July 11, 2017 Reference No. 11131634

Mr. James Frank P. Eng., MBA
Rankin Construction,
222 Martindale Road, Box 1116
St. Catharines, ON L2R 7A3

Dear Mr. Frank:

Re: Geotechnical Desktop Study
Proposed Seven Storey Condominium Building
57 Lakeport Road, St. Catharines, Ontario

1. Introduction

GHD has been retained by a Rankin Construction (Rankin) to conduct a desktop study for the proposed condominium development at 57 Lakeport Road (Site or Property), St. Catharines, Ontario. The Site location is shown on Figure 1. The purpose of the desktop study is to review available geological and geotechnical data and provide preliminary recommendations about the following aspects of the proposed development:

- Geotechnical feasibility of constructing one or more levels of underground structures
- Type of shoring system suitable for different depths of excavation and available local technologies
- Geotechnical design parameters for shoring design
- Long-term ground water table level and related hydrostatic pressure issues.
- Requirement for additional geotechnical and/or hydrogeological investigations.

This letter report provides the results of the desktop study and the preliminary design recommendations based thereon.

2. Documents Reviewed

The following documents were reviewed for the desktop study:

- Water well log A083872
- Available geologic mapping
- Geotechnical Investigation report dated August 1987 prepared by Peto MacCallum Ltd.
- Phase One Environmental Site Assessment, 57 Lakeport Road, St. Catharines, Ontario dated December 5, 2016, prepared by GHD

- Phase Two Environmental Site Assessment, 57 Lakeport Road, St. Catharines, Ontario dated June 29, 2017 prepared by GHD

3. Regional Geology and Site Description

3.1 Regional Geology

The Site is located in the physiographic region of Lake Iroquois Plain[1], which covers the lowland below the Niagara Escarpment up to the Lake Ontario shoreline.

A review of the Quaternary geology maps 2496[2] shows that the Site is located on a peninsula shaped reclaimed piece land within the Martindale Pond. The Quaternary deposits in the general Site area are comprised of glaciolacustrine clayey deposits. These deposits are underlain by clayey Halton Till that covers the Queenston Shale Bedrock.

A review of the bedrock topography map of the area[3] shows that the bedrock surface elevation within the study area is at approximately 64 m Above Mean Sea Level (AMSL), approximately 16 m or more below the existing grades.

The Peto MacCallum report dated August 1987 has reported the bedrock depth ranging from 16.5 to 19 m below the existing grades, which is consistent with the published geology.

3.2 Site Description

The Property is located in the north end of St. Catharines, Ontario, in the Port Dalhousie Heritage District. The Building located on the eastern portion of the Site was originally constructed in 1890 as a repair facility to support the Old Welland Canal lock formerly operated to the south of the Site until the Royal Canadian Legion acquired and occupied the Site in 1951. The exterior portion of the Site is complete with commercial parking on an asphalt paved parking lot occupying the western portion of the Property. The Property boundaries are shown on Figure 2.

4. Summarized Subsurface Soil and Groundwater Conditions

As part of the Phase Two Environmental Site Assessment (Phase II ESA) GHD advanced a total of five boreholes to depths ranging from 4.27 to 14.33 m below the existing ground surface (bgs) at the Site

[1] Chapman, L. J., and Putnam, D. F., (1984): The Physiography of Southern Ontario, Ontario Geological Survey, Special Volume 2, 270p. Accompanied by Map 2715 (coloured), Scale 1:600,000.

[2] Feenstra, B. H., (1984): Quaternary Geology of the Niagara-Welland Area; Ontario Geological Survey, Map 2496, Quaternary Geology Series, Scale 1:50,000 Geology 1969-1972

[3] Feenstra, B. H. (1981): Bedrock Topography of the Niagara and Niagara-on-the-lake Area, Southern Ontario; Ontario Geological Survey Preliminary Map P.2400, Bedrock Topography Series, Scale 1:50,000

between March 20 and March 21, 2017. Each borehole was instrumented as standpipe type monitoring well, the details of which are shown on the monitoring well instrumentation logs included as Attachment A.

The locations of the five boreholes, identified as MW1-17, MW3-17, MW4-17, MW5-17 and MW6-17, are shown on Figure 2. The boreholes were advanced by Aardvark Drilling Inc. (Aardvark) of Guelph, Ontario, using a CME 55 truck-mounted drill rig. Each borehole was advanced using a 108-millimetre (mm) inside diameter (ID) hollow stem auger with a tri-cone drilling bit. Overburden soils were sampled using the standard penetration test (SPT) methodology.

Subsurface soil conditions encountered at the borehole locations were found to be generally consistent with the published regional geology. Detailed descriptions of soils encountered at the borehole locations are recorded on the attached borehole logs. A brief description of Site soil stratigraphy encountered at the borehole locations is summarized, in order of depth, in the following sections. It should be noted that the subsurface conditions were determined at the borehole locations only, and may vary at other locations. Boundaries between various strata as shown on the logs represent an inferred transition between various strata, rather than a precise plane of geological change.

4.1 Topsoil

Borehole MW1-17 was located in a landscaped area at the Site and was advanced through a grass surfaced area. Topsoil extended to a depth of up to 1.0 m bgs at MW1-17.

4.2 Asphalt

Boreholes MW3-17, MW4-17 and MW6-17 were advanced through the asphalt paved areas which was approximately 80 mm thick at the three borehole locations.

4.3 Fill

Fill deposits were encountered either at the ground surface or below the surficial topsoil of pavements structures that continue to depths summarized in the following table:

Table 4.1 Depth of Fill at the Borehole Locations

Borehole No.	Depth (m bgs)
MW1-17	9.35
MW3-17	6.71 (EOBH)
MW4-17	5.56
MW5-17	5.94 (EOBH)
MW6-17	5.33
EOBH – End of Borehole	

Two samples of fill deposits were analyzed for grain size distribution during the Phase II ESA study. The results are summarized below.

Table 4.2 Results of Grain Size Analyses

Borehole No.	Depth (m bgs)	Percent Gravel	Percent Sand	Silt and Clay (Percent Fines Passing No. 200 sieve)
MW3-17	1.52 – 2.13	4	25	71
MW6-17	1.52 – 2.13	1	22	77

Based on the recovered soil samples, the fill deposits can be subdivide into the following sublayers briefly described below.

4.3.1 Silty Sand Fill

In the western portion of the Property, the fill deposits are comprised of medium to fine grained, brown silty sand that extend to depths of up to 2.30 m bgs at MW1-17 and 1.5 m bgs at MW3-17.

The SPT 'N' values of 2, 3 and 4 in the silty sandy fill deposits indicate very loose to loose conditions.

The samples from the silty sand fill were typically in a moist state.

4.3.2 Clayey Silt Fill

In the eastern portion of the property beginning at least at MW4-17, the sand and gravel fill deposits are underlain by brown to reddish brown clayey silt with occasional fine gravel to a depth of up to 5.50 m bgs (at MW4-17).

The SPT 'N' values in the clayey silt ranged from 3 to 9 indicating very soft to stiff consistency.

4.3.3 Sandy Silt Fill

The clayey silt fill material was underlain with medium to fine grained, brown to grey, sandy silt with occasional fine gravel to a depth of up to 6.7 m bgs (at MW4-17).

The SPT 'N' values of 3 in the sandy silt fill indicate very loose conditions. The samples from sandy silt fill were wet.

4.4 Silty Clay

Grey silty clay was encountered at a depth from approximately 6.7 m bgs to the termination depth of 14.33 m bgs at the location of borehole MW4-17.

The SPT 'N' values could not be recorded due to sinking of the sampler under self-weight and rods, indicating very soft conditions.

4.5 Silt Till

Silt till was encountered on Site at a depth of approximately 9.3 m bgs at MW1-17 and extended to the termination depth of borehole at 9.75 m bgs.

The SPT ‘N’ value of 46 recorded shows that the silt till is in a dense state. The silt till was not encountered at any other borehole on-Site.

4.6 Bedrock

The bedrock was not encountered in any of the GHD boreholes advanced for the Phase II ESA study. The boreholes drilled by Peto MacCallum in 1987, attached with this letter, however did contact the bedrock of Queenston Formation at depths of 16.5 to 19 m bgs.

The Ordovician Queenston Formation[4] is mainly a brick red shale with some green shale partings or mottlings and scattered interbeds of limestone. The Queenston Formation is reported have a thickness of 330 m under eastern Lake Erie and thins northwards, and was deposited under marine environment.

4.7 Groundwater

Groundwater observations were made in the monitoring wells as part of the Phase II ESA study on three occasions on March 23, 24 and 31, 2017. The groundwater depths were observed to range from 0.77 to 2.88 m bgs. The canal water level was recorded at 0.55 m below the existing grades on March 31, 2017.

Groundwater levels will also vary depending upon the seasonal and climatic conditions, Martindale Pond levels and other factors.

It is noted that on March 31, 2017 the Lake Ontario water level was recorded at 75.143 m with respect to International Great Lakes Datum (IGLD)[5].

The Peto Mac MacCallum report dated 1987 has reported ground water levels at a depth of 2.75 to 3.66 m bgs at the time of drilling.

5. Discussion and Preliminary Recommendations

5.1 Geotechnical Feasibility of Constructing Below Grade Levels

The subsurface conditions at the Site are comprised of loose to soft fill deposits and shallow groundwater conditions. These conditions typically make construction of the below grade levels difficult but not impossible as shown by experience with many commercial and residential buildings constructed along the lake front in the Toronto Harbour area. Below grade levels will require the following measures to ensure dry conditions over their service lives:

- Watertight basement walls
- Waterproofing of the basement walls

[4] Young-nam Lee (1988): Stress-Strain Behaviour of Queenston Formation; Doctoral Thesis, Western University, London, Ontario

[5] http://www.tides-marees.gc.ca/eng/Station/Month?type=1&sid=13030&tz=EST&pres=2&date=2017%2F02%2F28

Waterproofing is typically designed by the project architects and therefore is outside the scope of this desktop study. Recommendations for constructing watertight walls are provided below.

5.2 Suitable Shoring Systems

The overburden materials contain significant quantities of fill deposits and very soft to soft native clayey soils of glaciolacustrine origin. Both GHD and Peto MacCallum boreholes show that the glacial till is present only as a veneer covering the bedrock. The groundwater table is shallow and consistent with lake levels.

Due to the shallow groundwater table encountered during the Phase II ESA investigations, it is expected that a water tight shoring system will be required even if only one below grade level is constructed as part of the redevelopment. A multi-level structure will likely be supported on deep foundations bearing into the bedrock due to the presence of loose/soft fill and very soft to soft glaciolacustrine deposits. The following characteristics will therefore be desirable in a shoring system selected for the underground levels of the proposed multi-level development:

- The system should be useable as perimeter walls of the proposed structure.
- Due to shallow groundwater conditions, the shoring system should be such that a continuous dewatering of the overburden during the construction should not be required. Continuous dewatering of the overburden soils from a laterally unconfined area could result in settlement of loose/soft fill deposits as a result of the increased loading.

A shoring system consisting of secant piles is a robust system which, with piles being keyed into the bedrock to a suitable depth, will create a watertight seal. Further lateral support to a secant pile wall system, if required, can be provided using rock anchors. Secant piles can be used as the perimeter walls for the structure if designed as such.

5.3 Lateral Earth Pressures

The following soil parameters can be used for design of secant piles or similar systems for lateral earth pressures:

Table 5.1 Lateral Earth Pressure Coefficients

Soil	Bulk Density (kN/m^3)	Angle of Internal Friction Φ (degrees)	Coefficients of Lateral Earth Pressures		
			Ka	Ko	Kp
Fill Deposits	20	22	0.45	0.63	2.20
Glaciolacustrine Clay Deposits	19	25	0.41	0.58	2.46
Glacial Till Deposits	21	34	0.28	0.44	3.54

Due to the shallow groundwater conditions, the water level should be assumed to be at ground surface in the design of shoring systems.

5.4 Excavation

The OHSA regulations require that if workmen must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four broad soil types as summarized in the following table:

Table 5.2 OSHA Soil Types

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 m of bottom	1 horizontal to 1 vertical
2	Within 1.2 m of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

For the localized excavations within the confining shoring systems, the fill above the groundwater can be classified as Type 3 soils, and Type 4 soils if affected by groundwater seepage. The very soft clayey soils identified at deeper depths must also be considered Type 4 soils. The hard/dense glacial till deposits can be considered as Type 2 soils when properly dewatered. The highest number soil type identified in an excavation must govern the excavation slopes from top to bottom of the excavation.

For bulk excavations from within the confining shoring systems, a specialist excavation contractor should review the factual data provided in this report and implement a suitable excavation methodology based on his experience with similar projects.

5.5 Dewatering

If the migration of soil fines from within the confined shoring system is not a concern then dewatering from within the sealed shoring systems can be carried out through deep sumps, provided the dewatering equipment is capable of handling a heavy sediment load in the dewatering effluent. Alternatively, a filtered well system will be required.

6. Additional Investigations

It is recommended that the following additional geotechnical and hydrogeological investigations should be carried out to better determine the design and construction requirements:

1. Single Well Response Tests (SWRT) in the existing monitoring wells installed by GHD. The results of SWRT will provide an indication of in-situ of hydraulic conductivity of the heterogeneous fill deposits. The construction dewatering quantities and suitable dewatering methods can then be determined based on these in-situ hydraulic conductivities.
2. The Peto MacCallum investigation was carried out in part of the Site. The depth to bedrock is variable by 3 m or more therefore could have a significant effect on the construction cost. Depth to bedrock, and its properties should be confirmed across the footprint of the proposed multi-storey

building. The bedrock properties will be used to design the deep foundations, shoring system and rock anchors, if required.

7. Limitations of the Report

This desktop study (report) is intended solely for Rankin. Others may not rely upon the findings of this report without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The preliminary recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by Rankin and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No warranties or representations of any kind are either expressed or implied. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third party.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The preliminary recommendations and comments made in the study report are based on our review of subsurface investigations and resulting understanding of the project, as defined at the time of the study.

We appreciate the opportunity to work with you on this project. Should you have any questions or require further information, please do not hesitate to contact our office.

Sincerely,

GHD



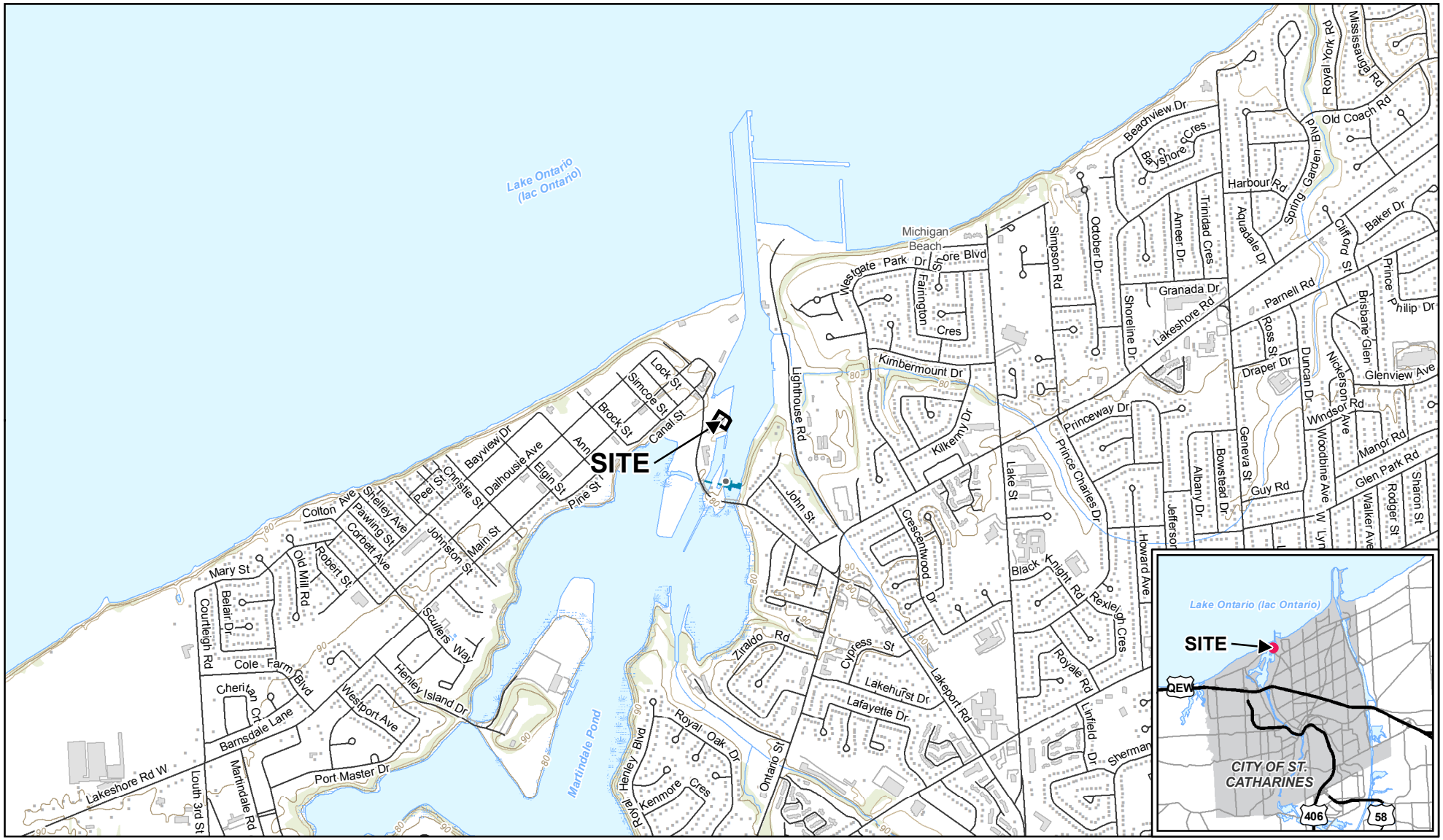
July 11, 2017

Hassan Gilani, M.Sc., P. Eng.

HG/cd/1

Encl.

cc: M. Gaudet, GHD



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0 200 400 600
Meters

Coordinate System:
NAD 1983 UTM Zone 17N

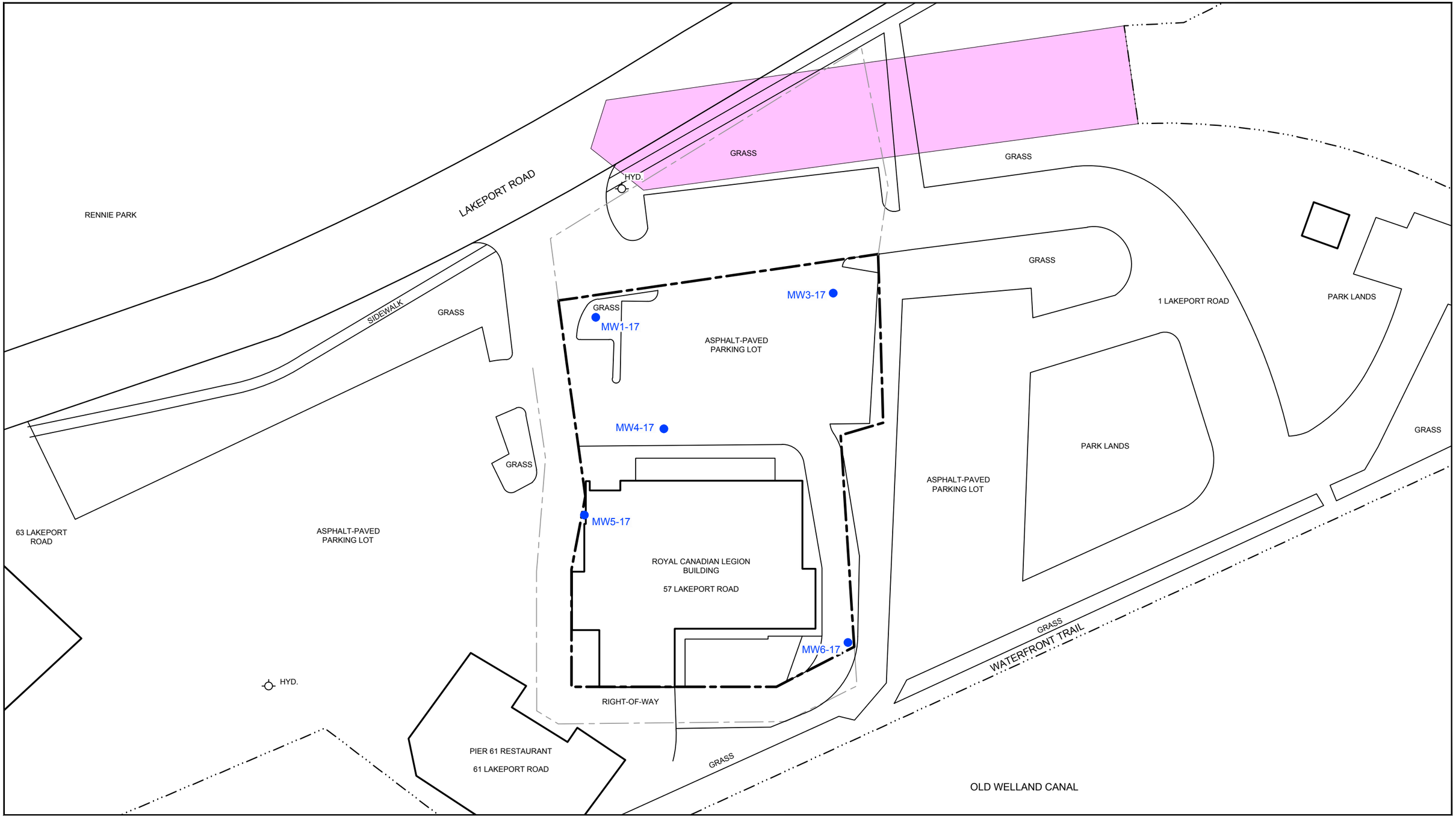
RANKIN CONSTRUCTION INC.
57 LAKEPORT ROAD, ST. CATHARINES, ONTARIO
GEOTECHNICAL DESKTOP STUDY

11131634-20
Jul 7, 2017

SITE LOCATION MAP

FIGURE 1

GIS File: Q:\GIS\PROJECTS\11131000s\11131634\Layouts\FRAN001\11131634-20(FRAN004)GIS-WA001.mxd



0 5 10 15m

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- SHORELINE
- HYD. HYDRANT
- MONITORING WELL
- FORMER LOCK

RANKIN CONSTRUCTION INC.
57 LAKEPORT ROAD, ST. CATHARINES, ONTARIO
GEOTECHNICAL DESKTOP STUDY

11131634-20

Jul 6, 2017

ENVIRONMENTAL INVESTIGATIVE LOCATIONS

FIGURE 2

CAD File: P:\drawings\11131000s\11131634\11131634-REPORTS\11131634-20(003)\11131634-20(003)GN\11131634-20(003)GN-WA003.dwg

Attachment A
Borehole Logs

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW1-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
	GROUND SURFACE	99.48						
0.5	TOPSOIL		CONCRETE; 51mm PVC WELL CASING; BENTONITE CHIPS	1SS		20	4	34
1.0	SM-SILTY SAND (FILL), very loose, fine grained, poorly graded, brown, moist	98.41	203mm BOREHOLE	2SS		100	3	6.9
1.5	- with clay, moist to wet at 1.52m BGS							
2.0			51mm PVC WELL SCREEN	3SS		60	2	0.3
2.5	ML-CLAYEY SILT (FILL), very soft, medium plasticity, brown, wet	97.19	SAND PACK					
	- trace sand at 2.59m BGS			4SS		100	0	6.9
3.0								
3.5				5SS		100	0	5.7
	- sandy at 3.81m BGS							
4.0				6SS		100	00	5.3
4.5	- trace sand at 4.57m BGS							
				7SS		100	1	5.3
5.0								
	- greyish brown at 5.33m BGS							
5.5				8SS		100	0	6.1
6.0	- vegetative matter, dark grey at 6.10m BGS							
				9SS		100	1	5.5
6.5			BENTONITE CHIPS					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

OVERBURDEN LOG 11131634-WI.GPJ CRA_CORP.GDT 4/4/17

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW1-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
7.5	- soft at 7.62m BGS			10SS		100	2	5.2
8.0				11SS		100	4	4.7
8.5	ML-SANDY SILT, loose, fine grained, poorly graded, greenish grey, wet - brown at 8.76m BGS	91.10		12SS		60	6	0.5
9.0								
9.5	ML-SILT (TILL), dense, fine grained, poorly graded, red, wet	90.13	WELL DETAILS Screened interval: 98.26 to 95.21m m asd 1.22 to 4.27m BGS Length: 3.05m Diameter: 51mm Slot Size: 0.010 Material: PVC Seal: 99.33 to 98.87m m asd 0.15 to 0.61m BGS Material: BENTONITE CHIPS Sand Pack: 98.87 to 94.91m m asd 0.61 to 4.57m BGS Material: SAND	13SS		80	46	1.1
10.0	END OF BOREHOLE @ 9.75m BGS	89.73						
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW2-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	99.26						
0	ASPHALT	99.16	CONCRETE	1SS		60	19	0.8
	SP/GP-SAND/GRAVEL (FILL), compact, medium sand, fine gravel, poorly graded, grey, dry	98.80						1.5
0.5	SM-SILTY SAND (FILL), trace fine gravel, compact, medium grained, poorly graded, brown, moist		51mm PVC WELL CASING					
1.0	- trace clay, very loose at 0.76m BGS		BENTONITE CHIPS	2SS		50	2	1.8
1.5	ML-CLAYEY SILT (FILL), very loose, medium plasticity, greyish brown, moist	97.74						
2.0			203mm BOREHOLE	3SS		100	5	1.2
2.5	- strong petroleum odour at 2.34m BGS			4SS 2.29-2.90m -003		100	5	202.8
3.0	ML-SANDY SILT, some sand, very stiff, low plasticity, grey, intermixed with brown, dry, slight petroleum odour	96.21						
3.5	- no petroleum odour at 3.20m BGS			5SS 3.05-3.66m -004		100	27	2.7
	- hard at 3.81m BGS							
4.0				6SS		50	72	3.8
4.5								
5.0	- grey at 5.08m BGS			7SS		100	42	3.3
	ML-SANDY SILT (FILL), dense, fine grained, poorly graded, orangish brown, moist	93.93	51mm PVC WELL SCREEN					
5.5				8SS		100	42	1.8
6.0	- coarse sand seams, trace fine gravel, wet at 6.10m BGS		SAND PACK					
6.5				9SS		100	61	0.3

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW2-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
7.5	END OF BOREHOLE @ 7.62m BGS	91.64	WELL DETAILS Screened interval: 94.69 to 91.64m m asd 4.57 to 7.62m BGS Length: 3.05m Diameter: 51mm Slot Size: 0.010 Material: PVC Seal: 99.11 to 94.99m m asd 0.15 to 4.27m BGS Material: BENTONITE CHIPS Sand Pack: 94.99 to 91.64m m asd 4.27 to 7.62m BGS Material: SAND					
8.0								
8.5								
9.0								
9.5								
10.0								
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW3-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	REC (%)	'N' VALUE	PID (ppm)
	GROUND SURFACE	98.81						
0	ASPHALT	98.73	CONCRETE					
	SP/GP-SAND/GRAVEL (FILL), compact, medum sand, fine gravel, poorly graded, light brown, dry	98.51		1SS		80	10	5.2
0.5	SM-SILTY SAND (FILL), compact, fine grained, poorly graded, brown, moist		51mm PVC WELL CASING					
1.0	- very loose at 0.76m BGS			0.72-1.37m -012 2SS		60	4	5.8
			BENTONITE CHIPS					
1.5	ML-CLAYEY SILT (FILL), with sand, soft, medium plasticity, brown, moist	97.29						
2.0			203mm BOREHOLE	3SS		60	3	6.2
	- grey, moist to wet at 2.29m BGS							
2.5				4SS 2.29-2.90m -013		80	4	6.3
3.0	ML-SANDY SILT, some sand, trace clay and gravel, firm, low plasticity, grey, moist to wet	95.76						
				5SS		100	5	6.8
3.5			51mm PVC WELL SCREEN					
	- soft, medium plasticity at 3.81m BGS							
4.0				6SS		100	3	6.7
			SAND PACK					
4.5	- greyish brown at 4.57m BGS							
	- grey, wet at 4.88m BGS			7SS		90	3	6.3
5.0								
	- very soft at 5.33m BGS							
5.5	ML-CLAYEY SILT, with vegetative matter, medium plasticity, dark grey, moist	93.32		8SS		100	0	5.5
6.0								
			BENTONITE	9SS		100	0	5.6
6.5								
	END OF BOREHOLE @ 6.71m BGS	92.10						

WELL DETAILS
Screened interval:

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 11131634-WI.GPJ CRA_CORP.GDT 4/4/17

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW3-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
7.5			95.76 to 92.71m m asd 3.05 to 6.10m BGS Length: 3.05m Diameter: 51mm Slot Size: 0.010 Material: PVC Seal: 98.66 to 96.07m m asd 0.15 to 2.74m BGS Material: BENTONITE CHIPS Sand Pack: 96.07 to 92.71m m asd 2.74 to 6.10m BGS Material: SAND					
8.0								
8.5								
9.0								
9.5								
10.0								
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (Ⓒ)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW4-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
	GROUND SURFACE	98.26						
0	ASPHALT	98.18	CONCRETE					
	SP/GP-SAND/GRAVEL (FILL), compact, coarse sand, fine gravel, poorly graded, grey, dry	97.85	51mm PVC WELL CASING	1SS 0-0.61m -007		70	15	4.0
0.5	ML-CLAYEY SILT (FILL), stiff, low plasticity, reddish brown, moist		BENTONITE CHIPS					
1.0				2SS		10	9	4.6
			203mm BOREHOLE					
1.5	- soft, grey, moist to wet at 1.52m BGS							
	- medium plasticity, wet at 1.83m BGS		51mm PVC WELL SCREEN	3SS 1.52-2.13m -008/ 009		50	3	5.7
2.0								
			SAND PACK					
2.5				4SS		60	3	6.1
3.0								
				5SS		40	3	5.4
3.5								
	- vegetative matter, dark brown at 3.81m BGS							
4.0				6SS		40	3	4.9
4.5								
				7SS		100	3	5.1
5.0								
5.5	SP-SAND, very loose, coarse grained, poorly graded, dark grey, wet	92.77 / 92.62		8SS		100	3	4.7
	ML-SANDY SILT, soft, medium plasticity, grey, wet							
6.0								
	- wood fragments at 6.40m BGS			9SS		100	3	5.6
6.5								
	CH-SILTY CLAY, very soft, high plasticity, grey, wet	91.55						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW4-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
7.5				10SS		100	0	6.1
8.0				11SS		100	0	6.2
8.5				12SS		100	0	6.1
9.0			BENTONITE CHIPS					
9.5				13SS		100	0	5.9
10.0				14SS		100	0	6.1
10.5								
11.0				15SS		100	0	5.5
11.5				16SS		100	0	2.5
12.0								
12.5				17SS		100	0	--
13.0				18SS		100	0	--
13.5								

WELL DETAILS
Screened interval:

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW4-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
14.5	- trace sand and gravel, red at 14.02m BGS	83.93	97.04 to 93.99m m asd 1.22 to 4.27m BGS Length: 3.05m Diameter: 51mm Slot Size: 0.010 Material: PVC Seal: 98.11 to 97.65m m asd 0.15 to 0.61m BGS Material: BENTONITE CHIPS Sand Pack: 97.65 to 93.69m m asd 0.61 to 4.57m BGS Material: SAND	19SS	X	100	3	-
	END OF BOREHOLE @ 14.33m BGS							
15.0								
15.5								
16.0								
16.5								
17.0								
17.5								
18.0								
18.5								
19.0								
19.5								
20.0								
20.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW5-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
	GROUND SURFACE	97.74						
0	SP/GP-SAND/GRAVEL (FILL), compact, medium sand, fine gravel, poorly graded, grey, moist		CONCRETE					
		97.44	51mm PVC WELL CASING	1SS 0-0.61m -010		70	17	9.5
0.5	ML-CLAYEY SILT, trace gravel, very stiff, low plasticity, brown, moist							
	- no gravel, firm, grey, mottling at 0.76m BGS		BENTONITE CHIPS					
1.0				2SS 0.76-1.68m -011		80	7	10.5
1.5	- soft, grey, with light brown, moist to wet at 1.52m BGS		203mm BOREHOLE					
2.0				3SS		70	4	8.9
	ML-SANDY SILT, soft, low plasticity, grey, wet	95.45	51mm PVC WELL SCREEN					
2.5				4SS		60	4	9.3
3.0	- with clay at 3.05m BGS		SAND PACK					
3.5				5SS		30	3	8.2
4.0	- vegetative matter (shells, roots, plant fragments), dark grey at 4.04m BGS			6SS		80	4	6.2
4.5								
5.0			BENTONITE CHIPS	7SS		100	2	3.9
5.5				8SS		100	0	
6.0	END OF BOREHOLE @ 5.94m BGS	91.80						
6.5								

WELL DETAILS
Screened interval:
96.52 to 93.47m m asd
1.22 to 4.27m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 0.010
Material: PVC
Seal:
97.59 to 96.83m m asd
0.15 to 0.91m BGS
Material: BENTONITE CHIPS
Sand Pack:
96.83 to 93.32m m asd
0.91 to 4.42m BGS

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

OVERBURDEN LOG 11131634-WI.GPJ CRA_CORP.GDT 4/4/17

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW5-17
DATE COMPLETED: March 21, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
7.5			Material: SAND					
8.0								
8.5								
9.0								
9.5								
10.0								
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW6-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd
	GROUND SURFACE	96.88
0.5	ASPHALT	96.80
	SP/GP-SAND/GRAVEL (FILL), loose, medium sand, fine gravel, poorly graded, light brown, moist	96.58
	ML-CLAYEY SILT (FILL), firm, low plasticity, greyish brown, moist	
1.0	- trace sand and asphalt, soft, black at 0.61m BGS	95.97
	ML-SANDY SILT (FILL), very soft, low plasticity, brown, moist to wet	
1.5	- trace gravel, reddish brown, wet at 1.52m BGS	
2.0		
2.5		
3.0	- trace vegetative matter, intermixed red and grey at 3.05m BGS	
3.5		
4.0		
4.5	ML-CLAYEY SILT (FILL), trace gravel, soft, medium plasticity, grey, wet	92.31
5.0		
5.5	CH-SILTY CLAY, trace sand, medium plasticity, dark grey	91.55
6.0	END OF BOREHOLE @ 6.10m BGS	90.78
6.5		

MONITORING WELL: CONCRETE; 51mm PVC WELL CASING; BENTONITE CHIPS; 203mm BOREHOLE; 51mm PVC WELL SCREEN; SAND PACK; BENTONITE CHIPS

WELL DETAILS
Screened interval:
95.36 to 92.31m m asd
1.52 to 4.57m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 0.010

SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
1SS		50	7	1.9
2SS 0.46-0.91m -001		50	3	2.7
3SS 0.91-1.52m -002		80	2	3.2
4SS		50	2	3.0
5SS		50	2	28
6SS		70	2	2.4
7SS		100	3	2.1
8SS		100	4	1.6
9SS		100	0	1.2
10SS		100	3	1.2

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: PHASE TWO ESA
PROJECT NUMBER: 11131634-20
CLIENT: RANKIN CONSTRUCTION INC
LOCATION: 57 LAKEPORT ROAD, ST CATHARINES, ONTARIO

HOLE DESIGNATION: MW6-17
DATE COMPLETED: March 20, 2017
DRILLING METHOD: HSA/SS
FIELD PERSONNEL: T. BRINDLE

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m m asd	MONITORING WELL	SAMPLE				
				NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
7.5			Material: PVC Seal: 96.73 to 95.66m m asd 0.15 to 1.22m BGS Material: BENTONITE CHIPS Sand Pack: 95.66 to 92.16m m asd 1.22 to 4.72m BGS Material: SAND					
8.0								
8.5								
9.0								
9.5								
10.0								
10.5								
11.0								
11.5								
12.0								
12.5								
13.0								
13.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS

Attachment B
Peto MacCallum Logs

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 1

JOB NAME: ADDITION AND ALTERATIONS TO ROYAL CANADIAN LEGION BRANCH NO. 350
JOB No.: 87 F 351
LOCATION: Port Dalhousie, Ontario
BORING DATE: July 21/87
ENGINEER: M. Coccia
BORING METHOD: Continuous Flight Hollow Stem Augers
TECHNICIAN: M. Rapsey

GROUND ELEVATION: 256.8

DEPTH	DESCRIPTION	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FOOT N-VALUES
	SAND FILL: Reddish brown, silty fine to medium sand, some gravel	255			
2.5					
	SILT FILL: Compact/very stiff, olive brown, mottled grey clayey silt, trace of sand, non to slightly plastic, becoming loose/firm with oc. splinters of wood		1	SS	23
		250	2	SS	7
			3	SS	6
		245	4	SS	7
14.5			5	SS	9
	SILT ALLUVIUM: Loose/firm, black to dark greyish brown, fine sandy to clayey silt, medium organic, occ. thin layers of clay and fine sand	240	6	SS	5
			7	SS	6
	one 6 in. layer of fine to coarse sand and rounded gravel, waterbearing		8	SS	5
		235			
			9	SS	4
28.0		230			
	SAND: Loose to compact, grey silty fine sand, saturated		10	SS	5
		225			
			11	SS	12
		220			
	AUGER PROBE				
		215			
		210			
	harder augering, possible clay till	205			
54.0					
	Borehole terminated at 54.0 ft. upon practical refusal to split spoon penetration on assumed bedrock.		12	SS	50/0 in.
		200			

SHEAR STRENGTH C_u
DYNAMIC CONE PENETRATION
STANDARD PENETRATION TEST - •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

After Sample 8 free water at 12.0 ft.

Upon completion of augering, free water at 22.0 ft. inside borehole.

Sample of ground water obtained for laboratory testing.

NOTES:

CHECKED BY: M. C.

PML 504

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 2

JOB NAME ADDITION AND ALTERATIONS TO ROYAL CANADIAN LEGION BRANCH NO. 350 — JOB No. 87 F 351
LOCATION Port Dalhousie, Ontario — BORING DATE July 21/87 — ENGINEER M. Coccia
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN M. Rapsey

DEPTH	SOIL PROFILE: DESCRIPTION (GROUND ELEVATION: 253.1)	LEGEND	ELEVATION	SAMPLES: NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SILT FILL: Compact, reddish brown sandy silt, trace of clay and gravel					
3.0			250			
	SILT FILL: Loose/stiff, olive brown, mottled grey clayey silt, some sand, non to slightly plastic, D.T.P.L.			1	SS	16
				2	SS	9
			245			
				3	SS	4*
				4	SS	12
12.0	occ. softened zones					
	SILT ALLUVIUM: Soft, dark greyish brown organic clayey silt, trace of sand, slightly plastic, W.T.P.L., medium organic with fine leafy organics		240	5	SS	4
				6	SS	3
			235		FV	
					3"	
				7	TW	PH
			230		FV	
				8	SS	4
			225		FV	
				9	SS	4
			220			
				10	SS	4
			215			
				11	SS	4
			210			
				12	SS	3
			205			
	with occ. pieces of decayed wood, occ. inclusions of silty clay			13	SS	8
			200			
				14	SS	2
57.5			195			
	SHALE: Red weathered shale					
60.5	Borehole terminated at 60.5 ft.			15	SS	100/6 in.

SHEAR STRENGTH C_u ksf (1 2 3 4) ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST •
BLOWS/FOOT (20 40 60 80)

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % (10 20 30)

GROUNDWATER OBSERVATIONS AND REMARKS

*no recovery

After SS4 free water at 12.0 ft.

43

Upon completion of augering, free wate at 16.0 ft. inside borehole.

NOTES:

Elev ~ 1 hole 283 reversed.

CHECKED BY: M.C.

PMI 1504

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 3

JOB NAME ADDITION AND ALTERATIONS TO ROYAL CANADIAN LEGION BRANCH NO. 350
LOCATION Port Dalhousie, Ontario — JOB No. 87 F 351
BORING METHOD Continuous Flight Hollow Stem Augers — BORING DATE July 22/87 — ENGINEER M. Cocc
TECHNICIAN M. Ra

DEPTH	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	GROUND ELEVATION: 255.1 (253')					
0	SILT FILL: Compact, olive brown silt, trace of clay and sand, mottled reddish brown, non-plastic, moist			1	SS	16
5			250	2	SS	7
	becoming loose, reddish brown with occ. small particles of weathered shale					
10			245	3	SS	4
				4	SS	3
15	15.3 / 15.5 SAND: Very loose, dark brown fine to coarse sand, some silt and rounded gravel		240	5	SS	5
				6	SS	2
20	SILT ALLUVIUM: Very soft, dark greyish brown organic clayey silt, occ. decayed woody and leafy organics		235	7	SS	3
					FV	
25			230	8	SS	3
	28.0				FV	
30	becoming fine sandy silt, very low organic		225	9	SS	2
35			220	10	SS	2
40			215	11	SS	6
45			210			
50	becoming compact with numerous pieces of decayed wood to 2 in. thick with zones of organic fine sand		205	12	SS	10
55			200			
	Sampled borehole terminated at 60.0 ft. due to excessive heave inside auger of sands.					
60	60.0 / 60.6 DYNAMIC CONE PENETRATION TEST		195			100/7 in.
	Dynamic cone penetration test terminated at 60.6 ft., upon practical refusal to cone penetration on assumed bedrock					

SHEAR STRENGTH C_u ksf (1 2 3 4) ▲
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST-•
BLOWS/FOOT (20 40 60 80)

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % (10 20 30)

GROUNDWA OBSERVATI AND REMAR

After SS5 fre water at 11.0

Upon completion augering, free w at 15.0 ft. insi borehole.

NOTES:

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 4

JOB NAME ADDITION AND ALTERATIONS TO ROYAL CANADIAN LEGION BRANCH NO. 350 — JOB No. 87 F 351

LOCATION Port Dalhousie, Ontario — BORING DATE July 22/87 — ENGINEER M. Coccia

BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN M. Rapsey

GROUND ELEVATION: 253.5

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N - VALUES
0	SILT FILL: Stiff/loose olive brown clayey silt, trace of sand, mottled grey, non to slightly plastic, D.T.P.L., oxidized stains	250	1	SS	8
			2	SS	7
		245	3	SS	7
	with softened/wet zones		4	SS	4
13.0		240	5	SS	3
	SILT ALLUVIUM: Soft, dark greyish brown organic clayey silt with fine leafy organics, pieces of wood			3"	
			6	TW	PH
		235		FV	
	becoming fine sandy, clayey silt		7	SS	2
		230		FV	
		225			
		220			
		215			
			8	SS	9
		210			
	AUGER PROBE	205			
		200			
	gravelly	195			
59.5	Borehole terminated upon refusal to auger at 59.5 ft., bedrock assumed.				

SHEAR STRENGTH C_u ksf (1 2 3 4)

DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST- •
BLOWS/FOOT (20 40 60 80)

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % (10 20 30)

GROUNDWATER OBSERVATIONS AND REMARKS

After SS4 free wat at 9.0 ft.

Upon completion of augering, free wat at 9.5 ft. inside borehole.

NOTES:

CHECKED BY: M-C.

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE No. 5

JOB NAME ADDITION AND ALTERATIONS TO ROYAL CANADIAN LEGION BRANCH NO. 350 JOB No. 87 F 351

LOCATION Port Dalhousie, Ontario BORING DATE July 21/87 ENGINEER M. Coccia

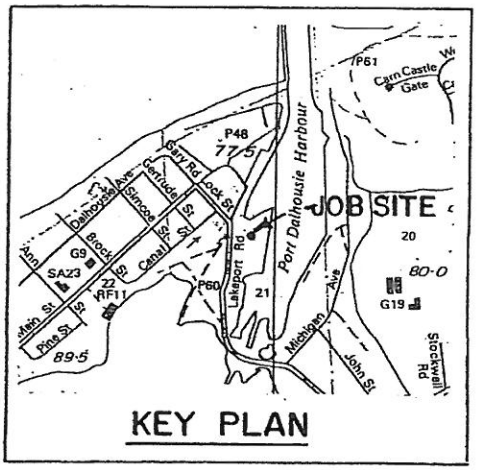
BORING METHOD Continuous Flight Hollow Stem Augers TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u ▲	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N - VALUES	DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST • BLOWS/FOOT 20 40 60 80	W_P W W_L WATER CONTENT % 10 20 30	
	GROUND ELEVATION: 256.1								
	UNSAMPLED AUGER PROBE		255						
5			250						
10			245						
15			240						
20			235						
25			230						
30			225						
35			220						
40			215						
45			210						
50			205						
55			200						
60			195						
62.3									Initial

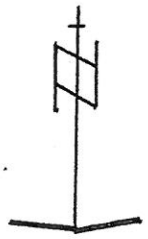
Borehole terminated at 62.3 ft. upon refusal to auger on assumed bedrock.

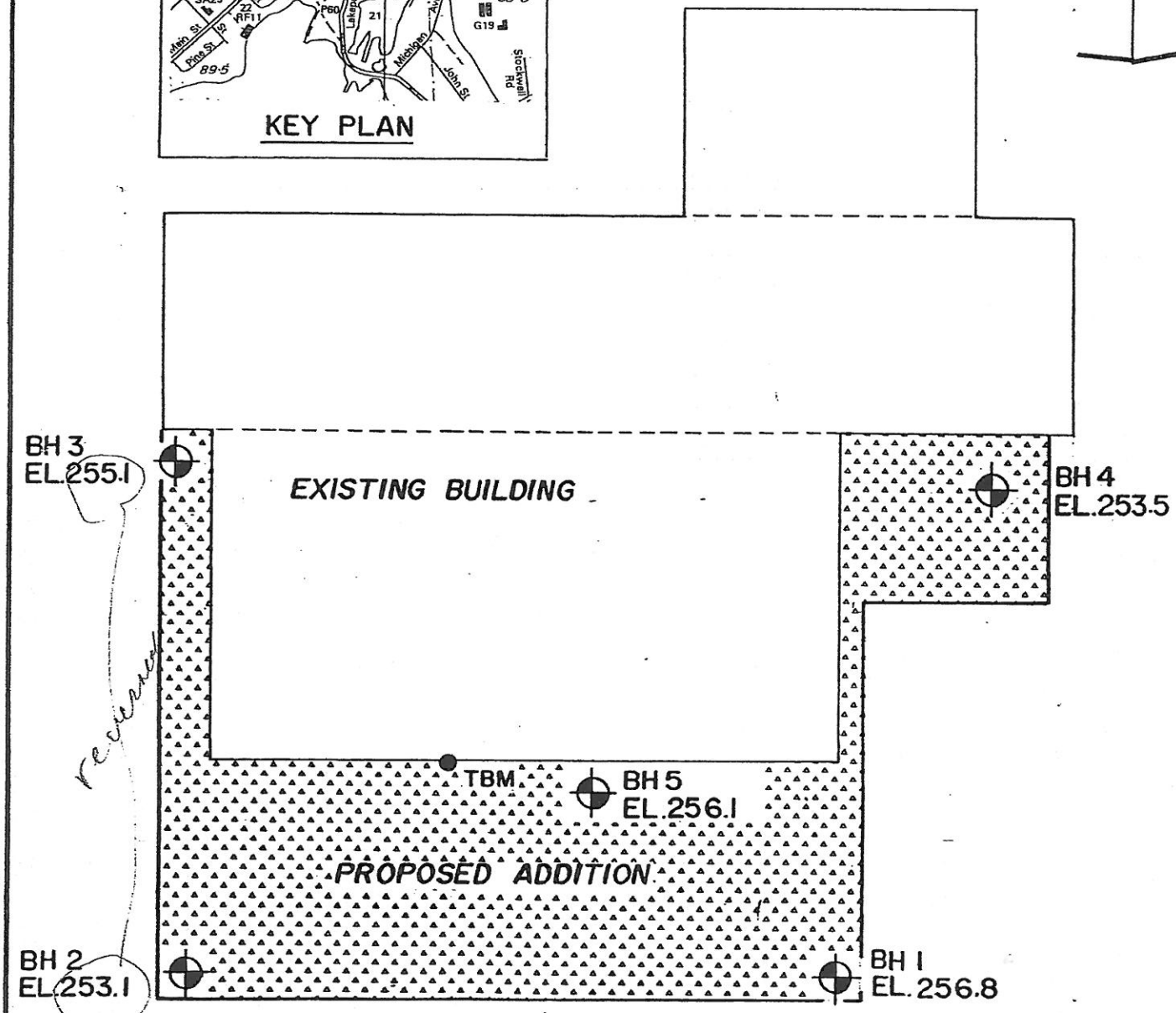
CHECKED BY:

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA



CRANE





TBM. TOP OF CONCRETE WINDOW SILL. EL. 259.37 IMP. (ASSUMED GEODETIC)
(SUPPLIED BY G. DOUGLAS URE & SONS.)

REFERENCE: REPRODUCED FROM SITE PLAN SUPPLIED BY CLIENT.

WILLIAMS WOODRUFF and ELMES

PROPOSED ADDITION & ALTERATIONS TO ROYAL CANADIAN LEGION, BRANCH 350
57 LAKEPORT ROAD, ST. CATHARINES, ONT.

BOREHOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
AUG. 1987	1"=20'	87 F 351	1