Geotechnical Investigation

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Project Name:
Geotechnical Investigation
Corkery Community Centre Expansion
3447 Old Almonte Road, Carp, Ontario

Project Number:
OTT-21010977-A0

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Table of Contents

Executive Summary 1
1. Introduction 3
2. Procedure 4
3. Subsurface Conditions and Groundwater Levels 6
3.1 Topsoil 6
3.2 Pavement Structure 6
3.3 Fill 6
3.4 Buried Concrete 7
3.5 Silty Sand to Sandy Silt 7
3.6 Limestone Bedrock 7
3.7 Groundwater Level Measurements 8
3.8 Existing Foundation Information 8
4. Site Classification for Seismic Site Response and Liquefaction Potential of Soils 10
4.1 Site Classification for Seismic Site Response 10
4.2 Liquefaction Potential of Soils 10
5. Grade Raise Restrictions 11
6. Foundation Considerations 12
7. Floor Slab and Drainage Requirements 14
8. Excavation and De-Watering Requirements 15
8.1 Excess Soil Management 15
8.2 Excavation 15
8.3 De-Watering Requirements 16
9. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes 17
10. Pavement Structure Reinstatement 18
11. Chemical Analysis 19
12. General Comments 20

List of Tables

Table I: Summary of Laboratory Testing Program 5

Table II: Summary of Results from Grain-Size Analysis 7

Table III: Summary of Unit Weight Determination and Unconfined Compressive Tests on Cores 8

Table IV: Summary of Groundwater Level Measurements 8

List of Figures

Figure 1 – Site Location Plan

Figures 2 – Test Hole Location Plan

Figures 3 to 9 – Borehole and Test Pit Logs

Figures 10 and 11 – Grain-Size Distribution Curves

Figure 12 – Rock Core Photographs

Appendices

Appendix A – Test Pit Photographs

Executive Summary

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed Corkery Community Centre Expansion located at 3447 Old Almonte Road, Carp, Ontario (Figure 1). EXP's terms of reference for this project was provided in our Proposal Number OTT-21010977-A0 dated May 21,2021 and was authorized by the City of Ottawa via Standing Offer RFSO-30019-91842-S01 Category 4 via Purchase Order Number: 004098170 dated August 5,2021.

As part of this assignment, EXP also completed the following environmental reports regarding excess soil management:

- Soil Characterization Report dated March 3,2023
- Soil Management Plan dated April 11,2023
- Excess Soil Destination Assessment Report dated April 11,2023

The structural drawings for the project, Drawing Nos. S100 to S501 dated November 4,2022 (Revision No. 4) and prepared by WSP indicate the proposed development will consist of a 21 m by 28 m slab-on-grade addition to be constructed on the east side of the existing community centre building. The addition will not have a basement. The design elevation of the ground floor of the proposed building addition will match that of the existing building at Elevation 160.54 m. The notes on Drawing No. S200 indicate the proposed addition will be supported by strip and spread footings founded 1.6 m below the ground floor at Elevation 158.94 m. It is our understanding that a stormwater management pond (SWMP) is proposed in close proximity to the existing building and the proposed new addition.

The fieldwork for this investigation was undertaken on June 17 and June 23,2021 and consists of seven (7) test holes (boreholes and test pits) consisting of four (4) boreholes (Borehole Nos. 1 to 4) and three (3) test pits (Test Pit Nos. 1 to 3) located within the building envelope of the proposed addition. Test Pit No. 1 was located next to the exterior wall of the existing building at the northeast corner of the building. The purpose of this test pit is to establish the type and depth of the foundation supporting the existing building. Test Pit Nos. 2 and 3 are located within the footprint of the proposed building addition and were undertaken to confirm the subsurface conditions encountered in the boreholes. The test pits were advanced to bucket refusal depths ranging from 1.3 m to 1.7 m below existing grade. The boreholes were advanced to termination/refusal depths between 1.8 m to 3.3 m below existing grade. The fieldwork was supervised on a full-time basis by a representative from EXP.

The test hole information indicates that beneath the surficial topsoil and pavement structure, fill extends to the surface of the bedrock contacted at depths of 1.3 m to 2.0 m (Elev. 158.8 m to Elevation 158.3 m). The exception to this is Borehole No. 4 where the fill extends to the native silty sand to sandy silt contacted at a 1.5 m depth (Elevation 159.0 m). It is noted that a 100 mm thick concrete layer was contacted between the fill and the underlying bedrock in Borehole No. 3 at a 1.5 m depth (Elevation 158.5 m). Based on auger refusal in the boreholes and bucket refusal in the test pits, bedrock was contacted at depths ranging between 1.3 m and 2.1 m below existing grade (Elevation 158.8 m to Elevation 158.3 m). The stabilized groundwater level measured in the boreholes is present below the bedrock surface (in the bedrock) at a 2.6 m depth (Elevation 157.4 m) in Borehole No. 3 and below the borehole investigated depth of 2.1 m (Elevation 158.4 m) and also within the bedrock in Borehole No. 4.

The site may be classified as **Class C** for seismic site response in accordance with the 2012 Ontario Building Code (as amended May 2, 2019). The subsurface soils are not considered to be liquefiable during a seismic event.

Since the site is not underlain by compressible clayey soils, there is no restriction to raising the grades at the site, from a geotechnical perspective.

Based on a review of the borehole and test pit information, the proposed building addition may be supported by strip and spread footings founded directly on the bedrock or on a minimum 300 mm thick engineered fill pad constructed on the bedrock and native soil (encountered in Borehole No. 4 only). The ground floor of the proposed building addition may be designed as a slab-on-grade and would have to be constructed on an engineered fill pad placed the bedrock and native silty sand to sandy silt. The engineered fill pad should be constructed in accordance with the procedure indicated in the attached report. The existing topsoil and fill are not considered suitable to support the footings and the floor slab of the proposed building addition.

It is noted that the existing fill was contacted over the majority of the site and to varying depths (elevations) below existing grade. The type and quality of the fill material also varied across the site. The variable nature and depth (elevation) of the fill should be taken into consideration as part of the construction budget.

Strip and spread footings designed to bear on the surface of the sound competent bedrock, that is free of loose and soft seams and loose rock pieces may be designed for a factored geotechnical resistance at Ultimate Limit State (ULS) of 500 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Higher factored ULS values for the footings founded on the sound competent bedrock, that is free of loose and soft seams and loose rock pieces, are available and can be provided by EXP, if required.

Strip and spread footings designed to bear on the properly prepared engineered fill pad may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ULS of 225 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5.

Settlements of the footings designed for the SLS bearing pressure (for engineered fill) and factored ULS values (for bedrock) recommended above and properly constructed are expected to be within the normally tolerated limits of 25 mm total and 19 mm differential movements.

The floor slab of the proposed building addition may be constructed as a slab-on-grade provided it is set on a bed of well compacted 19 mm sized clear stone at least 200 mm thick, placed on a minimum 300 mm thick engineered fill pad constructed on the approved native silty sand to sandy silt or bedrock subgrade.

All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 3 soil. The excavations may be undertaken as open cut provided the excavation side walls are sloped back at 1H:1V from the bottom of the excavation as per OHSA. For excavations that extend below zones of persistent seepage from surface and subsurface water, the side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation. Seepage of the surface and subsurface water into the excavations is anticipated and it should be possible to collect water entering the excavations at low points and to remove it by conventional sump pumping techniques.

It is anticipated that the majority of material required for the construction of the engineered fill pad and for backfilling purposes would have to be imported and should preferably conform to OPSS 1010 Granular B Type II. The on-site excavated material may be used for grading purposes in the landscaped areas.

The reinstated pavement structure for pedestrian pathways that may be affected by the construction of the new building addition should consist of 50 mm thick HL3F underlain by 300 mm thick OPSS Granular A base layer.

The above and other related considerations are discussed in greater detail in the main body of this report.

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed Corkery Community Centre Expansion located at 3447 Old Almonte Road, Carp, Ontario (Figure 1). EXP's terms of reference for this project was provided in our Proposal Number OTT-21010977-A0 dated May 21,2021 and was authorized by the City of Ottawa via Standing Offer RFSO-30019-91842-S01 Category 4 via Purchase Order Number: 004098170 dated August 5,2021. As part of this assignment, EXP also completed the following environmental reports regarding excess soil management:

- Soil Characterization Report dated March 3,2023
- Soil Management Plan dated April 11,2023
- Excess Soil Destination Assessment Report dated April 11,2023

The structural drawings for the project, Drawing Nos. S100 to S501 dated November 4, 2022 (Revision No. 4) and prepared by WSP indicate the proposed development will consist of a 21 m by 28 m slab-on-grade addition to be constructed on the east side of the existing community centre building. The addition will not have a basement. The design elevation of the ground floor of the proposed building addition will match that of the existing building at Elevation 160.54 m. The notes on Drawing No. S200 indicate the proposed addition will be supported by strip and spread footings founded 1.6 m below the ground floor at Elevation 158.94 m. It is our understanding that a stormwater management pond (SWMP) is proposed in close proximity to the existing building and the proposed new addition.

The geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at four (4) boreholes and three (3) test pits located within the footprint of the proposed new building addition,

b) Establish the 'as-built' detail of an exposed section of the foundation of the existing building in one (1) test pit located along the exterior wall of the existing building at the northeast corner of the building,

c) Classify the site for seismic site response in accordance with the requirements of the 2012 Ontario Building Code (as amended May 2, 2019) and assess the potential for liquefaction of the subsurface soils during a seismic even,;

d) Comment on grade-raise restrictions,

e) Make recommendations regarding the most suitable type of foundations, founding depth and bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) of the founding strata and comment on the anticipated total and differential settlements of the recommended foundation type,

f) Comment on excavation conditions and de-watering requirements during construction; and

g) Discuss backfilling requirements and suitability of on-site soils for backfilling purposes.

The comments and recommendations given in this report are based on the assumption that the above-described design concepts will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations, or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Procedure

The fieldwork for this investigation was undertaken on June 17 and June 23,2021 and consists of seven (7) test holes (boreholes and test pits) consisting of four (4) boreholes (Borehole Nos. 1 to 4) and three (3) test pits (Test Pit Nos. 1 to 3) located within the building footprint of the proposed addition. Test Pit No. 1 is located next to the exterior wall of the existing building at the northeast corner of the building. The purpose of this test pit is to establish the type and depth of the foundation supporting the existing building. Test Pit Nos. 2 and 3 are located within the footprint of the proposed building addition to confirm the subsurface conditions encountered in the boreholes. The test pits were advanced to bucket refusal depths of 1.3 m to 1.7 m below existing grade. The boreholes were advanced to termination/refusal depths between 1.8 m and 3.3 m below existing grade. The fieldwork was supervised on a full-time basis by a representative from EXP.

Prior to the start of the fieldwork, the borehole and test pit locations were cleared of private and public underground services. The geodetic elevation of the test holes was determined by a survey crew from EXP. The borehole and test pit locations are shown in Figure No. 2.

The boreholes were drilled using a CME 45 track mount drill rig equipped with continuous flight hollow stem augers and soil sampling capabilities. Standard penetration tests (SPTs) were performed in the boreholes at 0.75 m and 1.5 depth intervals with soil samples retrieved by the split-barrel sampler. In Borehole No. 3, the presence of bedrock was proven by conventional wash-boring and coring technique. A field record of wash water return, colour of wash water and any sudden drop of the core barrel were kept during rock coring operations.

A 19 mm diameter standpipe with slotted section was installed in Borehole Nos. 3 and 4 for long-term monitoring of the groundwater levels. The standpipes were installed in accordance with EXP standard practice and the installation configuration is documented on the respective borehole log. The boreholes were backfilled upon completion of the field work and the installation of the standpipes.

The test pits were excavated using a rubber-tired backhoe. A grab sample of the different soil types exposed in the test pits was taken from the side walls of the test pit during excavation. In Test Pit No. 1 located next to the existing building, the type of foundation and founding material were examined and recorded. Groundwater observations were also made in the open test pits. Upon completion of excavation, the test pits were backfilled and the backfill nominally packed in place with the backhoe bucket. The asphalt surface at the location of Test Pit No.1 was re-instated.

All the soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified. Similarly, all rock cores were visually examined, identified, and logged, and placed in core boxes for storage. On completion of the fieldwork, all soil samples and rock cores were transported to the EXP laboratory in Ottawa where they were visually examined by a geotechnical engineer and borehole/test pit logs prepared. A summary of the laboratory testing program conducted on the soil samples and rock cores is shown in Table I.

Table I: Summary of Laboratory Testing Program	
Type of Test	**Number of Tests Completed**
Soil Samples	
Moisture Content Determination	19
Grain Size Analysis	2
Rock Cores	
Unit Weight Determination and Unconfined Compressive Strength Test	2

3. Subsurface Conditions and Groundwater Levels

A detailed description of the subsurface conditions and groundwater levels from the boreholes and test pits are given on the attached Borehole and Test Pit Logs, Figure Nos. 3 to 9. The borehole and test pit logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted.

The boreholes and test pit were advanced to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of potential environmental conditions. As part of this assignment, EXP also completed the following environmental reports regarding excess soil management:

- Soil Characterization Report dated March 3,2023
- Soil Management Plan dated April 11,2023
- Excess Soil Destination Assessment Report dated April 11,2023

It should be noted that the soil boundaries indicated on the borehole and test pit logs are inferred from non-continuous sampling and observations during drilling and excavating operations. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Note on Sample Descriptions" preceding the borehole and test pit logs form an integral part of this report and should be read in conjunction with this report.

A review of the borehole and test pit logs indicates the following subsurface conditions with depth and groundwater level measurements.

3.1 Topsoil

A 75 mm to 250 mm thick surficial topsoil layer was encountered in all boreholes and test pits except for Test Pit No. 1.

3.2 Pavement Structure

Test Pit No. 1 is located in a paved area of the site. The pavement structure consists of a 75 mm thick asphaltic concrete layer underlain by a 210 mm thick base layer consisting of crusher run limestone granular fill.

3.3 Fill

Fill material was contacted beneath the topsoil layer and the pavement structure in all the boreholes and test pits and extends to the surface of the bedrock contacted at depths of 1.3 m to 2.1 m (Elev. 158.8 m to Elevation 158.3 m). The exception to this is Borehole No. 4 where the fill extends to the native silty sand to sandy silt contacted at a 1.5 m depth (Elevation 159.0 m).

The fill material is heterogeneous in composition ranging from a silty sand with gravel to sandy gravel with silt to silty gravel with sand. The fill material contains cobbles, boulders, topsoil inclusions, organic stains, plastic debris, and rootlets. The N values from the standard penetration test (SPT) range from 15 to 34 indicating the fill is in a compact to dense state. The moisture content of the fill material ranges from 3 percent to 15 percent.

The results of grain-size analysis conducted on two (2) selected samples of the fill are summarized in Table II and the grain-size distribution curves are shown in Figures 10 and 11.

Table II: Summary of Results from Grain-Size Analysis					
Borehole (BH) No. – Sample (SS) No.	Depth (m)	**Grain-Size Analysis (%)**			Soil Classification (USCS)
		Gravel	Sand	Fines (Silt and Clay)	
BH 2 – SS3	1.5 – 1.8	42	40	18	Silty Gravel with Sand (GM)
BH 4 – SS2	1.1 – 1.4	30	43	27	Silty Sand with Gravel (SM)

Based on a review of the results of the grain-size analysis, the fill may be classified as a silty gravel with sand (GM) and silty sand with gravel (SM) in accordance with the Unified Soil Classification System (USCS).

It is noted that the fill was contacted over the majority of the site. The fill extends to varying depths (elevations) below existing grade across the site. The type and quality of the fill material also varied across the site. The variable nature and depth (elevation) of the fill should be taken into consideration as part of the construction budget.

3.4 Buried Concrete

A 100 mm thick layer of concrete was contacted beneath the fill in Borehole No. 3 at a 1.5 m depth (Elevation 158.5 m). The origin of the concrete is not known. It is possible that the buried concrete may exist in other areas of the site.

3.5 Silty Sand to Sandy Silt

As previously indicated, the fill in Borehole No.4 is underlain by a compact native silty sand to sandy silt contacted at a 1.5 m depth (Elevation 159.0 m) and extends to the surface of the bedrock contacted at 2.1 m depth (Elevation 158.4 m). The natural moisture content of the silty sand to sandy silt is 8 percent.

3.6 Limestone Bedrock

The presence of the bedrock was confirmed in the test pits where the bedrock surface was exposed and in Borehole No. 3 where a 1.8 m length of bedrock was cored. In the test pits and Borehole No. 3, bedrock was contacted at 1.3 m to 1.7 m depths (Elevation 158.8 m to Elevation 158.4 m). In the remaining boreholes, Borehole Nos. 1,2 and 4, since auger refusal was met at depths (elevations) similar to the proven bedrock depths (elevations) in the test pits and Borehole No. 3, auger refusal is considered to have occurred on bedrock. In summary, the depth (elevation) of the bedrock is 1.3 m to 2.1 m (Elevation 158.8 m to Elevation 158.3 m).

The published geology map titled, *Generalized Bedrock Geology, Ottawa-Hull, Ontario and Quebec* (Map 1508A published by the Geological Survey of Canada dated 1976), indicates the site is underlain by limestone bedrock (with shaly partings) of the Ottawa formation.

Photographs of the bedrock cores are shown in Figure 12. Based on examination of the two (2) recovered bedrock cores, the bedrock is considered to be limestone bedrock. The total core recovery values (TCR) of the bedrock are 90 percent and 100 percent. The rock quality designation values (RQD) are 42 percent and 60 percent indicating the bedrock is of a poor and fair quality.

The document titled, *Karst Study for Southern Ontario* dated 2008 and prepared by the Ontario Geological Survey indicates the site is located in a potential and inferred karst area. The observations during the coring of the bedrock from Borehole No. 3 did not indicate drops in the core barrel that would suggest the presence of voids in the bedrock. The examination of the exposed sections of the bedrock surface in the test pits did not reveal the presence of depressions in the bedrock surface. Therefore, since no voids and depressions were observed in the bedrock within the investigated depth in the test pits and borehole, it is considered that the bedrock at the site does not exhibit karst features. Therefore, since karst features are not present at the site, no special treatment for the construction of the proposed building addition is required.

A total of two (2) rock core samples were selected for unit weight determination and unconfined compressive strength tests. The test results are presented in Table III.

Table III: Summary of Unit Weight Determination and Unconfined Compressive Tests on Cores

Borehole No. Run No.	Depth (m)	Compressive Strength (MPa)	Unit Weight (kN/m^3)
BH 3 – Run 1	1.7 - 1.9	200.8	24.9
BH 3 – Run 2	2.0 - 2.2	122.4	24.3

A review of the test results indicates a bedrock with compressive strength of the bedrock is 122 MPa and 201 MPa. Based on the compressive strength values, the rock can be classified with respect to intact strength as "very strong"(Canadian Foundation Engineering Manual, 4th Edition, 2006). The unit weight of the bedrock is 24.3 kN/m^{3}to 24.9 kN/m^3.

3.7 Groundwater Level Measurements

A summary of the groundwater level measurements taken in the boreholes 28 days following the completion of drilling and in the test pit upon completion of the excavation of the test pits is shown in Table IV.

Table IV: Summary of Groundwater Level Measurements

Borehole/Test Pit No. (BH/TP))	Ground Surface Elevation (m)	Date of Measurement (Elapsed Time in Days from Date of Installation)	Groundwater Depth Below Ground Surface (Elevation) m
BH 3	160.00	July 14, 2021 (28 days)	2.6 m (157.4)
BH 4	160.49	July 14, 2021 (28 days)	Dry
TP-3	160.24	June 23 (1 day)	1.6 m (158.6)

The groundwater level is at 1.6 m and 2.6 m depths (Elevation 158.6 m and Elevation 157.4 m). The groundwater level is Test Pit No. 3 is not considered to be representative of the stabilized groundwater level. The groundwater level measured in the boreholes is considered to be the stabilized groundwater level and is present below the bedrock surface (in the bedrock) at a 2.6 m depth (Elevation 157.4 m) in Borehole No. 3 and below the investigated depth of 2.1 m (Elevation 158.4 m) and also within the bedrock in Borehole No. 4.

Water levels were determined in the boreholes and test pits at the times and under the conditions stated above. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

3.8 Existing Foundation Information

Test Pit No. 1 is located along the exterior wall at the northeast corner of the existing building. The purpose of the test pit is to establish the type and depth of the foundation supporting the existing building. The test pit was advanced to bucket refusal at a 1.6 m depth below grade (Elevation 158.8 m) on bedrock. As previously mentioned, the test pit revealed a pavement structure consisting of a 75 mm thick asphaltic concrete layer overlying a 210 mm thick granular base layer. The upper granular material is underlain by 400 mm thick sand and gravel fill which is further underlain by sandy gravel with cobbles that extend to the surface of the bedrock contacted at a 1.6 m depth (Elevation 158.8 m).

The drawings of the existing building dated August 1995 indicates that the enclosed portion of the existing building, where the addition will be located next to, is supported by a thickened edge (perimeter) concrete slab with the thickened edge of the slab

located along the perimeter of the slab and founded on competent bedrock. The interior portion of the slab area was backfilled with compacted granular fill.

Comparison of the information from Test Pit No. 1 with the drawings of the existing building dated August 1995 confirms that the existing building is supported by a thickened edge (perimeter) concrete slab, with the thickened perimeter portion of the slab extending to the bedrock surface.

Photographs of the exposed 'as-built' details are shown in Appendix A.

4. Site Classification for Seismic Site Response and Liquefaction Potential of Soils

4.1 Site Classification for Seismic Site Response

The proposed building addition may be supported by footings founded on the bedrock or on an engineered fill pad constructed on the bedrock and native silty sand to sandy silt (Borehole No. 4), as discussed in Section 6 of this report. For footings founded on an engineered fill pad overlying bedrock or founded directly on the bedrock, the average standard penetration test N-value over a 30 m depth below the footings, is considered to be greater than 50 which corresponds to a Class C in accordance with the 2012 Ontario Building Code (OBC as amended May 2,2019). Therefore, the site classification for seismic site response is taken to be Class C.

The site classification may be improved by conducting a shear wave velocity sounding survey at the site and founding the footings at 3.0 m or less from the bedrock surface, as per the 2012 OBC (as amended May 2,2019).

4.2 Liquefaction Potential of Soils

The subsurface soils are not considered to be liquefiable during a seismic event.

5. Grade Raise Restrictions

Since the site is not underlain by compressible clayey soils, there is no restriction to raising the grades at the site, from a geotechnical perspective.

6. Foundation Considerations

The structural drawings for the project, Drawing Nos. S100 to S501 dated November 4, 2022 (Revision No. 4) and prepared by WSP indicate the proposed development will consist of a 21 m by 28 m slab-on-grade addition to be constructed on the east side of the existing community centre building. The addition will not have a basement. The design elevation of the ground floor of the proposed building addition will match that of the existing building at Elevation 160.54 m. The notes on Drawing No. S200 indicate the proposed addition will be supported by strip and spread footings founded 1.6 m below the ground floor at Elevation 158.94 m.

Based on a review of the borehole and test pit information, the proposed building addition may be supported by strip and spread footings founded directly on the bedrock or on a minimum 300 mm thick engineered fill pad constructed on the bedrock and native soil (encountered in Borehole No. 4 only). The ground floor of the proposed building addition may be designed as a slab-on-grade and would have to be constructed on an engineered fill pad placed the bedrock and native silty sand to sandy silt. The engineered fill pad should be constructed in accordance with the procedure below. The existing topsoil and fill are not considered suitable to support the footings and the floor slab of the proposed building addition.

It is noted that the existing fill was contacted over the majority of the site and to varying depths (elevations) below existing grade. The type and quality of the fill material also varied across the site. The variable nature and depth (elevation) of the fill should be taken into consideration as part of the construction budget.

Strip and spread footings designed to bear on the surface of the sound competent bedrock, that is free of loose and soft seams and loose rock pieces may be designed for a factored geotechnical resistance at Ultimate Limit State (ULS) of 500 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5. Higher factored ULS values for the footings founded on the sound competent bedrock, that is free of loose and soft seams and loose rock pieces, are available and can be provided by EXP, if required.

The Serviceability Limit State (SLS) bearing pressure of the competent bedrock, required to produce 25 mm settlement of the structure will be much larger than the recommended values for the factored geotechnical resistance at ULS. Therefore, for footing founded on competent bedrock the factored geotechnical resistance at ULS will govern the design.

Strip and spread footings designed to bear on the properly prepared engineered fill pad may be designed for a bearing pressure at serviceability limit state (SLS) of 150 kPa and factored geotechnical resistance at ULS of 225 kPa. The factored geotechnical resistance at ULS includes a geotechnical resistance factor of 0.5.

Settlements of the footings designed for the SLS bearing pressure (for engineered fill) and factored ULS values (for bedrock) recommended above and properly constructed are expected to be within the normally tolerated limits of 25 mm total and 19 mm differential movements.

The preparation of the site for engineered fill pad construction requires all topsoil, organic stained soils and fill be excavated and removed down to the native compact silty sand to sandy silt and bedrock. The excavation should extend a sufficient distance beyond the limits of the footprint of the proposed building addition to accommodate a 600 mm wide bench of engineered fill around the perimeter of the building addition, which is thereafter sloped at an inclination of 1H:1V down to the approved native silty sand to sandy silt and bedrock. The exposed native soil subgrade should be proofrolled and examined by a geotechnical engineer. Any loose/soft areas identified during proofrolling operations should be excavated and replaced with Ontario Provincial Standard Specification (OPSS) Granular B Type II compacted to 100 percent standard Proctor maximum dry density (SPMDD). The exposed competent bedrock subgrade should be examined by a geotechnical engineer to ensure the founding surface of the bedrock is competent and free of weathered zones of the bedrock, loose material (soil and rock pieces) and soft seams.

Following approval of the subgrade for the engineered fill pad, the excavation may be backfilled with the engineered fill consisting of free draining Ontario Provincial Standard Specification (OPSS) 1010 Granular B Type II material placed in 300 mm thick lifts and each lift compacted to 100 percent of the SPMDD under the footings and to 98 percent of the SPMDD under the floor slab area. The engineered fill should be placed under the full-time supervision of a geotechnician working under the

direction of a geotechnical engineer. In-place density tests should be undertaken on each lift of the engineered fill to ensure that it is properly compacted prior to placement of the subsequent lift.

Where a footing may be founded partly on soil and partly on competent bedrock, it is recommended that a gradual transition zone of 4H:1V be created from footings on bedrock to soil. The transition zone should be filled with Ontario Provincial Standard Specification (OPSS) Granular A or B Type II compacted to 100 percent standard Proctor maximum dry density (SPMDD). In this case, the SLS and factored ULS values for the engineered fill should be used in the footing design.

All footing beds should be examined by a geotechnical engineer to ensure that the founding soil/bedrock is capable of supporting the bearing pressure at SLS, the factored geotechnical resistance at ULS and that the footing beds have been properly prepared.

A minimum of 1.5 m of earth cover should be provided to the exterior footings founded on the engineered fill pad of the heated building addition to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided. EXP can provide additional comments in this regard, if required.

If all the footings of the proposed heated building addition are founded on the competent bedrock (free of loose and soft seams and loose rock pieces), frost protection for the footings is not required.

The recommended bearing pressure at SLS and factored geotechnical resistances at ULS have been calculated by EXP from the borehole and test pit information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes and test pits, when foundation construction is underway. The interpretation between boreholes and test pits and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

7. Floor Slab and Drainage Requirements

The floor slab of the proposed building addition may be constructed as a slab-on-grade provided it is set on a bed of well compacted 19 mm sized clear stone at least 200 mm thick, placed on a minimum 300 mm thick engineered fill pad constructed on the approved native silty sand to sandy silt or bedrock subgrade as discussed in Section 6 of this report. The clear stone would minimize the capillary rise of moisture from the sub-soil to the floor slab. As an alternative to using the 200 mm thick clear stone layer, a 200 mm thick layer of OPSS Granular A compacted to 98 percent SPMDD may be used instead and overlain by a vapour barrier. Adequate saw cuts should be provided in the floor slabs to control cracking.

Since the groundwater level is well below the design elevation of the finished floor slab and is below the bedrock surface, perimeter and underfloor drainage systems are not required. However, if drainage systems from the existing building are encountered during construction of the new addition, the existing drainage systems should be extended into the building addition area.

The new stormwater management pond (SWMP) that will be located in close proximity to the proposed building addition should be designed in such a manner so as not to cause high surface and subsurface water levels at the proposed building addition. If high water levels are anticipated, consideration may be given to installing a perimeter drainage system for the building addition.

The finished floor slab should be set at least 150 mm higher than the finished exterior grade.

The finished exterior grade should be sloped away from the building addition to prevent ponding of surface water close to the exterior walls of the proposed building.

8. Excavation and De-Watering Requirements

8.1 Excess Soil Management

Ontario Regulation 406/19 made under the Environmental Protection Act (November 28, 2019) has been enacted as of January 1, 2021. The new regulation dictates the testing protocol required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

Reference is made to the following EXP environmental reports regarding excess soil management:

- Soil Characterization Report dated March 3,2023
- Soil Management Plan dated April 11,2023
- Excess Soil Destination Assessment Report dated April 11,2023

8.2 Excavation

Excavation for the construction of the proposed new building addition is anticipated to extend through the surficial topsoil layer the fill and to the native silty sand to sandy silt and the limestone bedrock. The excavations are anticipated to be above the groundwater level.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing cobbles, boulders and debris within the fill.

Excavation of the bedrock is not anticipated for this project.

All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 3 soil. The excavations may be undertaken as open cut provided the excavation side walls are sloped back at 1H:1V from the bottom of the excavation as per OHSA. For excavations that extend below zones of persistent seepage from surface and subsurface water, the side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation.

The 1995 drawings indicate the enclosed portion of the existing building, where the addition will be located next to, is supported by a thickened edge (perimeter) concrete slab-type foundation with the thickened edge of the slab located along the perimeter of the slab and founded on competent bedrock; also confirmed by Test Pit No. 1. The interior portion of the slab area between the slab and the bedrock is backfilled with compacted granular fill and the granular fill is considered to be confined between the thickened edge slab and the bedrock. Therefore, since the thickened edge slab is founded on bedrock, the interior granular fill is confined between the thickened edge slab and the bedrock and the excavations for the footings and engineered fill for the proposed addition will extend to the bedrock surface, similar to the existing thickened edge slab, it is considered that there is no risk of undermining the thickened edge slab-type foundation and the interior granular fill during the construction of the new building addition.

Even though blasting is not required for this project, the limits of the maximum peak particle velocity values for blasting from the City of Ottawa Special Provisions, SP-1201, may be used as guidance in controlling and monitoring vibrations created during the construction of the new addition.

It is recommended that a pre-construction condition survey of the existing building and infrastructure located within the influence zone of the construction be undertaken prior to the start of the construction for the new building addition.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

8.3 De-Watering Requirements

Since the groundwater level is deep below the bedrock surface and well below the design elevations of the ground floor and footings, the groundwater is not anticipated to adversely impact the construction and performance of the proposed addition. However, seepage of the surface and subsurface water into the excavations is anticipated and it should be possible to collect water entering the excavations at low points and to remove it by conventional sump pumping techniques.

If less than 50 m^3 of water are to be pumped per day, no permits are required. If between 50 m^3 and 400 m^3 of water is to be pumped per day, then the activity should be registered on the Environmental Activity and Sector Registry (EASR), an online registry maintained by the Ministry of the Environment, Conservation and Parks (MECP). If more than 400 m^3 of water is to be pumped per day, then a Category 3 Permit to Take Water (PTTW) is required. A hydrogeological investigation of the proposed excavation would be required to support a PTTW application.

Since water taking can be groundwater, storm water, or a combination of both, the most likely potential for significant volumes of water requiring removal from an excavation at the site is storm water. If a major rain event occurs while a large excavation is open, then it is possible that the total accumulation of water within the excavation will exceed 50 m^3. If that occurs, then it may be removed without a permit by pumping over several days during which no single-day water-taking is more than 50 m^3. Alternatively, a maximum of 400 m^3 of water may be pumped per day once the online EASR application form is filled out and the fee is paid. The EASR application may be completed by the property owner or their delegate. EXP would be pleased to assist with the EASR, should it be deemed necessary. Per the terms of the EASR, the total quantities of water actually removed from the excavation must be reported to the MECP.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to adequately engineer construction dewatering systems.

9. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The on-site soils to be excavated are anticipated to be topsoil, fill and native silty sand to sandy silt. These soils are not considered suitable for re-use as material beneath structural elements and for backfilling purposes. However, they can be used for general grading purposes in landscaped areas.

It is anticipated that material required for the construction of the engineered fill pad and for backfilling purposes would have to be imported and should preferably conform to OPSS 1010 Granular B Type II.

10. Pavement Structure Reinstatement

The reinstated pavement structure for pedestrian pathways that may be affected by the construction of the new building addition should consist of 50 mm thick HL3F underlain by 300 mm thick OPSS Granular A base layer.

The asphaltic concrete should be compacted from 92 percent to 97 percent of the maximum relative density. The Granular A should be compacted to 100 percent SPMDD.

11. Chemical Analysis

Chemical analysis of the existing subsurface soils is not required, since the majority of the subsurface soils consist of fill which will have to be excavated and removed and the area backfilled with imported Ontario Provincial Standard Specification (OPSS) Granular B Type II material.

12. General Comments

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes and test pits required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for the design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report is not intended to reflect on environmental aspects of the soils. Reference is made to the following EXP environmental reports regarding excess soil management:

- Soil Characterization Report dated March 3,2023
- Soil Management Plan dated April 11,2023
- Excess Soil Destination Assessment Report dated April 11,2023

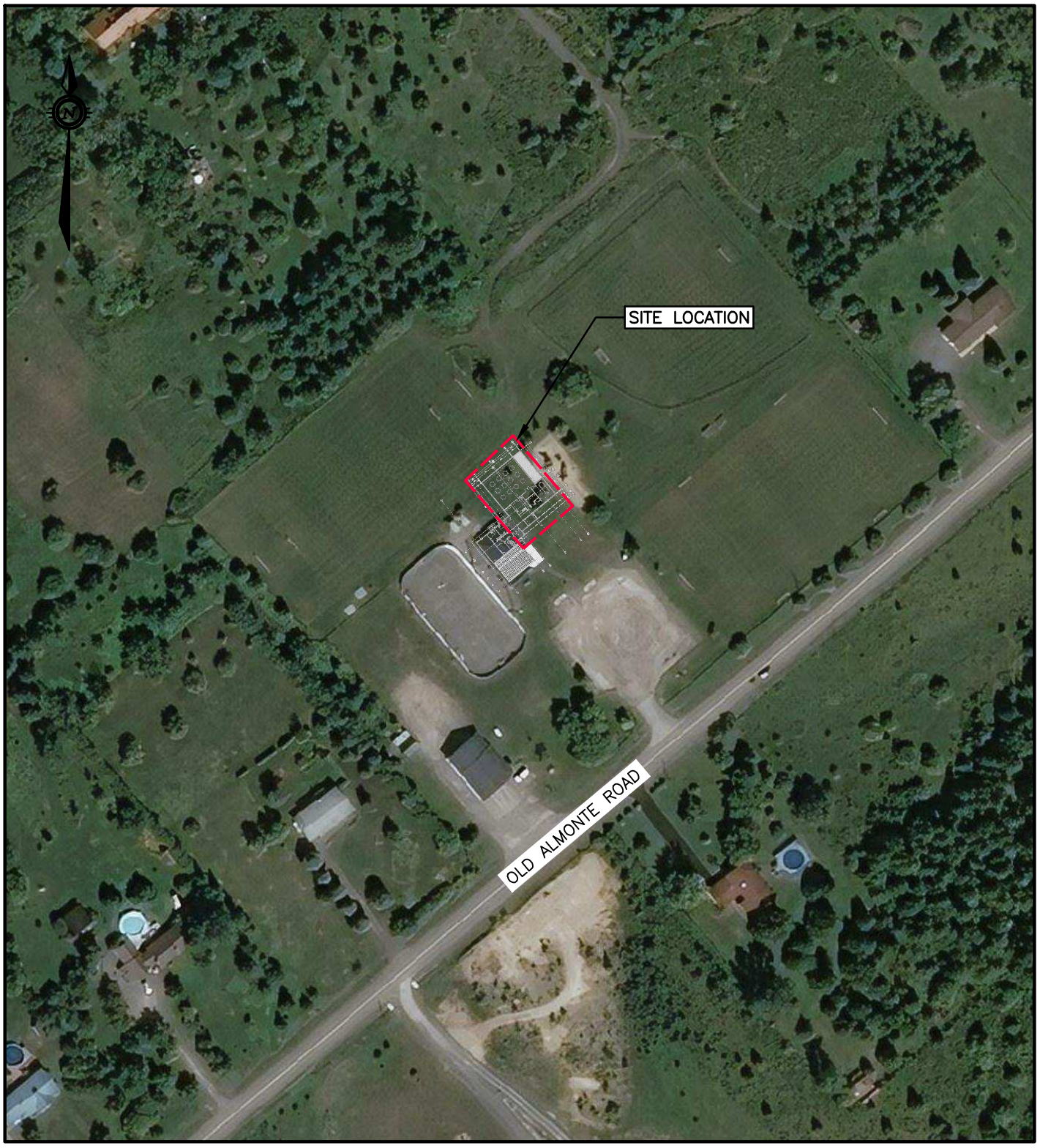
We trust that the information contained in this report will be satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Sincerely,

Susan M. Potyondy, P.Eng
Senior Project Manager
Earth and Environment

Ismail M. Taki, M.Eng., P.Eng.
Senior Manager, Eastern Region
Earth and Environment

Figures



0 20m 40m 80m

HORIZONTAL 1:2000

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DESIGN	I.T.
DRAWN	G.C.
DATE	JULY 2021
FILE NO	OTT-21010977-A0

GEOTECHNICAL INVESTIGATION
CORKERY COMMUNITY CENTRE EXPANISON
3447 OLD ALMONTE ROAD, CARP, ONTARIO

SITE LOCATION PLAN

SCALE 1:2000

SKETCH NO FIG 1

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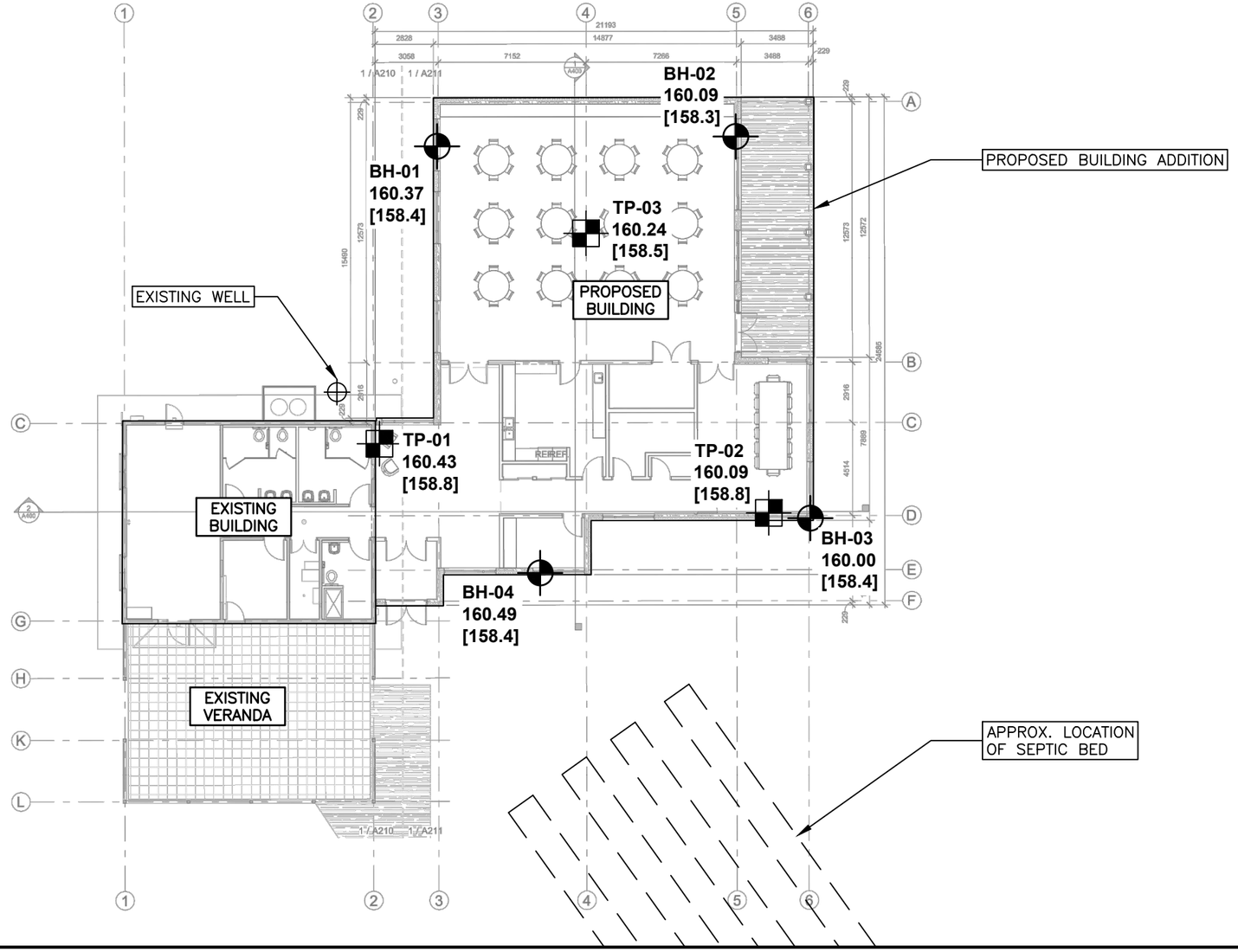

LEGEND

BH-01 BOREHOLE LOCATION
160.37 GROUND SURFACE ELEVATION IN METERS
[158.4] BEDROCK ELEVATION IN METERS

TP-01 TEST PIT LOCATION
160.43 GROUND SURFACE ELEVATION IN METERS
[158.8] BEDROCK ELEVATION IN METERS

0 2m 4m 10m
HORIZONTAL 1:250

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE AND TEST PIT LOCATIONS. BETWEEN BOREHOLE AND TEST PIT LOCATIONS THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL AND ROCK SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TOPSOIL AND ASPHALT QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT BOREHOLE AND TEST PIT LOCATIONS.
4. BOREHOLE AND TEST PIT ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE DRAWING OBTAINED FROM CSV ARCHITECTS, "CORKERY COMMUNITY CENTRE – SITE PLAN", PROJ. NO. 2020-0640, DWG. NO. A100, REV. 1, DATED MAY 27, 2021

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www.exp.com

DESIGN	I.T.
DRAWN	G.C.
DATE	JULY 2021
FILE NO	OTT-21010977-A0

GEOTECHNICAL INVESTIGATION
CORKERY COMMUNITY CENTRE EXPANSION
3447 OLD ALMONTE ROAD, CARP, ON

TEST HOLE LOCATION PLAN

SCALE 1:250
SKETCH NO FIG 2

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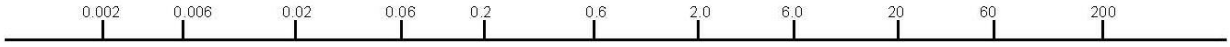
Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH-01

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 3

Page. 1 of 1

Date Drilled: 'June 17, 2021

Drill Type: CME 45 Track-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test ——— | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits ⊢○ | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	160.37	0				
		FILL Silty sand with gravel, rootlets, brown, moist, (compact)	160.3		15 ○	×	SS1	
		FILL Sandy gravel with silt, cobbles and boulders, light brown, damp, (compact)	159.7	1	20 ○	×	SS2	
					22 + 50 for 130 mm ○	×	SS3	
		Auger Refusal at 2.0 m Depth	158.4					

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
'June 17, 2021	Dry	Open

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

Log of Borehole BH-02

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 4

Page. 1 of 1

Date Drilled: 'June 17, 2021

Drill Type: CME 45 Track-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~100 mm thick	160.09	0				
		FILL Silty sand and gravel, light brown, damp, (compact)	160.0		15	×	SS1	
				1	18	×	SS2	
		FILL Silty gravel with sand, cobbles and boulders, light brown, damp, (loose)	158.6		4 + 50 for 100 mm	×	SS3	
		Auger Refusal at 1.8 m Depth	158.3					

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'June 17, 2021	Dry	Open

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

Log of Borehole BH-03

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 5

Page. 1 of 1

Date Drilled: 'June 17, 2021

Drill Type: CME 45 Track-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test — | Shelby Tube ■ | Shear Strength by Vane Test +S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○—| | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth
		160		0
		TOPSOIL ~75 mm thick	159.9	
		FILL Silty sand with gravel, with organic stains and topsoil inclusions, mottled brown to yellow brown, moist, (compact)		
			159.3	
		FILL Sandy gravel with silt, cobbles and boulders, piece of plastic polyethylene sheet, light brown, damp, (compact)		1
			158.5	
		CONCRETE Light grey, heavily fractured, heavily weathered, ~100 mm	158.4	
		LIMESTONE BEDROCK Moderately to lightly weathered, contains minor shaley laminations & turbidites, widely to moderately spaced wavy subhorizontal fractures, light grey		2
			157.4	
				3
		Borehole Terminated at 3.3 m Depth	156.7	

Standard Penetration Test N Value: 20 40 60 80; Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

15 ○ | 34 ○ | 18 + 50/25 mm ○ | 200.8 MPa ⊕ | 122.4 MPa ⊕

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	
RUN 1	24.9
RUN 2	24.3

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. 25 mm piezometer installed in borehole upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'June 17, 2021	Dry	Open
`July 14, 2021	2.6	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.5 - 2	90	60
2	2 - 3.3	100	42

LOG OF BOREHOLE BH LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

Log of Borehole BH-04

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 6

Page. 1 of 1

Date Drilled: 'June 17, 2021

Drill Type: CME 45 Track-Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~75 mm thick	160.49	0				
		FILL Silty sand with gravel, with topsoil inclusions and organic stains, brown, moist, (compact)	160.4		18	×	SS1	
				1	18	×	SS2	
		SILTY SAND TO SANDY SILT with gravel, brown, moist, (compact)	159.0					
				2	11	×	SS3	
		Auger Refusal at 2.1 m Depth	158.4					

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. 25 mm piezometer installed in borehole upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'June 17, 2021	Dry	Open
`July 14, 2021	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

Log of Borehole TP-01

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 7

Page. 1 of 1

Date Drilled: 'June 23, 2021

Drill Type: Caterpillar 415 Backhoe

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			160.43	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		ASPHALT ~75 mm thick	160.4					
		GRANULAR FILL crusher run limestone, ~210 mm thick	160.2			×	GS1	
		FILL Silty sand with gravel, brown, moist	159.8			×	GS2	
		FILL Sandy gravel with silt, numerous cobbles and boulders, light brown, damp		1		×	GS3	
			158.8					
		Bucket Refusal at 1.6 m Depth						

LOG OF BOREHOLE TP LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Test pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
'June 23, 2021	Dry	Open

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole TP-02

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 8

Page. 1 of 1

Date Drilled: 'June 23, 2021

Drill Type: Caterpillar 415 Backhoe

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~250 mm thick	160.09	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
			159.8					
		FILL Silty sand with gravel, with rootlets and topsoil inclusions, contains plastic debris, mottled brown to grey, moist				×	GS1	
		- changes to orange brown below 0.7 m depth	159.2			×	GS2	
		FILL Silty sand with gravel, numerous cobbles and boulders, light brown, damp		1		×	GS3	
			158.8					
		Bucket Refusal at 1.3 m Depth						

LOG OF BOREHOLE TP LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

NOTES:
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2. Test pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS		
Date	Water Level (m)	Hole Open To (m)
'June 23, 2021	Dry	Open

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole TP-03

Project No: OTT-21010977-A0

Project: Corkery Community Centre Expansion

Location: 3447 Old Almonte Road, Carp, ON

Figure No. 9

Page. 1 of 1

Date Drilled: 'June 23, 2021

Drill Type: Caterpillar 415 Backhoe

Datum: Geodetic Elevation

Logged by: G.C. Checked by: I.T.

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL ~200 mm thick	160.24	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
			160.0					
		FILL Silty sand with gravel, cobbles and boulders, light brown, damp				×	GS1	
▼		- wet below 1.6 m depth	158.64	1				
			158.5					
		Bucket Refusal at 1.7 m Depth						

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. Test pit backfilled upon completion of excavation.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21010977-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
'June 23, 2021	1.6 m	Open

CORE DRILLING RECORD

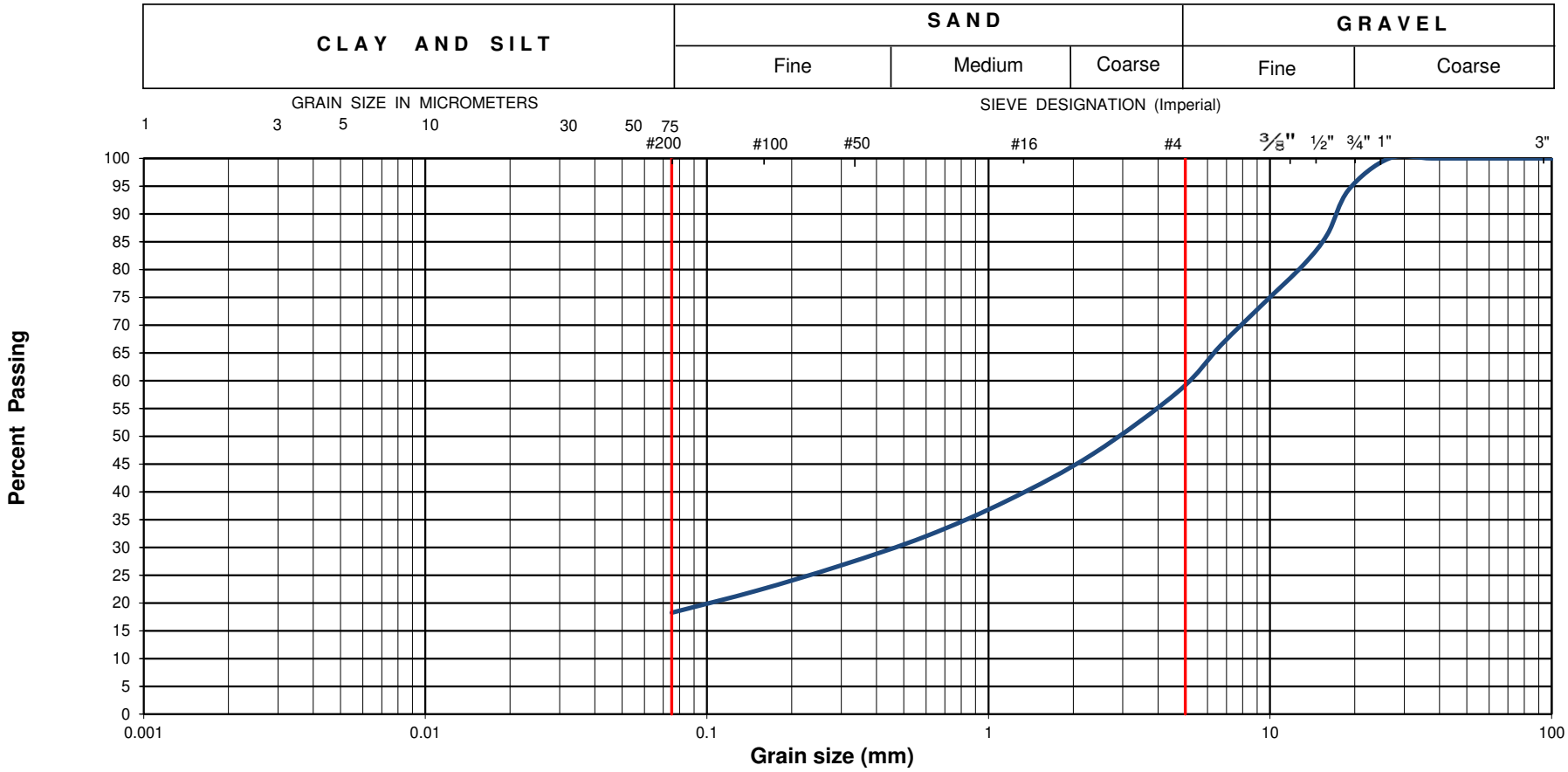
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE TP LOGS - 21010977.GPJ TROW OTTAWA.GDT 7/20/21

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System

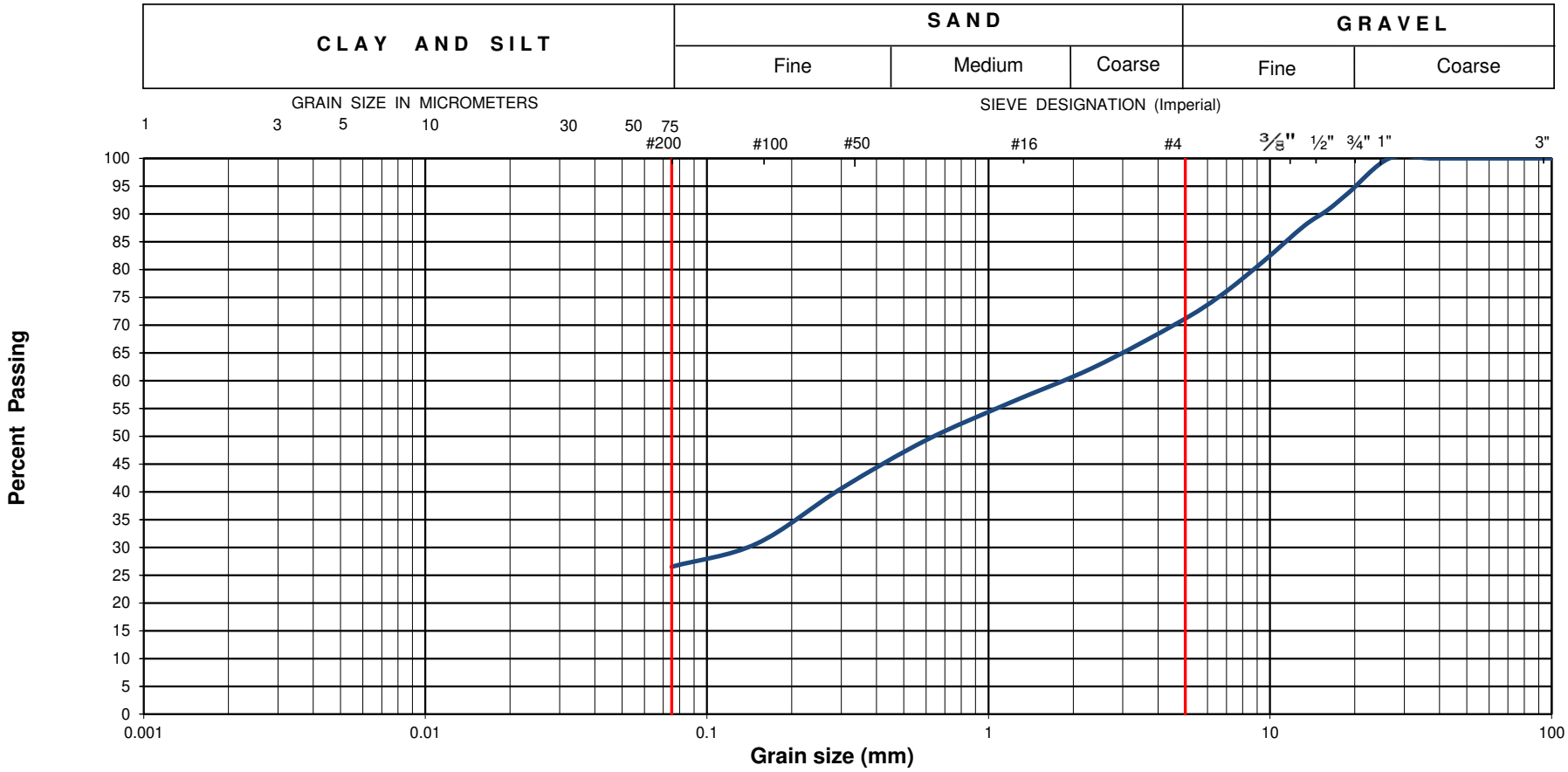


EXP Project No.:	**OTT-21010977-A0**	**Project Name :**	**Corkery Community Centre Expansion**						
Client :	**City of Ottawa**	**Project Location :**	**3447 Old Almonte Road. Carp, Ottawa, ON**						
Date Sampled :	**June 17, 2021**	**Borehole No:**	**BH2**	**Sample:**	**SS3**	**Depth (m) :**	**1.5-1.8**		
Sample Composition :		**Gravel (%)**	**42**	**Sand (%)**	**40**	**Silt & Clay (%)**	**18**	**Figure :**	**10**
Sample Description :		**FILL: Silty Gravel with Sand (GM)**							

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System



EXP Project No.:	**OTT-21010977-A0**	**Project Name :**	**Corkery Community Centre Expansion**						
Client :	**City of Ottawa**	**Project Location :**	**3447 Old Almonte Road. Carp, Ottawa, ON**						
Date Sampled :	**June 17, 2021**	**Borehole No:**	**BH4**	**Sample:**	**SS2**	**Depth (m) :**	**1.1 - 1.4**		
Sample Composition :		**Gravel (%)**	**30**	**Sand (%)**	**43**	**Silt & Clay (%)**	**27**	**Figure :**	**11**
Sample Description :		**FILL: Silty Sand with Gravel (SM)**							

Concrete

DRY BEDROCK CORES

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borehole no.	core runs	PROJECT	project no.
BH-03	Run 1: 1.5 m - 2.0 m Run 2: 2.0 m - 3.3 m	GEOTECHNICAL INVESTIGATION CORKERY COMMUNITY CENTRE EXPANSION 3447 OLD ALMONTE ROAD, CARP, ONTARIO	OTT-21010977-A0
date cored 6/17/2021		ROCK CORE PHOTOGRAPHS	FIG 12

Appendix A – Test Pit Photographs

Photograph No. 1: Exposed subsurface soil conditions in Test Pit No. 1

Photograph No. 2: Detailed view of thickened structural slab and subbase materials in Test Pit No. 1

Photograph No. 3: Exposed subsurface soil conditions in Test Pit No. 3

Photograph No. 4: Reinstated pavement conditions at Test Pit No. 1 location

Legal Notification

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