.1.2.1. Select vibration isolation devices so that the maximum movement of equipment from the static deflection point is 6 mm 1/4 inch. Equipment flexibly mounted on vibration isolators must have a bumper restraint or snubber in each horizontal direction and vertical restraints must be provided where require to resist overturning. Isolator housing and restraints must be constructed of ductile materials. A viscoelastic pad or similar material of appropriate thickness must be used between the bumper and components to limit the impact load. Restraints must be designed to resist the calculated horizontal lateral and vertical forces.
  - 2.1.2.2. Spring vibration isolators must be seismically rated, restrained isolators for equipment subject to load variations and large external forces. The seismically rated housing must be sized to meet or exceed the force requirements applicable to the project and meet the required isolation criteria. Design force,

Fp, must be doubled for vibration isolators with an air gap greater than 0.25 inches as specified in ASCE 7-16, Chapter 13.

## **2.2. BOLTS AND NUTS**

- 2.2.1. Hex head bolts, and heavy hexagon nuts must be ASTM A325 or ASTM A490 bolts and ASTM A563 nuts. Provide bolts and nuts galvanized in accordance with ASTM A153/A153M when exposed to weather.

## **2.3. SWAY BRACING**

- 2.3.1. Material used for members listed in the Contract Documents, must be structural steel conforming with the following:
  - 2.3.1.1. Plates, rods, and rolled shapes, ASTM A36/A36M.
  - 2.3.1.2. Wire rope, ASTM A603.
  - 2.3.1.3. Tubes, ASTM A500/A500M, Grade B.
  - 2.3.1.4. Pipes, ASTM A53/A53M, Grade B.
  - 2.3.1.5. Angles, ASTM A36/A36M.
  - 2.3.1.6. Channels (Struts) with in-turned lips and associated hardware for fastening to channels at random points conforming to MFMA-4.

## **3 EXECUTION**

### **3.1. EQUIPMENT RESTRAINT AND BRACING:**

- 3.1.1. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- 3.1.2. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- 3.1.3. Construct seismic restraints and anchorage to allow for thermal expansion.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Administrative Requirements
- .5 1.5. Submittals
- .6 2.1. Materials
- .7 3.1. Dewatering
- .8 3.2. Excavating
- .9 3.3. Backfilling
- .10 3.4. Fill Types And Compaction
- .11 3.5. Field Quality Control
- .12 3.6. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
- 1.3.1.1. Excavation and backfilling for work in areas within building footprint.
  - 1.3.1.2. Work shall be subject to review and approval of Inspection and Testing company.

### **1.4. ADMINISTRATIVE REQUIREMENTS**

- 1.4.1. Conduct a pre-installation meeting in accordance with Section 01 31 19.
- 1.4.2. Independent inspection and testing company shall attend the pre-installation meeting.

### **1.5. SUBMITTALS**

- 1.5.1. Submit required submittals in accordance with Section 01 33 00.
- 1.5.2. Material test reports: For each material proposed for backfill as follows:
- 1.5.2.1. Classification according to ASTM D2487-17.
  - 1.5.2.2. Laboratory compaction curve according to:
    - (1) Standard Proctor Maximum Dry Density (SPMDD): ASTM D698-12(2021).

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Granular A fill: OPSS 1010, Granular A.
- 2.1.2. Granular B fill: OPSS 1010, Granular B Type I.
- 2.1.3. Granular B fill: OPSS 1010, Granular B Type II.
- 2.1.4. Clear stone: OPSS 1004 - November 2021, Clear Stone, 19 mm (3/4") Type 1.
- 2.1.5. Native fill:
  - 2.1.5.1. Clean (meeting chemical criteria for residential land use), native soil, excavated at Place of the Work, as selected and approved by geotechnical engineer, free of organic material including roots and tree or shrub material, particles larger than 200 mm (8"), foreign or building debris, chemicals and infectious substances detrimental to plants, free of deleterious matter, and provided moisture content of fill is controlled and provided fill is capable of being compacted to required density.
- 2.1.6. Moisture content of fill shall be within 2% of optimum moisture density test (ASTM D698-12(2021)).
- 2.1.7. Obtain fill materials from sources approved by geotechnical engineer. Submit reports for acceptance prior to importing fill.



### **3 EXECUTION**

#### **3.1 DEWATERING**

- 3.1.1. Bail, pump out or divert water from excavations, from whatever cause, as it accumulates, and until the permanent drainage is operational and foundations are in place.

#### **3.2 EXCAVATING**

- 3.2.1. Excavate to elevations and dimensions required for installation, construction and inspection of the Work. Remove and dispose of waste, soil and like materials from the Place of the Work and pay dumping costs.
- 3.2.2. Removal of existing boulders and/or concrete elements up to a size of 1 m<sup>3</sup> (1.3 yd<sup>3</sup>), encountered below existing grade while excavating, are included as part of the Work.
- 3.2.3. Notify Consultant at each time of occurrence when existing boulders and/or concrete elements greater than 1m<sup>3</sup> are encountered below existing grade, providing detailed record of each occurrence in writing. This record must be approved by the Consultant before claims for extras will be considered.
- 3.2.4. If upon excavating to the specified elevations, it is found that existing conditions are not fulfilled, adjust the excavations accordingly, but only with the written authorization of the Consultant.
- 3.2.5. Remove water, disturbed soil or foreign matter from footing excavations before placement of reinforcement or concrete.
- 3.2.6. During cold weather, prevent soil which will be adjacent to or beneath concrete from freezing.
- 3.2.7. Excavation will not be considered complete until the soil at founding elevation is inspected and approved by the geotechnical engineer.

#### **3.3 BACKFILLING**

- 3.3.1. Commence backfilling after areas of Work to be backfilled have been inspected, and pipe and conduit joints tested and accepted by Consultant.
- 3.3.2. Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground. Backfill material shall not be frozen or contain ice, snow or debris.
- 3.3.3. Backfill simultaneously each side of walls and other structures to equalize soil pressures.
- 3.3.4. Obtain Consultant's acceptance prior to placing backfill against foundation walls enclosing interior space.
- 3.3.5. Request reviews by Consultant and geotechnical engineer of excavation prior to beginning backfilling.
- 3.3.6. Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Consultant.
- 3.3.7. Place and compact fill materials in continuous horizontal layers not exceeding 200 mm (8") loose depth.
- 3.3.8. Use backfilling methods to prevent disturbing or damaging buried services and site improvements.

#### **3.4 FILL TYPES AND COMPACTION**

- 3.4.1. Dimensions specified in following paragraphs are minimum dimensions of fill after compaction.
- 3.4.2. Compaction shall be to applicable Standard Proctor Maximum Dry Density (SPMDD).
- 3.4.3. Concrete floor slab base course:
  - 3.4.3.1. Provide minimum 200 mm (8") base course of 19mm clear crushed stone to underside of slab compacted to at least 100% of its SPMDD and placed to allow maximum concrete floor slab thickness tolerance of  $\pm 10$  mm (3/8") in accordance with CSA-A23.1-14.
  - 3.4.3.2. Compact disturbed subgrade to at least 98% of its SPMDD.
- 3.4.4. Backfill against foundation walls:
  - 3.4.4.1. Provide fill material, compacted to at least 98% SPMDD.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.
- 3.5.2. In-situ tests and inspections:
  - 3.5.2.1. Independent inspection and testing company shall inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
  - 3.5.2.2. Inspections:
    - (1) Determine prior to placement of fill that site has been prepared in compliance with requirements.
    - (2) Determine that fill material and maximum lift thickness comply with requirements.
    - (3) Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
  - 3.5.2.3. Testing:
    - (1) Test compaction of soils in place according to requirements of Contract Documents. Tests shall be performed at the following locations and frequencies:
      - (A) Paved and building slab areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 200 sq. m (2152 sq. ft.) or less, but in no case fewer than three tests.
      - (B) Foundation wall backfill: At each compacted backfill layer, at least one test for every 30 m (100 feet) or less of wall length, but no fewer than two tests.
      - (C) Trench backfill: At each compacted initial and final backfill layer, at least one test for every 50 m (164 feet) or less of trench length, but no fewer than two tests.

### **3.6. PROTECTION**

- 3.6.1. Protect excavated areas from exposure to sun and rain which would cause cave-ins or softening of beds on which foundations and drains rest. Prevent flow of water and earth fines into excavated pits and trenches. Seal or divert flow from springs that fill excavations.
- 3.6.2. Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with approved material.
- 3.6.3. Protect bottoms of excavations from freezing.
- 3.6.4. Effect measures to minimize dust as result of the Work.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL REQUIREMENTS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Requirements
- .2 1.2. Section Includes
- .3 1.3. Description
- .4 1.4. Site Conditions
- .5 1.5. Environmental Requirements
- .6 2.1. Materials
- .7 2.2. Stockpiling
- .8 3.1. Stripping Of Topsoil
- .9 3.2. Excavation/Grading
- .10 3.3. Proof Rolling
- .11 3.4. Field Quality Control

### **1.3. DESCRIPTION**

- 1.3.1. Provide all labour, materials, tools and equipment necessary for all excavation and backfill to the full extent of work shown on the plans and this specification, including but not limited to the following:
- 1.3.1.1. Grading (cutting and filling) to subgrade elevations including compaction and fine grading of existing earth materials to +/- 25 mm of design subgrade elevations (not uniformly high or low) in accordance with OPSS 206.
  - 1.3.1.2. Proof rolling of subgrade with Geotechnical consultant present
  - 1.3.1.3. Excavation and disposal of all excess unsuitable materials off site.
  - 1.3.1.4. Supply and installation of earth borrow material as required to establish design subgrade elevations.

### **1.4. SITE CONDITIONS**

- 1.4.1. Protection:
- 1.4.1.1. Provide protection (i.e. shoring, cribbing, bracing and planking) to ensure no damage occurs to existing facilities and equipment situated on site. In certain areas only hand tools may be used.
  - 1.4.1.2. Provide adequate protection around bench marks, layout markers, survey markers, and geodetic monuments.
  - 1.4.1.3. Protect bottom of excavations from freezing.
  - 1.4.1.4. Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with lean concrete. Keep bottoms of excavations dry at all times.
  - 1.4.1.5. Direct discharge from pumps, when draining excavations, so that damage to site and adjacent property does not occur.
  - 1.4.1.6. Do not stockpile excavated material to interfere with site operation or drainage.
  - 1.4.1.7. Effect approved measures to minimize dust as a result of all grading work and all other construction activities related to this contract.
  - 1.4.1.8. Protect legal iron bars, bench marks, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise.
  - 1.4.1.9. Ensure sufficient quantities of wood sheeting, timbers, steel members and other materials are available at all times in order to support, brace or protect utilities, structure and properties near to or occurring within excavations.

- 1.4.2. The Contractor shall take all the necessary precautions to protect all utilities against damage. The Contractor shall carry out his work in a safe manner with due regard for roadway traffic to the satisfaction of the Consultant, and any authority having jurisdiction.
- 1.4.3. The Contractor shall have full and sole responsibility for the safety of all excavation performed under this Contract until final acceptance of the work.
- 1.4.4. Utility Lines:
  - 1.4.4.1. Before beginning work, establish location and extent of underground utility lines in area of excavation. Notify Consultant of all existing located services encountered, and do not continue with excavation without the Consultant's instructions. Repair and pay for damages to existing utility lines resulting from the work.
  - 1.4.4.2. Relocate existing lines in area of excavation which must remain active as indicated on the drawings.
  - 1.4.4.3. Remove abandoned utility lines, if any, to distance of 2 m from foundations. Cap lines at cut-off points.
  - 1.4.4.4. Record locations, if any, of maintained, re-routed and abandoned underground utility lines.
  - 1.4.4.5. Repair and pay for damage to existing underground lines as may result from this work.
- 1.4.5. Examination:
  - 1.4.5.1. Ensure in examination of the site that all possible factors concerning earthwork are investigated, and that the following are known in particular:
    - .1 Methods and means available for material handling, disposal, storage, and transportation.
    - .2 Physical conditions of site, including ground water table and drainage course, extent of removals and grading completed under a previous contract (demolition and site demolition).
  - 1.4.5.2. Unsatisfactory Soil Conditions:
    - .1 Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the *Owner's Consultant* and Geotechnical Engineer.
  - 1.4.5.3. All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued.
- 1.4.6. Material Unsuitable for Backfill:
  - 1.4.6.1. The Contractor shall be responsible for all costs associated with the excavation and removal, off site, of all materials unsuitable for backfill or re-use.
- 1.4.7. Water:
  - 1.4.7.1. Keep excavation free from water at all times. *Provide* drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto private property.
- 1.4.8. Inspection and Testing:
  - 1.4.8.1. Testing of materials and compaction will be carried out by testing laboratory designated by the Architect.

## **1.5. ENVIRONMENTAL REQUIREMENTS**

- 1.5.1. Protect and repair exposed excavations where required to prevent adverse effects of rain, freezing weather and other weather conditions on subgrade of subsequent work.
- 1.5.2. Suspend construction operation at times when satisfactory results cannot be obtained on account of rain, snow, freezing weather or other unsatisfactory conditions.
- 1.5.3. Do not carry out filling or backfilling in freezing weather unless authorized by Consultant. Do not use frozen material nor place material where the material in place is already frozen.
- 1.5.4. Dispose of excess or unsuitable earth materials generated from the site grading in accordance with Ontario Reg. 558. The items in the Form of Tender include all costs for disposal of excess or unsuitable material off the site and the Contractor shall make the

arrangements for the disposal of the materials removed in accordance with MOE Reg. 558.

## **2 PRODUCTS**

### **2.1. MATERIALS**

#### **2.1.1. Earth Borrow**

2.1.1.1. Earth borrow shall be earth material obtained from outside the project limits that meets the requirements of Ontario Provincial Standard Specification 212.

#### **2.1.2. Backfill**

2.1.2.1. Site or imported material containing no organic or foreign matter, and which the subcontractor can demonstrate is compactable to a density of 98% SPMDD.

### **2.2. STOCKPILING**

#### **2.2.1. Fill Materials**

2.2.1.1. Temporarily Stockpile fill materials in areas designated by *Owner*. Stockpile granular materials to prevent segregation.

#### **2.2.2. Protection**

2.2.2.1. Protect fill materials from contamination and freezing.

## **3 EXECUTION**

### **3.1. STRIPPING OF TOPSOIL**

3.1.1. Do stripping of topsoil in accordance with this Section and Geotechnical Consultant requirements and civil drawings.

3.1.2. Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Consultant.

3.1.3. Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.

3.1.4. Strip all topsoil. Avoid mixing topsoil with subsoil.

3.1.5. Stockpile sufficient topsoil for restoration of all grassed areas impacted by the construction.

3.1.6. Remove and dispose of surplus topsoil, off site.

3.1.7. All silt fence and erosion control measures to be in place before start of topsoil stripping operation.

### **3.2. EXCAVATION/GRADING**

3.2.1. Grade to subgrade levels (to a tolerance +/- 25 mm but not consistently high or low) allowing for surface treatment as indicated.

3.2.2. Do not place material which is frozen nor place material on frozen surfaces.

3.2.3. Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

3.2.4. Excavation, placing and compacting of fill materials are to be carried out in accordance with Ontario Provincial Standard Specification (OPSS) 206.

3.2.5. Do not disturb soil within branch spread of trees or shrubs to remain.

3.2.6. If any soft areas are detected during the proof rolling process, and with the Consultant's direction, sub-excavate as per Geotechnical Consultant's recommendations. Sub-excavated areas are to be backfilled with suitable native material, or imported approved granular material.

### **3.3. PROOF ROLLING**

3.3.1. Proof rolling shall be carried out on completed subgrade prior to installing granular sub-base materials.

3.3.2. Proof rolling shall be carried out using a roller with a minimum static weight of 5 tonnes, and shall consist of a minimum of four passes per unit area. Wet areas or deleterious materials identified during proof rolling shall be sub-excavated and be replaced with

engineered fill, consisting of Granular B, Type I as per OPSS 1010 or select native material, compacted to 98% SPMDD in maximum 200 mm lifts.

**3.4. FIELD QUALITY CONTROL**

- 3.4.1. Inspection and testing of materials and compaction will be carried out by the Geotechnical Consultant engaged by the Owner for this project. Costs of tests will be paid by Owner.
- 3.4.2. Sieve Analysis
  - 3.4.2.1. Proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.
- 3.4.3. Reinstatement
  - 3.4.3.1. All disturbed areas must be reinstated to Consultant's and Owner's satisfaction.
  - 3.4.3.2. Any damage to the existing rail right-of-way, due to the Contractor's operations, shall be made good at the Contractor's expense.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the *Contract Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Quality Assurance
- .5 2.1. Materials
- .6 3.1. Examination
- .7 3.2. Tree Pruning
- .8 3.3. Tree Protection
- .9 3.4. Tree Repair And Replacement
- .10 3.5. Field Quality Control

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. This section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

### **1.4. QUALITY ASSURANCE**

- 1.4.1. Qualifications:
  - 1.4.1.1. An experienced tree service firm, minimum 5 years experience, that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project and present at the Place of the Work during execution of tree protection and trimming.
- 1.4.2. Tree Pruning Standard:
  - 1.4.2.1. Comply with ANSI A300 (Part 1), "Tree, Shrub, and other Woody Plant Maintenance—Standard Practices (Pruning)."

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Products and remedial care for protection of the trees and plants as specified are to be as recommended by a qualified arborist, must comply with references above, with approval of the Consultant.
- 2.1.2. Provide tree protection barrier alternative where indicated on the drawings and subject to the approval by Urban Forestry Services.
- 2.1.3. Mulch:
  - 2.1.3.1. Clean, straw mulch from local sources free of weeds and hazardous materials.

## **3 EXECUTION**

### **3.1. EXAMINATION**

- 3.1.1. Examine the Place of the Work before commencement of work and inform Consultant if site conditions will not permit completion of tree and plant protection work as in accordance with the Contract Documents.
- 3.1.2. No ground breaking activities or demolition should occur until all tree preservation requirements have been met.

- 3.1.3. All Subcontractors, Suppliers, and site personnel shall be informed of the tree and plant protection measures and guidelines prior to their commencing any activities at the Place of the Work.
- 3.1.4. The Tree Protection Zone (TPZ) shall be posted with signs.
- 3.1.5. Within the Tree Preservation Zone (TPZ) there shall be:
  - 3.1.5.1. No construction;
  - 3.1.5.2. No altering of grade by adding fill, excavating, trenching, scraping, dumping or disturbance of any kind.
  - 3.1.5.3. No storage of construction materials, equipment, soil, construction waste or debris.
  - 3.1.5.4. No disposal of any liquids (i.e.: concrete sleuth, gas, oil, paint).
  - 3.1.5.5. No movement of vehicles, equipment or pedestrians.
  - 3.1.5.6. No parking of vehicles or machinery.
  - 3.1.5.7. No activity of any kind without permission of the arborist
  - 3.1.5.8. Activity of any kind without permission of the arborist

### **3.2. TREE PRUNING**

- 3.2.1. Prune trees and plants indicated to remain that are affected by temporary and permanent construction.
- 3.2.2. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- 3.2.3. Pruning Standards: Prune trees according to ANSI A300.
  - 3.2.3.1. Type of Pruning: Cleaning, Raising, and Reduction.
- 3.2.4. Cut branches with sharp pruning instruments; do not break or chop.
- 3.2.5. Chip removed tree branches and dispose of off-site.

### **3.3. TREE PROTECTION**

- 3.3.1. Protect trees to be preserved from damage during the Work in accordance with the following specifications and make good any damage at no expense to Owner.
- 3.3.2. The location of the tree preservation zone is clearly indicated on the Tree Preservation Plan. Trees to be protected will be confirmed by the Consultant.
- 3.3.3. Tree protection shall remain in place until all sitework has been completed, and may not be removed, relocated, or otherwise altered without the written permission of the Consultant.
- 3.3.4. The trees to be protected shall be fertilized with a deep root application of an approved fertilizer before construction commences on this project as well as a second fertilization in two years.
- 3.3.5. The trees to be protected shall be pruned in accordance with Tree Pruning paragraphs above in this section.
- 3.3.6. The arborist shall undertake proper root pruning when and if roots of retained trees are to be exposed, damaged or severed by construction activities. The arborist shall supervise the excavation of soil where roots are to be cut. All roots are to be cut cleanly at the excavation zone and backfilled with an appropriate soil mix. Exposed roots shall be covered with soil or mulch as soon as possible to prevent further damage and desiccation. Root pruning prior to excavation will help prevent unnecessary damage to tree roots.
- 3.3.7. In areas where mulch may remain following construction the trees shall have minimum 100 mm (4") of mulch installed over the root system before construction starts, and set back from the trunk by rodent guard. Mulch shall be spread evenly under the canopy to the dripline, to the limits of the protection fence, or as otherwise indicated in the Contract Documents.
- 3.3.8. There shall be a source of water provided to ensure that the trees get adequate water during the dry periods. It will be the responsibility of the Contractor to monitor for moisture content in the soil for the duration of the Work.



- 3.3.9. The protection zone shall not be breached in any way. There shall be no material stored in the preservation zones, no grade changes and no parking.
- 3.3.10. Ensure all trees are protected from compaction of roots or damage to trunk or limbs prior to receipt of permits for removal or remedial care as recommended by arborist.
- 3.3.11. Obtain necessary permits, reports, and approvals.
- 3.3.12. Proceed with execution of specified work, under direction of the Consultant.
- 3.3.13. No rigging cables will be wrapped around or installed in trees. Do not burn waste near trees and do not flush concrete trucks or cement mixing machines over root system.

### **3.4. TREE REPAIR AND REPLACEMENT**

- 3.4.1. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
- 3.4.2. Remove and replace trees indicated to remain that die or are damaged during construction operations that Consultant and arborist determine are incapable or restoring to normal growth pattern.
  - 3.4.2.1. Provide new trees of same size and species as those being replaced; plant and maintain as specified by Consultant.
  - 3.4.2.2. Provide new trees of 150 mm (6") calliper size and of a species selected by Consultant when damaged trees more than 150 mm (6") in calliper size, measured 305 mm (12") above grade, are required to be replaced. Plant and maintain new trees as specified by Consultant.
- 3.4.3. Aerate surface soil, compacted during construction, 3048 mm (10 ft) beyond drip line and no closer than 914 mm (36") to tree trunk. Drill 50 mm (2") diameter holes a minimum of 305 mm (12") deep at 610 mm (24") on centre. Backfill holes with an equal mix of augured soil and sand.
- 3.4.4. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicative existing tree to be replaced. Comply with ANSI Z60.1-2014; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in lead and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 3.4.4.1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk, crossing trunks; cut-off limbs more than 19 mm (3/4") in diameter; or with stem girding roots will be rejected.
  - 3.4.4.2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established planting, or not grown in a nursery unless otherwise indicated.
- 3.4.5. Provide trees of sizes, grades, and all sizes complying with ANSI Z60.1-2014 for types and form of trees required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- 3.4.6. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1-2014. Root flare shall be visible before planting.

### **3.5. FIELD QUALITY CONTROL**

- 3.5.1. Conduct quality control in accordance with Section 01 45 00.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. References
- .5 1.5. Design Requirements
- .6 1.6. Submittals
- .7 1.7. Quality Assurance
- .8 1.8. Delivery, Storage, And Handling
- .9 1.9. Site Conditions
- .10 2.1. Materials
- .11 2.2. Mixes
- .12 2.3. Admixtures
- .13 3.1. General
- .14 3.2. Preparation
- .15 3.3. Formwork
- .16 3.4. Reinforcing
- .17 3.5. Placing Of Concrete
- .18 3.6. Concrete Curbs
- .19 3.7. Concrete Pavements
- .20 3.8. Consolidating
- .21 3.9. Curing And Protection
- .22 3.10. Construction Joints
- .23 3.11. Finishing
- .24 3.12. Identification Stamp
- .25 3.13. Broom Finish
- .26 3.14. Removal Of Forms
- .27 3.15. Defective Concrete
- .28 3.16. Protection

### **1.3. SUMMARY**

- 1.3.1. Design, labour, Products, equipment and services necessary for concrete curbs and pavements Work in accordance with the Contract Documents.

### **1.4. REFERENCES**

- 1.4.1. ASTM A185/A185-M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- 1.4.2. ASTM C260, Specification For Air-Entraining Admixtures For Concrete.
- 1.4.3. ASTM C309, Specification For Membrane-Forming Compounds for Curing Concrete.
- 1.4.4. ASTM C494/C494-M, Specification For Chemical Admixtures For Concrete.
- 1.4.5. ASTM D994, Specification For Preformed Expansion Joint Filler For Concrete (Bituminous Type).
- 1.4.6. CAN/CSA A23.1/A23.2-M, Concrete Materials and Methods of Concrete Construction/Methods of Tests For Concrete.
- 1.4.7. CAN/CSA A3000, Cementitious Materials Compendium.
- 1.4.8. CAN/CSA G30.18-M, Billet-Steel Bars for Concrete Reinforcement.
- 1.4.9. CSA O121, Douglas Fir Plywood.
- 1.4.10. CAN/CSA S269.3-M, Concrete Formwork.

## **1.5. DESIGN REQUIREMENTS**

- 1.5.1. Concrete: 30 Mpa unless otherwise indicated on drawings. Exterior concrete to have 5-7% entrained air.
- 1.5.2. Design concrete so that material will not segregate and excessive bleeding will not occur.
- 1.5.3. Comply to the MTC Manual of Uniform Traffic Control Devices for signs and flagging when working within existing road ways. Any requirements to restrict local traffic due to the contractors works, must be reviewed and approved by the Consultant.

## **1.6. SUBMITTALS**

- 1.6.1. Product data:
  - 1.6.1.1. Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 for each material indicating:
    - (1) .1 Performance criteria, compliance with appropriate reference standard(s), and characteristics.
  - 1.6.1.2. Product transportation, storage, handling and installation requirements.
- 1.6.2. Shop drawings:
  - 1.6.2.1. Submit shop drawings in accordance with Section 01 30 00 indicating elevations, sections, details, materials, joint assemblies, finishes and relationships to adjacent construction.

## **1.7. QUALITY ASSURANCE**

- 1.7.1. Inspection and testing:
  - 1.7.1.1. Materials: CAN/CSA A23.1/A23.2-M; Inspect and test for conformance to requirements of this Standard and to Specifications.
  - 1.7.1.2. Tests will be made in accordance with CAN/CSA A23.2-M.
  - 1.7.1.3. Remove defective materials and completed Work which do not conform to the Contract Documents.

## **1.8. DELIVERY, STORAGE, AND HANDLING**

- 1.8.1. Deliver and store materials on Site in accordance with CAN/CSA A23.1/A23.2-M.

## **1.9. SITE CONDITIONS**

- 1.9.1. Conform to CAN/CSA A23.1/A23.2-M.
- 1.9.2. Do not deposit concrete on frozen ground. When deposited in forms concrete shall have a temperature between 10EC and 30EC and these limits shall be maintained for 72 hours.

# **2 PRODUCTS**

## **2.1. MATERIALS**

- 2.1.1. Forms: Plywood to CSA O121, G1S; Douglas Fir plywood, seven ply, exterior grade, waterproof glue, edges sealed with oil based sealer.
- 2.1.2. Form ties: Adjustable snap ties, formed to break 25 mm or more from surface of concrete after form removal, with a minimum working strength of 1360 kg.
- 2.1.3. Form release agent: 100% biodegradable, chemically active, VOC compliant, 'Bioform' by Universal Building Product or approved alternative.
- 2.1.4. Reinforcing steel: CAN/CSA G30.18-M; Billet-steel bars, deformed unless indicated otherwise, Grade 400R.
- 2.1.5. Welded steel wire fabric: ASTM A185/A185-M; Resistance welded in size and spacing shown for smooth wire fabric, in flat sheets only.
- 2.1.6. Chairs, bolsters, supports, spacers: CAN/CSA A23.1-M with sufficient strength to rigidly support weight of reinforcement and construction loads. Manufactured by NCA/Acrow - Richmond or Dayton Superior.
- 2.1.7. Cement: CAN/CSA A3000; Portland, Type 10.
- 2.1.8. Coarse and fine aggregate: CAN/CSA A23.1/A23.2-M.
- 2.1.9. Water: CAN/CSA A23.1/A23.2-M.
- 2.1.10. Water reducing admixture: ASTM C494/C494-M, Type A.

- 2.1.11. Set retarding admixture: ASTM C494/C494-M, Type D.
- 2.1.12. Air entraining admixture: CAN/CSA A23.1/A23.2-M and ASTM C260.
- 2.1.13. Pigmented curing compound: ASTM C309, Type 2, Class B; White pigmented resin based.
- 2.1.14. Joint filler: ASTM D994, Asphalt impregnated; 'Asphalt Joint Expansion Joint Filler' by W. R. Meadows Ltd., in thickness shown on Contract Drawings. Furnish kraft paper or polyethylene sheet as bond breaker between sealant and joint filler
- 2.1.15. Joint Sealant: Two component, non-tracking, chemically reactive urethane/coal tar modified sealant; 'Sealtight Gardox' by W. R. Meadows Ltd. or 'Vulkem 202' by Tremco.
- 2.1.16. Bonding Agent: Furnish 'Sika-Dur' by Sika, or 'Intralock' by W. R. Meadows.

## **2.2. MIXES**

- 2.2.1. Acceptance of any concrete mix proportion or material, does not preclude its future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unacceptable.
- 2.2.2. Mix concrete and concrete proportions in accordance with CAN/CSA A23.1/A23.2-M.

## **2.3. ADMIXTURES**

- 2.3.1. Use admixtures for concrete from single manufacturer, unless otherwise acceptable to Consultant.
- 2.3.2. Have manufacturer certify that admixtures are compatible.
- 2.3.3. Add admixtures to concrete mix in accordance with manufacturer's recommendations.
- 2.3.4. Except as specified otherwise, comply with requirements of CAN/CSA A23.1/A23.2-M.
- 2.3.5. Use of calcium chloride or additional admixtures, other than those specified, is not acceptable.

## **3 EXECUTION**

### **3.1. GENERAL**

- 3.1.1. Give Consultant at least 2 working days notice prior to placement of concrete to permit a review of compaction, placement of formwork, reinforcing steel, and associated items embedded in concrete for conformance to reviewed shop drawings and Contract Documents.
- 3.1.2. Do not place concrete on surfaces which contain frost, water or debris.
- 3.1.3. Provide concrete curb cuts and sidewalk handicap access ramps as indicated, in accordance with the authorities having jurisdiction.

### **3.2. PREPARATION**

- 3.2.1. Verify grades of items set in paving area for conformity with elevations and sections before placing granular base and subbase material.
- 3.2.2. Obtain approval of subgrade by Consultant before placing granular subbase and base.
- 3.2.3. Set out work from lines and levels shown on drawings.
- 3.2.4. Prevent damage to adjacent and/or existing buildings and/or properties, and existing curbs, sidewalks and asphalt paving.
- 3.2.5. Accurately saw-cut and modify existing sidewalks to nearest adjacent dummy/expansion joint as directed on site by Consultant.
- 3.2.6. Remove and dispose of debris from the work of this section in accordance with authorities having jurisdiction.
- 3.2.7. Fine grade, shape and compact subgrade to minimum of 95% Standard Proctor Density.
- 3.2.8. Wet base immediately in advance of concreting to ensure a firm moist surface without ponding.
- 3.2.9. Repair damage to base resulting from hauling or equipment operations.

### **3.3. FORMWORK**

- 3.3.1. Construct formwork in accordance with CAN/CSA S269.3-M to produce finished concrete conforming to shape, dimensions, locations and elevations indicated. Ensure no lumber remains in concrete

- 3.3.2. Set forms true to line and grade, join neatly and tightly, and stake securely to resist concrete pressure and impact from tampers without springing.
- 3.3.3. Apply release agent by spray in accordance with manufacturer's recommendations. Ensure form surfaces receive a uniform coating.

### **3.4. REINFORCING**

- 3.4.1. Place reinforcing steel as shown on reviewed shop drawings and in accordance with CAN/CSA A23.1-M. Make bars as long as possible.
- 3.4.2. Make splices in locations shown on Drawings. Lap lengths in accordance with CSA A23.3 unless otherwise shown.
- 3.4.3. Lap ends and sides of wire fabric not less than 150 mm.

### **3.5. PLACING OF CONCRETE**

- 3.5.1. Before placing fresh concrete against set or partially set concrete, clean surfaces to remove dirt, scum, shavings, debris, laitance, etc. on set surfaces, brush generously with bonding agent.
- 3.5.2. Place concrete in accordance with CAN/CSA A23.1/A23.2-M.
- 3.5.3. Slope concrete to levels shown on Contract Drawings.
- 3.5.4. Do not place concrete at such a rate as to endanger formwork or to prevent proper compaction.
- 3.5.5. Place concrete to prevent cold joints and segregation and vibrate sufficiently to ensure thorough compaction, maximum density in accordance to CAN/CSA A23.1/A23.2-M
- 3.5.6. Check Work frequently with accurate instruments during placing of concrete.
- 3.5.7. When completing concrete placement for day, carry placement through to a scheduled joint location.
- 3.5.8. Where concrete placement is stopped for more than 30 minutes due to breakdowns, weather or any other reasons, construct extra bulkhead and construction joint as directed.

### **3.6. CONCRETE CURBS**

- 3.6.1. Align concrete curbs with curves and tangents indicated on drawings. Concrete curb to be in accordance to details indicated on drawings.
- 3.6.2. Where existing curb is met, the contractor must make the required transition to style and grade of existing curb to the satisfaction of the Consultant.
- 3.6.3. Curbs shall have expansion joints at minimum 4500 mm o.c. and in accordance with authorities having jurisdiction. Place reinforcing bars at top and base of curb, with minimum 50 mm concrete cover.
- 3.6.4. All restoration of the existing road structure for the transition to existing curb is the responsibility of the contractor.
- 3.6.5. Finish edges of dummy joints and expansion joints with 3 mm radius edging tool.

### **3.7. CONCRETE PAVEMENTS**

- 3.7.1. Concrete sidewalk to be in accordance with details indicated on drawings.
- 3.7.2. Concrete for standard sidewalk to be 150 mm thick, except through entrances where the concrete shall be 200 mm thick with wire mesh. The compacted granular 'A' is to be 150 mm thick at all locations.
- 3.7.3. Where existing sidewalk is met, make the required transition to grade, to the satisfaction of the Consultant. Furthermore, co-ordinate with the City and Consultant, to insure compatibility of existing and or future adjacent works by City forces.
- 3.7.4. All structural concrete, such as but not limited to, concrete walkway adjacent to building, concrete pads for loading docks, and concrete slabs for loading areas to be constructed in accordance with reviewed shop drawings.
- 3.7.5. Dummy joints: 6 mm deep at 1500 mm o.c. Tool joints with 6 mm wide steel trowel, radiusing edges 6 mm.
- 3.7.6. Expansion joints: 6000 mm o.c. maximum.
- 3.7.7. Tool edges of sidewalk with 50 mm wide steel trowel, radiusing edges 6 mm.

- 3.7.8. Install sealant in expansion/isolation joints as shown and specified.

### **3.8. CONSOLIDATING**

- 3.8.1. Consolidate concrete in accordance with CAN/CSA A23.1/A23.2-M  
3.8.2. Work concrete into complete contact with forms and embedded items. Consolidate concrete adjacent to side forms and along entire length of forms to ensure a smooth surface finish after stripping of formwork.

### **3.9. CURING AND PROTECTION**

- 3.9.1. Cure and protect concrete in accordance with CAN/CSA A23.1/A23.2-M.  
3.9.2. Apply curing compound after finishing operations have been completed, at rate recommended by compound manufacturer. Ensure compound application is uniform and continuous over entire area being cured.

### **3.10. CONSTRUCTION JOINTS**

- 3.10.1. Obtain Consultant's acceptance to install construction joints in locations other than those shown.  
3.10.2. Construct construction joints to CAN/CSA A23.1-M and as shown. Supply and install dowels in construction joints unless otherwise detailed.  
3.10.3. Joints at building face or other abutments: place 12 mm joint filler keeping top 12 mm below concrete surface; apply kraft paper or polyethylene bond over filler and fill with self-levelling sealant applied in accordance with manufacturer's printed instructions.  
3.10.4. For sawn joints:  
3.10.4.1. Do sawn joints in accordance with drawing details. Prepare sample sawn joint for approval by Consultant.  
3.10.4.2. Ensure joints are straight. Mark alignment with chalk line or other suitable guide. Layout to be approved by Consultant.  
3.10.4.3. Saw joints using approved equipment and methods to produce joint dimensions indicated.  
3.10.4.4. Supply sufficient men and equipment including standby equipment, to maintain a satisfactory sawing schedule.  
3.10.4.5. Schedule sawing operations on 24 hour basis and consistent with concrete placing.  
3.10.4.6. Make initial saw cuts in a progressive manner and as soon as possible without excessive ravelling.  
3.10.4.7. If a crack occurs ahead of saw cut, stop immediately. Move ahead several joints and cut one or more joints before returning to saw intermediate joints. Where cracking persists, make 1060 mm saw cut from one edge and complete sawing from opposite edge. Adjust sawing schedule accordingly.  
3.10.4.8. If uncontrolled cracking or other surface damage results from inadequate or improper sawing techniques suspend further concrete operations until situation is corrected and immediately remove and replace damaged slabs.  
3.10.4.9. Immediately on completion of sawing, flush joints with water to remove laitance.

### **3.11. FINISHING**

- 3.11.1. When striking off concrete surface, maintain a uniform roll of concrete ahead of first screed for it's full length when finishing machine is on first pass.  
3.11.2. Where joints are formed rather than sawn, form longitudinal and transverse joints after final pass of finishing machine.  
3.11.3. Hand finish areas inaccessible to finishing machine to same quality and surface characteristics as machine finished surfaces.  
3.11.4. Finish concrete surface with an approved float at proper time. Operate from edge to edge with a wiping motion while advancing , with each succeeding pass overlapping previous one.  
3.11.5. Check surface with approved straightedge 4500 mm long. Correct irregularities exceeding 5 mm before concrete takes initial set.

- 3.11.6. Finish edges of slabs with edging tool to form a smooth squared surface. Do not patch with cement paste.

### **3.12. IDENTIFICATION STAMP**

- 3.12.1. For sidewalks in the public right-of-way, mark concrete at each end of the work and at least every 18000 mm or such other places as the Consultant may select.
- 3.12.2. The stamp shall be located on the centre of the bay of walk, next to and parallel to a transverse joint.
- 3.12.3. The size and shape of the stamp shall be required by municipality.
- 3.12.4. The imprint shall be clear and legible and satisfactory to the Consultant.

### **3.13. BROOM FINISH**

- 3.13.1. Commence texturing immediately after float finishing.
- 3.13.2. Use soft bristled broom to produce an approved light, non-slip concrete surface finish with fine granular or sandy texture free from disfigurements. Finishes to be approved by Consultant.
- 3.13.3. Apply broom finish at right angles to curb and parallel to joints. All trowel and tool marks to be removed with broom. Do not contaminate joints by over-brooming.

### **3.14. REMOVAL OF FORMS**

- 3.14.1. Do not disturb forms until concrete has hardened and developed sufficient strength to safely support its own weight and load on it.
- 3.14.2. Strip formwork in accordance with CAN/CSA A23.1-M.

### **3.15. DEFECTIVE CONCRETE**

- 3.15.1. Concrete is defective when:
  - 3.15.1.1. Containing excessive honeycombing or embedded debris.
  - 3.15.1.2. Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
  - 3.15.1.3. Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.
  - 3.15.1.4. Any 28 day strength test result is less than 80% of specified minimum 28 day strength.
  - 3.15.1.5. Surface texturing, joint type and placement and tolerances are unacceptable in the opinion of the Consultant.
- 3.15.2. Repair of defective concrete work:
  - 3.15.2.1. Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by Consultant.
  - 3.15.2.2. Grind off high surface variations where directed.
- 3.15.3. Remove and replace defective concrete where directed.
  - 3.15.3.1. Remove minimum 3000 mm of pavement by sawing through concrete across full lane width.
  - 3.15.3.2. Replace with new concrete to this specification.
  - 3.15.3.3. Construct dummy contraction joint between sawn face of existing concrete and face of new concrete.

### **3.16. PROTECTION**

- 3.16.1. Do not open concrete pavement to traffic or construction equipment until concrete reaches 70% of specified strength or until approved by Consultant.

**END OF SECTION**

## **1 GENERAL**

### **1.1. GENERAL INSTRUCTIONS**

- 1.1.1. Read and be governed by conditions of the Contract *Documents*, including sections of Division 1.

### **1.2. SECTION INCLUDES**

- .1 1.1. General Instructions
- .2 1.2. Section Includes
- .3 1.3. Summary
- .4 1.4. Submittals
- .5 1.5. Quality Assurance
- .6 2.1. Materials
- .7 3.1. Preparation
- .8 3.2. Application
- .9 3.3. Adjusting And Cleaning
- .10 3.4. Protection

### **1.3. SUMMARY**

- 1.3.1. Section includes:
  - 1.3.1.1. Painted pavement markings and linework including:
  - 1.3.1.2. Parking stall and drive aisle linework.
  - 1.3.1.3. Symbols and markings for barrier free parking.

### **1.4. SUBMITTALS**

- 1.4.1. Submit required submittals in accordance with Section 01 33 00 – Submittal Procedures.
- 1.4.2. Product data sheets:
  - 1.4.2.1. Submit manufacturer's Product data sheets for Products proposed for use in the work of this Section.

### **1.5. QUALITY ASSURANCE**

- 1.5.1. Qualifications:
  - 1.5.1.1. The Contractor shall Provide work of this Section, executed by competent installers with a minimum of five years' experience in application of Products specified.

## **2 PRODUCTS**

### **2.1. MATERIALS**

- 2.1.1. Paint: in accordance with CAN/CGSB 1.74-2001 AMEND NO.1 Alkyd Traffic Paint - Amendment No. 1, low VOC alkyd traffic paint, in colours to the Consultant's selection.
  - 2.1.1.1. Maximum Volatile Organic Compound (VOC) limits; exterior:
    - (1) Flat paints: <100 g/L.
    - (2) Non-flat paints: <200 g/L.

## **3 EXECUTION**

### **3.1. PREPARATION**

- 3.1.1. Substrate surfaces to be free from surface water, frost, ice, dust, oil, grease and other foreign materials.

### **3.2. APPLICATION**

- 3.2.1. Lay out pavement and slab markings.
- 3.2.2. Apply paint only when air temperature is above manufacturer's recommended temperature and no rain is forecast.



- 3.2.3. Symbols, numbers, letters, and text to conform to dimensions indicated, 150 mm (6") minimum. Apply letters, numbers, and text of legible size to parking stalls and drive aisles. Number sequence and text to the Consultant's selection.
- 3.2.4. Symbols and markings for barrier free parking in accordance with CAN/CSA B651-12, and to requirements of the Authorities Having Jurisdiction.
- 3.2.5. Paint lines to be of uniform colour and density with sharp edges, 100 mm (4") wide, unless otherwise indicated in the Contract Documents.

### **3.3. ADJUSTING AND CLEANING**

- 3.3.1. Remove paint where spilled, splashed, splattered, or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- 3.3.2. Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- 3.3.3. Remove combustible rubbish materials and empty paint cans each Day and safely dispose of same in accordance with requirements of the Authorities Having Jurisdiction.
- 3.3.4. Clean equipment and dispose of wash water/solvents as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, and the like), paints, thinners, paint removers/strippers in accordance with safety requirements of the Authorities Having Jurisdiction.

### **3.4. PROTECTION**

- 3.4.1. Keep traffic off wet paint for period of time as recommended by paint manufacturer 3.4.1.1.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 03 30 00 - Cast-in-Place Concrete
- .2 Section 09 91 13 - Exterior Painting
- .3 Section 26 05 27 - Grounding - Primary

### **1.02 PRICE AND PAYMENT PROCEDURES**

- .1 Unit Prices: Products specified in this Section form a part of a Unit Price. Unit Prices submitted for this Section will be used as the basis for adjustments to the Contract Price for work performed by this Section.
- .2 Measurement and Payment:
  - .1 Measure the supply and installation of wood composite fences in linear metres along the slope of grade installed.

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 C94 - Standard Specification for Ready-Mixed Concrete.
  - .2 C177-04 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal
  - .3 Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - .4 D143-94(2000) - Standard Test Methods for Small Clear Specimens of Timber.
  - .5 D198-05 - Standard Test Methods of Static Tests of Lumber in Structural Sizes.
  - .6 D1037-06 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle
  - .7 Panel Materials.
  - .8 D1413-05 - Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.
  - .9 D1761-06 - Standard Test Methods for Mechanical Fasteners in Wood.
  - .10 D1929-96(2001) - Standard Test Method for Determining Ignition Temperature of Plastics.
  - .11 D2047-04 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring
  - .12 Surfaces as Measured by the James Machine.
  - .13 D2394-05 - Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish
  - .14 Flooring.
  - .15 D2395-06 - Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials.
  - .16 D4761-05 - Standard Test Methods for Mechanical Properties of Lumber and Wood-Base
  - .17 Structural Material.
  - .18 E84-07 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- .19 F1679-04 Standard Test Method for Using a Variable Incidence Tribometer (VIT).
- .2 CSA Group (CSA):
  - .1 [CSA A23.1](#): [19] /CSA A23.2: [19], Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
  - .2 [CSA A3000](#)-[18], Cementitious Materials Compendium

## 1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, product literature and data sheets for concrete mixes, fence fabric, and posts. Include product characteristics, performance criteria, metal thickness, finishes, and limitations.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- .1 Perform in accordance with Section 01 60 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging labelled with manufacturer's name and address.
- .3 Deliver, store and handle products in accordance with the manufacturer's instructions.
- .4 Store level and flat, off ground or floor, with supports at each end and maximum 24 inches on center.
- .5 Do not stack wood composite over 8 feet (2438mm) high
- .6 Cover wood composite with waterproof covering, vented to prevent moisture buildup.

## 2 PRODUCTS

### 2.01 MATERIALS

- .1 Concrete Materials: In accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .1 Coarse aggregate nominal size: [20-5].
  - .2 Compressive strength: Minimum MPa at 28 days.
  - .3 Additives: Fly ash to [ASTM C 618](#).
- .2 Wood composite: Reclaimed wood and plastic with integral colouring; free from toxic chemicals and preservatives:
  - .1 Characteristics:
    - .1 Abrasion resistance: 0.01 inch wear per 1000 revolutions, tested to ASTM D 2394.
    - .2 Hardness: 1124 pounds, tested to ASTM D 143.
    - .3 Self ignition temperature: 743 degrees F, tested to ASTM D 1929.
    - .4 Flash ignition temperature: 698 degrees F, tested to ASTM D 1929.
    - .5 Flame spread rating: 80, tested to ASTM E 84.
    - .6 Water absorption, 24 hour immersion, tested to ASTM D 1037:
    - .7 Sanded surface: 4.3 percent.
    - .8 Unsanded surface: 1.7 percent.
    - .9 Thermal expansion coefficient, 36 inch long samples:
    - .10 Width: 35.2 x 10-6 to 42.7 x 10-6.
    - .11 Length: 16.1 x 10-6 to 19.2 x 10-6.
    - .12 Fastener withdrawal, tested to ASTM D 1761:
    - .13 Nail: 163 pounds per inch.

- .14 Screw: 558 pounds per inch.
- .15 Static coefficient of friction:
- .16 Dry: 0.53 to 0.55, tested to ASTM D 2047.
- .17 Dry: 0.59 to 0.70, tested to ASTM F 1679.
- .18 Wet: 0.70 to 0.75, tested to ASTM F 1679.
- .19 Fungus resistance, white and brown rot: No decay, tested to ASTM D 1413.
- .20 Termite resistance: 9.6 rating, tested to AWPA E-1.
- .21 Specific gravity: 0.91 to 0.95, tested to ASTM D 2395.
- .22 Compression:
- .23 Parallel: 1806 PSI ultimate, 550 PSI design, tested to ASTM D 198.
- .24 Perpendicular: 1944 PSI ultimate, 625 PSI design, tested to ASTM D 143.
- .25 Tensile strength: 854 PSI ultimate, 250 PSI design, tested to ASTM D 198.
- .26 Shear strength: 561 PSI ultimate, 200 PSI design, tested to ASTM D 143.
- .27 Modulus of rupture: 1423 PSI ultimate, 250 PSI design, tested to ASTM D 4761.
- .28 Modulus of elasticity: 175,000 PSI ultimate, 100,000 PSI design, tested to ASTM D 4761.
- .29 Thermal conductivity: 1.57 BTU per inch per hour per square foot at 85 degrees F, tested to ASTM C 177.

## 2.02 COMPONENTS

- .1 Fence System: Seclusions Privacy Fence System by Trex Fencing or approved equal.
  - .1 Height: 1830mm
  - .2 Components:
    - .1 Fence Posts
    - .2 Post Caps: Pyramid
    - .3 Top Rail
    - .4 Aluminum bottom rail inserts
    - .5 Bottom rail covers/pickets, 67 inch
    - .6 Fence brackets
  - .3 Surface Texture: Smooth
  - .4 Colour: Woodland Brown or approved equal
- .2 Accessories
  - .1 Fasteners: 1-5/8 inch galvanized or corrosion-resistant coated steel. Provide finish nails where applicable.
  - .2 Concrete: Provide as specified in Section 03 30 00 – Cast-in-Place Concrete; minimum 28 MPA at 28 days, entrained air of 6% to 1% and slump point of discharge of 60mm for curbs and footings.

## 3 EXECUTION

### 3.01 EXAMINATION

- .1 Inform Consultant of unacceptable conditions immediately upon discovery.
- .2 Do not begin installation until substrates have been properly prepared.
- .3 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- .1 Grading: Remove debris and correct ground undulations along fence line to obtain

smooth uniform gradient between posts.

- .1 Provide clearance between bottom of fence and ground surface of 25 mm to 30 mm.
- .2 Clean surfaces thoroughly prior to installation.
- .3 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.03 INSTALLATION FENCE

- .1 Install fence to [CAN/CGSB-138.3](#), along fence lines indicated on Drawings.
- .2 Excavate post holes [to dimensions indicated on Drawings]
  - .1 Excavate corner posts 300 mm deeper than line posts.
- .3 Space line posts 2438 mm apart, measured parallel to ground surface.
- .5 Install corner post where change in alignment exceeds 10 degrees.
- .6 Cut and drill wood composite using carbide-tipped blades.
- .7 Install end posts at end of fence and at buildings.
- .8 Drill post holes into undisturbed or compacted soil; excavate deeper in soft or loose soils and for posts with heavy lateral loads.
- .9 Drill posts to 12-inch (300mm) diameter. Locate bottom of post 30 inches below frost line.
- .10 Place concrete in post holes then embed posts into concrete to minimum 1200mm depth.
  - .1 Extend concrete 50 mm above ground level. Slope upper concrete surface to drain water away from posts.
  - .2 Temporarily brace posts in plumb position and true to alignment and elevation until concrete has set.
- .11 Screw fence brackets to posts with four 1-5/8 inch long exterior screws.
- .12 Cut top rails, pickets, bottom rail covers and aluminum bottom rails to lengths required.
- .13 Slide bottom rail covers over aluminum bottom rail pieces.
- .14 Position aluminum bottom rail on fence brackets with deeper side of rail channel facing downward.
- .15 Cut end pickets to height to provide clearance under brackets and screw to posts.
- .16 Insert pickets into bottom rail, interlocking adjacent pieces.
- .17 Position top rail and screw attach to top brackets with 1-5/8 inch long exterior screws.
- .18 Use finish nails to secure pickets to rails if the pickets are not tightly interlocked.
- .19 Place post caps over post tops and secure with construction adhesive or four finish nails.

### 3.05 CLEANING

- .1 Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.
- .2 Clean wood composite to remove stains:
  - .1 Mold, mildew, and berry and leaf stains: clean surfaces with conventional deck wash containing detergent or sodium hypochlorite.
  - .2 Rust and ground-in dirt: clean surfaces with cleaner containing oxalic or phosphoric acid.
  - .3 Oil and grease: clean surfaces with detergent containing degreasing agent.

### 3.06 PROTECTION

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before substantial completion.

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**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 03 30 00 – Cast-in-Place Concrete

### **1.02 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's instructions, printed product literature and data sheets for furniture and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
  - .1 Submit shop drawings indicating dimensions, sizes, assembly, anchorage, and installation details for each furnishing specified.

### **1.03 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for care and cleaning of site furnishings for incorporation into manual specified in Section 01 77 00 – Contract Closeout Procedures and Submittals.

### **1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations.
  - .2 Store and protect furnishings from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **2 PRODUCTS**

### **2.01 PICNIC TABLES**

- .1 (2 Total) APEX Picnic Table with Ipe Wood Slat Top & Benches US-199-23-WD3C-WD3C-84 by Hauser Site Furniture or approved equal. Installed as per manufacturer's instructions.
  - .1 Frame: Aluminum.

- .2 Seat and Table Top: wood slats constructed from lpe.
- .3 Dimensions:
  - .1 Height: 787mm.
  - .2 Length: 2134mm.
  - .3 Depth: 1676mm.
- .4 Finish:
  - .1 Frame: Gunmetal or approved equal.
  - .2 Seat: lpe.

## **2.04 BICYCLE RACK**

- .1 (3 Total) Maglin Bicycle Rack – MBR 150-S by Maglin Furniture Systems or approved equal. Installed as per manufacturer's instructions
  - .1 Basic Construction Material: pre-finished tubular steel.
    - .1 Frame: Black or approved equal.
  - .2 Dimensions:
    - .1 Height: 705mm.
    - .2 Circle Width: 508mm.
    - .3 Frame Width: 41mm.
  - .3 Finish: Maglin Powdercoat System.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for exterior site furnishing installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.02 PREPARATION**

- .1 Locate and protect utility lines.
- .2 Notify and acquire written acknowledgement from utility authorities before beginning installation.

### **3.03 INSTALLATION**

- .1 Assemble furnishings in accordance with manufacturer's written



recommendations.

- .2 Install furnishings true, plumb, anchored firmly, and supported as directed by Consultant.
- .3 Touch-up damaged finishes to approval of Consultant.

#### **3.04 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 13 – Progressive Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 13 - Progressive Cleaning.

#### **3.05 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by site furnishings installation.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 31 22 13 - Rough Grading
- .2 Section 31 23 33.01 - Excavation Trenching and Backfilling
- .3 Section 32 93 10 - Trees, Shrubs And Ground Cover Planting

### **1.02 DEFINITIONS**

- .1 Compost:
  - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil amendment.
  - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
  - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (i.e., C:N ratio below 25), and contains no toxic or growth inhibiting contaminants.

### **1.03 REFERENCE STANDARDS**

- .1 Agriculture and Agri-Food Canada:
  - .1 The Canadian System of Soil Classification, Third Edition, 1998
- .2 Canadian Council of Ministers of the Environment (CCME):
  - .1 PN1340- [2005], Guidelines for Compost Quality
- .3 Canadian Society of Landscape Architects (CSLA)/Canadian Nursery Landscape Association (CNLA):
  - .1 Canadian Landscape Standard, [second] edition
  - .2 Canadian Nursery Stock Standard, [2017]

### **1.04 MEASUREMENT PROCEDURES**

- .1 Preparation of sub-grade for placing of topsoil will not be measured for payment.
- .2 Topsoil stripping will not be measured by Consultant.
- .3 Measure supplying, placing, and spreading topsoil in cubic metres as determined from actual surface area covered and depth of topsoil specified.
  - .1 Specified depth of topsoil: Measured and approved by Consultant after settlement and consolidation as specified.
- .7 Measure finish grading in square metres from actual surface measurements as determined by Consultant.

## **1.06 PAYMENT**

- .1 Testing of topsoil: Contractor will pay for cost of tests as specified in Section 01 21 13 – Cash Allowances.

## **1.07 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals:
  - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
  - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.08 QUALITY ASSURANCE**

- .1 Pre-installation meetings: Conduct pre-installation meeting to verify Project requirements, installation instructions and warranty requirements in accordance with Section 01 32 00 Construction Progress Documentation
- .2 Qualifications: Submit proof of qualifications when requested by Consultant.
- .3 Contractor Qualifications:
  - .1 Landscape Contractor: To be a Member in Good Standing of Landscape Ontario Green for Life (LO).
  - .2 Landscape Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.

## **1.09 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused soil amendments from landfill to official hazardous material collections site approved by Consultant.
- .2 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## **2 PRODUCTS**

### **2.01 TOPSOIL**

- .1 Topsoil for sod, seeded areas, and planting beds: mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 5 to 10 % organic

- matter by weight.
- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
  - .1 Debris and stones over 50 mm diameter.
  - .2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistency: Friable when moist.

## 2.02 SOIL AMENDMENTS

- .1 Fertilizer:
  - .1 Fertility: Major soil nutrients present in following amounts:
  - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
  - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
  - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .5 Calcium, magnesium, sulphur, and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .6 pH range of 6.5 to 8.0
- .2 Peatmoss:
  - .1 Derived from partially decomposed species of horticultural grade Sphagnum Mosses.
  - .2 Texture ranging from porous to spongy fibrous, elastic, and substantially homogeneous.
  - .3 Free of wood and deleterious material which could prohibit growth.
  - .4 Shredded particle minimum size: 5 mm
  - .5 pH range of 3.5 to 6.5
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: Compost Category [A][B] in accordance with [CCME PN1340], unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Limestone:
  - .1 Ground agricultural limestone.
  - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .6 Use industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

## 2.03 SOURCE QUALITY CONTROL

- .1 Advise Consultant of sources of topsoil to be used with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to imported soil(s) as specified.

- .3 Conduct soil testing by recognized testing facility for pH, Nitrogen (N), Phosphorous (P), and Potassium (K), and organic matter.
- .4 Carry out testing of topsoil by testing laboratory designated by Consultant.
  - .1 Perform soil sampling, testing and analysis in accordance with applicable Provincial standards.

### **3 EXECUTION**

#### **3.01 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as directed by Consultant after area has been cleared of stumps, rocks greater than 100 mm diameter, and invasive or noxious plants and their reproductive parts and removed from site.
- .2 Strip topsoil to depths as indicated by Consultant.
  - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as [directed by Consultant or as indicated on drawings].
  - .1 Stockpile height not to exceed 2.0 m.
  - .2 Protect stockpile from adverse weather conditions, contamination from invasive plant material, and compaction.
  - .3 Avoid placing stockpile in low areas where natural drainage or storm water could pond, or erode these materials during inclement weather.
- .4 Dispose of unused topsoil in an environmentally responsible manner but do not use as landfill as directed by Consultant.

#### **3.02 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct.
  - .1 If discrepancies occur, notify Consultant and do not start work until instructed by Consultant.
- .2 Grade soil, eliminate uneven areas and low spots, ensure positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
  - .1 Remove soil contaminated with calcium chloride, toxic materials, and petroleum products.
  - .2 Remove debris which protrudes more than 75 mm above surface.
  - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

#### **3.03 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after Consultant has accepted subgrade.

- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 Keep topsoil 15 mm below finished grade for sodded areas.
- .4 Spread topsoil [as indicated] to the following minimum depths after settlement.
  - .1 150 mm for seeded areas.
  - .2 150 mm for sodded areas.
  - .3 300 mm for flower beds.
  - .4 500 mm for shrub beds.
  - .5 600 mm for tree beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.
- .6 Avoid spreading or grading in wet, frozen, or saturated state.

### **3.04 SOIL AMENDMENTS**

- .1 For planting beds and turf areas: amend soil as per soil testing report.

### **3.05 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Consultant.
  - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

### **3.06 ACCEPTANCE**

- .1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

### **3.07 SURPLUS MATERIAL**

- .1 Dispose of surplus materials off-site as directed by Consultant.

### **3.08 CLEANING**

- .1 Proceed with cleaning in accordance with Section 01 74 13 – Progressive Cleaning.
  - .1 Leave Work area organized and tidy at end of each day.
  - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Upon completion remove surplus materials, rubbish, tools, and equipment.
  - .1 Clean and reinstate areas affected by Work.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 32 91 19.13 - Topsoil Placement and Grading

### **1.02 REFERENCE STANDARDS**

- .1 Canadian Society of Landscape Architects (CSLA) / Canadian Nursery Landscape Association (CNLA)
  - .1 Canadian Landscape Standard [2016], First Edition
  - .2 Canadian Nursery Stock Standard [2017], Ninth Edition

### **1.03 MEASUREMENT AND PAYMENT**

- .1 Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Consultant for:
  - .1 Turf Grass Nursery Sod Type Number One per square metre.
  - .2 Commercial Grade Turf Grass Nursery Sod per square metre.
  - .3 Pegged Turf Grass Nursery Sod Type or Commercial Grade Turf Grass Nursery Sod per square metre.
  - .4 Sod that has not been grown as Turf Grass Nursery Sod crop.

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 31 19 - Project Meetings.
- .2 Scheduling:
  - .1 Schedule sod laying and/or seeding to coincide with preparation of soil surface.
  - .2 Schedule sod/seed installation when frost is not present in ground.

### **1.05 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for [sod, geotextile and fertilizer] and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS Safety Data Sheet (SDS) in accordance with Section [01 47 15 - Sustainable Requirements: Construction] and Section [02 81 00 - Hazardous Materials].
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.

- .5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality.

## **1.06 QUALITY ASSURANCE**

- .1 Qualifications: Provide proof of qualifications when requested by Consultant.
- .2 Contractor Qualifications:
  - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Green for Life (LO).
  - .2 Landscape Sodding Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.
  - .3 Landscape Maintenance Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Turf Maintenance designation or equivalent.

## **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with supplier's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with supplier's recommendations.
  - .2 Replace defective or damaged materials with new.
- .4 For palletized sod products:
  - .1 Sod shall not be dumped or dropped from vehicle.
  - .2 Provide wind protection measures to protect sod during transportation against wind exposure and to prevent drying.
  - .3 Ensure sod freshness and health when it arrives on site.
  - .4 Provide weather protection measures as required to keep sod fresh and moist if installation is to be delayed.
  - .5 During the growing season, and where feasible, sod should be delivered to the site within 36 hours of harvest and be installed within 24 hours of delivery.
  - .6 Allow sod to dry sufficiently after becoming waterlogged to prevent tearing or damage during handling.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.



- .1 Turf Grass Nursery Sod types:
  - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
  - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.
  - .3 Number One Named Cultivars: Nursery Sod grown from certified seed.
- .2 Turf Grass Nursery Sod quality:
  - .1 Not more than 1 broadleaf weed and up to 1% native grasses per 40 m<sup>2</sup>.
  - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
  - .3 Mowing height limit: 35 to 65 mm.
  - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Commercial Grade Turf Grass Nursery:
  - .1 Mow sod at height directed by Consultant within 36 hours before lifting and remove clippings.
  - .2 Not more than 5 broadleaf weeds and up to 20% native grasses per 40 m<sup>2</sup>.
- .3 Sod establishment support:
  - .1 Wooden pegs: 17 x 8 x 200 mm.
  - .2 Biodegradable starch pegs: 17 x 8 x 200 mm.
- .4 Fertilizer:
  - .1 To Canada "Fertilizers Act" and Fertilizers Regulations.
  - .2 Complete, synthetic, slow release with [65] % of nitrogen content in water-insoluble form.

## **2.02 SOURCE QUALITY CONTROL**

- .1 Obtain written approval from Consultant of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Consultant.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sod installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon

- discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.02 PREPARATION**

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Consultant and re-commence work when instructed by Consultant.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod and plus or minus 15 mm for Commercial Grade Turf Grass Nursery, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Consultant in accordance with Section 01 74 19 - Waste Management and Disposal.

### **3.03 SOD PLACEMENT**

- .1 Lay sod during active growing season for type of sod. Laying sod during dry, freezing, or over frozen soil is unacceptable.
- .2 If growing medium surface is dry, it shall be lightly moistened immediately before laying sod.
- .3 Lay sod flush with adjoining grass areas, paving and top surface of curbs, unless shown otherwise on the drawings.
- .4 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .5 Lay sod sections in rows, joints staggered a minimum of 25 cm). Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

### **3.04 SOD PLACEMENT ON SLOPES AND PEGGING**

- .1 Start laying sod at bottom of slopes.
- .2 Peg sod on slopes steeper than three (3) horizontal to one (1) vertical, within 1.0 m of catch basins and within 1.0 m of drainage channels and ditches to following pattern:
  - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
  - .2 Not less than 3-6 pegs per square metre.

- .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Consultant.
- .4 Drive pegs to 20 mm above soil surface of sod sections.

### **3.05 FERTILIZING PROGRAM**

- .1 Fertilize during establishment and warranty periods to following program:
  - April to May, 10-6-4 at 4.6 kg/ 100 square metre
  - June 1 to July 1, 21-7-7 at 4.6 kg/ 100 square metre
  - September 1 to October 1, 10-6-4 at 4.6 kg/ 100 square metre
  - October 1 to November 15, 32-0-6 at 0.5 kg/ 100 square metre

### **3.06 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 - Cleaning].
  - .1 Leave Work area clean at end of each day.
  - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 - Cleaning].
  - .1 Clean and reinstate areas affected by Work.

### **3.07 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Perform following operations from time of installation until acceptance.
  - .1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of [75 to 100] mm.
  - .2 Cut grass to [50] mm when or before it reaching height of [75] mm.
  - .3 Maintain sodded areas weed free 95%.
  - .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water it well.

### **3.09 ACCEPTANCE**

- .1 Turf Grass Nursery Sod areas will be accepted by Consultant provided that:
  - .1 Sodded areas are properly established.
  - .2 Sod is free of bare and dead spots.
  - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
  - .4 Sodded areas have been cut minimum 2 times before acceptance.
- .2 Sodded Commercial Grade Turf Grass Nursery Sod areas will be accepted by Consultant provided that:
  - .1 Sodded areas are properly established.
  - .2 Extent of surface soil visible when grass has been cut to height of [60] mm is acceptable.
  - .3 Sod is free of bare or dead spots and extent of weeds apparent in grass is acceptable.

- .4 Sodded areas have been cut minimum 2 times before acceptance.
- .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .3 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.
- .4 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

### **3.10 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Water sodded areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and resod dead or bare spots to satisfaction of Consultant.
- .3 Cut grass and remove clippings that will smother grass as directed by Consultant to height as follows:
  - .1 Turf Grass Nursery Sod:
    - .1 50 mm during normal growing conditions.
  - .2 Commercial Grade Turf Grass Nursery Sod:
    - .1 60 mm during normal growing conditions.
  - .3 Cut grass at 2 week intervals or as directed by Consultant, but at intervals so that approximately one third of growth is removed in single cut.
  - .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water it well.
  - .5 Eliminate weeds by mechanical or chemical means to extent acceptable to Consultant.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 31 22 13 - Rough Grading
- .2 Section 31 23 33.01 - Excavation Trenching and Backfilling
- .3 Section 32 91 19.13 - Topsoil Placement and Grading

### **1.02 DEFINITIONS**

- .1 Mycorrhiza: Association between fungus and roots of plants. This symbiosis enhances plant establishment in newly landscaped and imported soils.

### **1.03 REFERENCE STANDARDS**

- .1 National Resources Canada (NRCan):
  - .1 Canada's Plant Hardiness Zones, [current edition]
- .2 Canadian Society of Landscape Architects (CSLA)/Canadian Nursery Landscape Association (CNLA):
  - .1 Canadian Landscape Standard, [2020]
  - .2 Canadian Nursery Stock Standard [2017], Ninth Edition
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS)

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling: obtain approval from Consultant of schedule seven (7) days in advance of shipment of plant material.
- .2 Schedule to include:
  - .1 Quantity and type of plant material.
  - .2 Shipping dates.
  - .3 Arrival dates on site.
  - .4 Planting dates.

### **1.05 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for [trees, shrubs, ground cover, fertilizer, mycorrhiza, anti-desiccant, anchoring equipment, and mulch] and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit WHMIS SDS

- .3 Samples:
  - .1 Submit samples of mulch and mycorrhiza.

## **1.06 QUALITY ASSURANCE**

- .1 Qualifications: Provide proof of qualifications when requested by Consultant.
  - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Green for Life (LO).
  - .2 Landscape Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.
  - .3 Landscape Maintenance Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Ornamental Maintenance designation or equivalent.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Protect plant material from frost, excessive heat, wind, and sun during delivery.
  - .2 Protect plant material from damage during transportation:
    - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
    - .2 Delivery distance exceeds 30 km or the vehicle travels at speeds over 80 km/h, use an enclosed vehicle where practical.
    - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .2 Storage and Handling Requirements:
  - .1 Immediately store and protect plant material which will not be installed within three (3) hours.
    - .1 Store in accordance with supplier's written recommendations at a storage location approved by Consultant.
  - .2 Protect stored plant material from frost, wind, and sun to ensure planting success as follows:
    - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
    - .2 For pots and containers, maintain moisture level in containers.
    - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
  - .3 Store and manage hazardous materials in accordance with manufacturer's written instructions.

## **1.08 WARRANTY**

- .1 Contractor hereby warrants that plant material as itemized on plant list will remain free of defects in accordance with General Conditions CCDC, GC 12.3, but for 1 full growing season, providing adequate maintenance has been provided.
- .2 End-of-warranty inspection will be conducted by Consultant.
- .3 Consultant reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

## **2 PRODUCTS**

### **2.01 PLANT MATERIAL**

- .1 Type of root preparation, sizing, grading, and quality: comply to Canadian Nursery Stock Standard.
  - .1 Source of plant material: grown in Zone 6 in accordance with Plant Hardiness Zones in Canada.
  - .2 Plant material shall be planted in zone specified as appropriate for its species.
  - .3 Plant material in location appropriate for its species.
- .2 Plant material: free of disease, insects, defects, or injuries and structurally sound with strong fibrous root system.
- .3 Trees: with straight trunks, well and characteristically branched for species.
- .4 Trees larger than [200] mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season before arrival on site.
- .5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.
- .6 Collected stock: maximum 40 mm in caliper, with well-developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.
  - .1 During collection, ensure 10% maximum seed crop (or plants) are collected from healthy population of many individuals, and from several plants of same species.
  - .2 Leave remainder for natural dispersal and as food for dependent organisms.

### **2.02 WATER**

- .1 Free of impurities that would inhibit plant growth.

### **2.03 STAKES**

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm OR Wood, pointed one end, 38 x 38 x 2300 mm.

### **2.04 WIRE TIGHTENER**

- .1 Type 1: galvanized steel, stamped plate type, OR rod, triangular shape.
- .2 Type 2: turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm open length.

### **2.05 GUYING WIRE**

- .1 Type 1: steel, 11-gauge wire.

### **2.06 GUYING COLLAR**

- .1 Tube: new 2-ply rubber 25 mm diameter hose.
  - .1 Ensure that hose remains soft and pliable under all weather conditions.

### **2.07 TRUNK PROTECTION**

- .1 Plastic: Big-O, 500 mm x 100 mm diameter, cut vertically.

### **2.08 MULCH**

- .1 Shredded bark: varying in size from 25 to 75 mm in length, from coniferous trees.

### **2.09 FERTILIZER**

- .1 Synthetic commercial type as recommended by soil test report.
  - .1 Ensure new root growth is in contact with mycorrhiza.
  - .2 Use mycorrhiza as recommended by manufacturer's written recommendations.

### **2.10 SOURCE QUALITY CONTROL**

- .1 Obtain approval from Consultant of plant material before planting.
- .2 Imported plant material shall be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: Verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.



- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.02 PRE-PLANTING PREPARATION**

- .1 Proceed only after receipt of written acceptability of plant material from Consultant.
- .2 Remove damaged roots and branches from plant material.
- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .4 Locate and protect utility lines.
- .5 Notify and acquire written acknowledgement from utility authorities before beginning excavation of planting pits for trees and shrubs.

### **3.03 EXCAVATION AND PREPARATION OF PLANTING BEDS**

- .1 Establishment of sub-grade for planting beds in accordance with Section [31 22 13 - Rough Grading].
- .2 Preparation of planting beds in accordance with Section [32 91 19.13 - Topsoil Placement and Grading].
- .3 For individual planting holes:
  - .1 Stake out location and obtain approval from Consultant before excavating.
  - .2 Excavate to depth and width as indicated on Drawings or directed by Consultant.
  - .3 Execute excavation work in accordance with Section 31 23 33.01 - Excavation Trenching and Backfilling.
  - .4 Remove subsoil, rocks, roots, debris, and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
  - .5 Scarify sides of planting hole.
  - .6 Remove water which enters excavations before planting. Notify Consultant if water source is ground water.

### **3.04 PLANTING**

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
  - .1 Plant trees and shrubs with roots placed straight out and spread evenly in hole.
- .2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
  - .1 Do not pull burlap or rope from under root ball.

- .3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .4 Plant vertically in locations as indicated on Drawings or directed by Consultant.
  - .1 Orient plant material to give best appearance in relation to structure, roads, and walks.
- .5 For trees and shrubs:
  - .1 Backfill soil in 150 mm lifts.
    - .1 Tamp each lift to eliminate air pockets.
    - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
    - .3 After water has penetrated into soil, backfill to finish grade.
  - .2 Form watering saucer as indicated on Drawings or directed by Consultant.
- .6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .7 Perform backfilling work in accordance with Section 31 23 33.01 - Excavation Trenching and Backfilling.
- .8 Water plant material thoroughly.
- .9 After soil settlement has occurred, fill with soil to finish grade.

### **3.05 TRUNK PROTECTION**

- .1 Install trunk protection on deciduous trees as indicated on Drawings or directed by Consultant.
- .2 Install trunk protection before installation of tree supports.

### **3.06 TREE SUPPORTS**

- .1 Install tree supports as indicated on Drawings or directed by Consultant.
- .2 Use single stake tree support for deciduous trees less than 3.0 m in height and evergreens less than 2.0 m in height.
  - .1 Place stake on prevailing wind side and 150 mm minimum from trunk.
  - .2 Drive stake 150 mm minimum into undisturbed soil beneath roots.
    - .1 Ensure stake is secure, vertical and unsplit.
  - .3 Install 150 mm long guying collar 1500 mm above grade.
  - .4 Thread Type 1 guying wire through guying collar tube.
    - .1 Twist wire to form collar and secure firmly to stake. Cut off excess wire.
- .3 Use three (3) guy wires and anchors for deciduous trees greater than 3.0 m in height, 50 mm caliper and evergreens greater than 2.0 m in height.
  - .1 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar

- mounting height not to exceed 2.5 m above grade.
- .2 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.
- .3 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree but do not allow for root system to shift into growing medium.
- .4 After tree supports have been installed, remove broken branches with clean, sharp tools.

### **3.07 MULCHING**

- .1 Ensure soil settlement has been corrected before mulching.
- .2 Spread mulch as indicated on Drawings or directed by Consultant.

### **3.08 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Perform following maintenance operations from time of planting to acceptance by Consultant.
  - .1 Water to maintain soil moisture conditions for optimum establishment, growth, and health of plant material without causing erosion.
    - .1 Monitor and maintain self-watering product (if specified) during establishment period.
    - .2 Water evergreen plant material thoroughly in late fall before freeze-up to saturate soil around root system.
  - .2 Remove weeds monthly.
  - .3 Replace or re-spread damaged, missing, or disturbed mulch.
  - .4 Cultivate non-mulched areas, as required to keep top layer of soil friable.
  - .5 Use appropriate control methods if required, to control insects, fungus, and disease, in accordance with federal, provincial and municipal regulations. Obtain product approval from Consultant before application.
  - .6 Remove dead or broken branches from plant material.
  - .7 Keep trunk protection and guy wires in proper repair and adjustment.
  - .8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

### **3.09 MAINTENANCE DURING WARRANTY PERIOD**

- .1 From time of acceptance by Consultant to end of warranty period, perform following maintenance operations.
  - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
    - .1 Self watering product to be monitored and maintained during warranty period.
    - .2 Reform damaged watering saucers.
  - .2 Remove weeds monthly.

- .3 Replace or re-spread damaged, missing, or disturbed mulch.
- .4 Cultivate non-mulched areas, cultivate monthly to keep top layer of soil friable.
- .5 Use appropriate control methods, if required to control insects, fungus, and disease, in accordance with federal, provincial and municipal regulations. Obtain product approval from Consultant before application.
- .6 Apply fertilizer in early spring as indicated by soil test.
- .7 Remove dead, broken or hazardous branches from plant material.
- .8 Keep trunk protection and tree supports in proper repair and adjustment.
- .9 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
- .10 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

### **3.10 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 13 – Progressive Cleaning.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 13 – Progressive Cleaning.
- .3 Waste Management: Separate waste materials for [reuse][and][recycling] in accordance with Section 01 74 19 - Waste Management and Disposal.
  - .1 Divert discarded burlap, wire, and plastic plant containers materials from landfill to plastic recycling facility.
  - .2 Dispose of unused fertilizer at official hazardous material collection site.
  - .3 Dispose of unused anti-desiccant at official hazardous material collections site.
  - .4 Divert unused wood and mulch materials from landfill to composting facility.

### **3.11 CLOSEOUT ACTIVITIES**

- .1 Submit trees, shrubs, and other plantings maintenance reports for review by Consultant.

**END OF SECTION**