Geotechnical Investigation Report

Codrington Fisheries Research Facility – Proposed Building Addition

March 29, 2023

Prepared for:
Ministry of Natural Resources & Forestry

Cambium Reference: 4161-005

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1.0 Introduction

Cambium Inc. (Cambium) was retained by the Ministry of Natural Resources and Forestry (Client) to complete a geotechnical investigation in support of a proposed building addition for the existing Codrington Fisheries Research Facility located at 15 Fish Hatchery Road in Codrington, Ontario (Site). The approximate site location is shown in Figure 1.

This report presents the methodology and findings of the investigation at the Site and addresses requirements and constraints for the design and construction of the development.

1.1 Reviewed Documents

The following project documents were received and reviewed during the drafting of this report:

[1] MECHANICAL MASTER PLANS – Prepared by: Rombald Inc., Prepared for: Canadian Aquaculture Systems Incorporated.

Project: Codrington Research Facility, Drawing ID: M.1 – M.3, Dated: March 3, 2023.

[2] CONSTRUCTION NOTES, PLANS AND DETAILS – Prepared by: MTE Inc., Prepared for: Canadian Aquaculture Systems Incorporated.

Project: Codrington Fisheries Research Facility, Project ID: 52738-100, Drawing ID: S1.0 – S1.1, Dated: January 2023.

2.0 Site & Project Description

2.1 Site Description

The proposed development property is located at 15 Fish Hatchery Road in Codrington, Ontario. The property is a commercial lot occupied by the Codrington Fisheries Research Facility and contains numerous buildings and structures associated with the research facility throughout the property. The property is bounded to the north, east, and west by arable land and to the south by forested lands. There is a creek that runs north to south through the middle of the property while the property itself is accessible via Fish Hatchery Road to the west. The specific area of investigation, or subject Site, is located at the northeast side of the property, just south of the existing shed or warehouse building. The surface of the Site consists of topsoil and the immediate investigation limits were generally flat with minimal changes in elevation.

2.2 Project Description

It is Cambium's understanding that the proposed developments include the removal of the existing shed or workshop building and construction of a new building. The proposed building will occupy approximately 2,500 square feet and is to consist of one-storey to be used for operational purposes.

The geotechnical investigation was required to confirm the existing subsurface conditions, groundwater conditions, and soil bearing capacity as input into the design and construction of the proposed development. Geotechnical recommendations such as the potential re-use of soils, frost penetration, groundwater elevation, and dewatering are provided along with Site Plans, including borehole locations in Figure 2 of this report.

3.0 Methodology

The geotechnical investigation was conducted at the Site by Cambium on March 1, 2023. Boreholes were advanced nearby the proposed development footprint as shown in Figure 2.

3.1 Borehole Investigation

A total of two boreholes, designated as boreholes BH101-23 and BH102-23, were strategically placed and advanced throughout the site to depths of approximately 6.7 meters below ground surface (mbgs) after which cone penetration tests were continued to depths of approximately 20.9 to 22.1 mbgs. Both boreholes were terminated after practical refusal was encountered.

Drilling and sampling of the boreholes was completed using a truck-mounted drill rig operating under the supervision of a Cambium technician. All boreholes were advanced to the sampling depths by means of continuous flight solid stem augers. Boreholes were advanced using Standard Penetration Testing (SPT) and soil samples were collected at intervals of approximately 0.75 mbgs or whenever a change in soil type occurred, starting directly from the surface material and extending to a depth of approximately 6.8 mbgs. Beneath this depth, Cone Penetration Testing was conducted until practical refusal was encountered to obtain N-Values and determine the compactness of the underlying soils. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling. All boreholes were backfilled in accordance with O.Reg. 903, as amended, and the property was reinstated to pre-existing conditions.

Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described, and geotechnical recommendations are discussed in the following sections of this report.

3.2 Site Survey

Borehole locations are shown in Figure 2. The location of each borehole was referenced locally by a Cambium technician using a Trimble Catalyst surveying unit. UTM coordinates and

relative elevations are included on the borehole logs provided in Appendix A. Elevations were recorded relative to the base of hydro pole CB6 K4Z located at the south side of the property, depicted as benchmark BM on Figure 2, which was assigned an elevation of 200.00 mRel.

3.3 Physical Laboratory Testing

Physical laboratory testing, consisting of three sieve and hydrometer analyses (LS-702, LS-705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Atterberg Limit testing was completed on one soil sample while moisture content testing was completed on all soil samples. Results are presented in Appendix B and are discussed in Section 4.0.

4.0 Subsurface Conditions

The stratigraphy encountered in the boreholes are indicated on the attached borehole logs in Appendix A. It is noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change. In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (drilling speed, shaking/grinding of the augers, etc.).

The subsurface conditions at the Site generally consisted of an organic surface material underlain by fill material consisting of soils comprising a mixture of sand and gravel. Beneath the fill material, a native sand and silt soil was encountered prior to reaching material consisting of a mixture of silt and clay that extended to the end of the targeted sampling depths. Cone Penetration Testing was then initiated, and practical refusal was encountered in both boreholes advanced. The various soil strata are described in detail below and are identified on the borehole logs included in Appendix A.

4.1 Surficial Soil

Boreholes BH101-23 and BH102-23 were advanced through the surficial organic topsoil material. The encountered topsoil thicknesses are summarized in Table 1 below.

Table 1 Existing Topsoil Thicknesses

Borehole	Thickness (mm)
BH101-23	125
BH102-23	125

Analysis of the organic content within the topsoil material was beyond the scope of this project.

4.2 Fill Material

Beneath the surficial topsoil, a gravelly sand soil was encountered in both boreholes advanced. The gravelly sand soil is believed to be a fill material used within the previous gravel parking area located in the vicinity of the proposed building addition. The gravelly sand soils contained trace amounts of silt content and extended to depths between approximately 0.8 to 0.9 mbgs.

The gravelly sand soils were brown in colour and were moist at the time of the investigation with natural moisture content ranging between 7.8 to 9.6% based on laboratory testing. The soils have a compact relative density based on SPT N values of 13 to 14 blows for 305 mm of penetration.

4.3 Sand and Silt

Underlying the fill material in both boreholes, a sand and silt soil was encountered that contained significant quantities of organic material indicating it may consist of the original topsoil layer prior to placement of fill. The soils extended to depths of approximately 1.7 to 2.3 mbgs and generally appeared to increase in sand content and decrease in silt content with depth. In borehole BH101-23, a thin layer of sandy clayey silt with trace amounts of gravel was encountered underlying the fill material at depths of approximately 0.78 to 1.1 mbgs.

The sand and silt soils were brown to dark brown in colour and were moist at the time of the investigation with natural moisture content ranging between 81.0 to over 100 % based on laboratory testing. The soils have a very loose to loose relative density based on SPT N values of 1 to 5 blows for 305 mm of penetration.

Laboratory particle size distribution analysis was completed for one sample of the clayey silt soils, taken from the borehole and depth indicated below. The analysis results, based on the Unified Soil Classification System (USCS) scale, are summarized in Table 2 with full results provided in Appendix B.

Table 2 Particle Size Distribution Analysis – Clayey Silt Materials

Sample	Depth (mbgs)	Soil	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Moisture (%)
BH101-23, SS2A	0.8 – 1.1	Sandy Clayey Silt trace Gravel	4	13	53	30	24.8

4.4 Clayey Silt to Silt and Clay

Underlying the sand and silt soils, the boreholes encountered fine grained, cohesive soil consisting of clayey silt and silt and clay soils. These soils were encountered at depths ranging between 1.7 and 2.3 mbgs and extended to the end of sampling depths in both boreholes advanced. A clayey silt soil was encountered in borehole BH101-23 between the depths of approximately 2.3 to 3.0 mbgs that contained trace amounts of sand content. A silt and clay soil was encountered underlying the clayey silt in borehole BH101-23 and directly underlying the sand and silt soils in borehole BH102-23. The silt and clay soils contained trace to some amounts of sand content that generally decreased with depth.

The clayey and silt soils were grey in colour and wet at the time of investigation with natural moisture content ranging between 28.0 to 55.0 % based on laboratory testing. The soils have a very soft to soft density based on SPT N values of 0 to 3 blows for 305 mm of penetration.

The clayey silt soils appeared wetter than the plastic limit (WTPL) at the time of the investigation with natural moisture content values of 38.7% based on laboratory testing.

Field shear vane tests were also conducted within the silt and clay materials which yielded a peak shear strength between 27.1 and 65.0 kPa and a remolded shear strength of 7.22 kPa.

Laboratory particle size distribution analysis was completed for two samples of the clayey silt to silt and clay soils, taken from the borehole and depth indicated below. The analysis results, based on the Unified Soil Classification System (USCS) scale, are summarized in Table 3 with full results provided in Appendix B.

Table 3 Particle Size Distribution Analysis – Silt and Clay Materials

Sample	Depth (mbgs)	Soil	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Moisture (%)
BH101-23, SS4	2.3 – 2.9	Clayey Silt trace Sand	0	3	69	28	27.4
BH103-23, SS3B	1.7 – 2.1	Silt and Clay some Sand	0	6	56	38	26.0

4.5 Dynamic Cone Penetration Test

Dynamic cone penetration testing (DCPT) was initiated within both boreholes at a depth of approximately 6.8 mbgs. The cone penetration test was advanced to depths of approximately 20.9 mbgs in borehole BH101-23 and 22.1 mbgs in borehole BH102-23. In general, the soils maintain a very loose/soft to loose/firm relative density to a depth of approximately 11.5 to 12.5 mbgs. The soils then become compact or stiff to very stiff extending to a depth of approximately 16.9 to 19.5 mbgs. At these depths, the soils become compact to dense and eventually became very dense before practical refusal was encountered.

4.6 Practical Refusal / Bedrock

Practical refusal was encountered in both boreholes at depths of approximately 20.9 to 22.1 mbgs. Table 4 shows the depths where practical refusal was encountered and associated elevations.

Table 4 Depths of Practical Refusal

Borehole ID	Elevation (mREL)	Depth of Practical Refusal (mbgs)	Depth of Practical Refusal (mREL)
BH101-23	195.75	20.9	175.85
BH102-23	195.72	22.1	173.62

Based on results of the investigation and known local geology, it is inferred that refusal was encountered due to very dense or hard soils. Bedrock is not believed to have been encountered within the depths explored. While refusal was encountered, it cannot be confirmed that refusal was a result of bedrock. In order to confirm this, a more advanced geotechnical investigation involving rock coring and visual observation of the bedrock would be required.

4.7 Groundwater

At the time of the investigation, groundwater seepage was encountered in both boreholes advanced within the scope of the investigation. Table 5 shows the depths at which groundwater was encountered and the standing water levels observed upon completion of the borehole.

Table 5 Depths of Groundwater Encounter and Standing Water Levels

Borehole	Relative Elevation (mREL)	Depth to Groundwater (mbgs)	Groundwater Encountered (mREL)	Standing Water Level (mbgs)	Standing Water Level (mREL)
BH101-23	195.75	2.3	193.45	0.9	194.85
BH102-23	195.72	1.5	194.22	0.9	194.82

It should be noted that groundwater levels at the Site may fluctuate seasonally and in response to climatic events. Based on these observations, the groundwater table at the Site is likely within the upper 2.0 m of the subsurface and is tied to the water elevation in the creek that flows north and south of the building.

5.0 Geotechnical Design Considerations

This section of the report provides engineering information on, and recommendations for, the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and our understanding of the project requirements. The information in this portion of the report is provided for planning and design purposes for the guidance of the design engineers and architects. Where comments are made on construction, they are provided only to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the Site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own independent interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like. Cambium will not assume any responsibility for construction-related decisions made by contractors on the basis of this report. Additionally, if subsurface conditions throughout to the southern boundary of the proposed design differ from those encountered during the geotechnical investigation, Cambium should be consulted to update the following recommendations.

5.1 Site Preparation

Any surficial topsoil, organic fill, and any other disturbed material or native soils encountered should be excavated and removed beneath the proposed development footprints; additionally, this material should be excavated and removed to a minimum distance of 1 m around the proposed footprint. Any topsoil and materials with significant quantities of organics and deleterious materials (i.e., construction debris, asphalt etc.) are not appropriate for use as fill. Utility trench subgrades should be inspected by a qualified geotechnical engineer prior to construction of the proposed developments.

Any exposed subgrades should be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any granular fill. Any loose/soft soils identified at the time of proof-rolling that are unable to uniformly be compacted should be sub-excavated and

removed. The excavations created through the removal of these materials should be backfilled with approved engineered fill consistent with the recommendations provided below.

The encountered clayey silt to silt and clay soils at the site can be unstable if they are wet or saturated. Such conditions are common in the spring and late fall. Under these conditions, if the material is encountered during any excavations, temporary use of granular fill, and possible reinforcing geotextiles, may be required to prevent severe rutting on construction access routes. Where possible, any existing roadways should be used for construction access routes.

5.2 Frost Penetration

Based on climate data and design charts, the maximum frost penetration depth below the surface at the site is estimated at 1.2 mbgs. Utilities should be founded at or below a depth of 1.2 mbgs, upon free-draining granular fill extending to below 1.2 mbgs or be adequately insulated.

Any services should be located below this depth or be appropriately insulated.

5.3 Excavations

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA) and Ontario Regulation 213/91 (as amended). Soils encountered above the groundwater table at the Site can be considered Type 3 soils and as such, excavation side slopes should be no steeper than 1H:1V.

If the groundwater table is encountered during excavations, soils below the groundwater table should be treated as Type 4 soils and therefore excavation side slopes should be decreased to 3H:1V in these areas. Where the side slopes consist of more than one soil type, the soil shall be classified as the type with the highest number among the soil types present. Please note that the soil type classifications indicated above are provisional and are subject to change based on field observations of the actual conditions at the time of exposure.

Excavation slopes should be protected during construction from precipitation, runoff, or snow/ice melt and should be inspected regularly for signs of instability. If localized instability is

noted during excavation or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or the excavation sidewalls must be fully supported (shored).

Stockpiles of excavated materials should be kept at least at the same distance as the excavation depth from the top edge of the excavation to prevent slope instability. Care should also be taken to avoid overloading of any existing underground services/structures by stockpiles.

5.4 Dewatering

Based on the results of the investigation, groundwater seepage may be encountered during excavations and the installation of underground services or foundations depending on the proposed design. Any patterns of groundwater flow trends were not recognized based on the borehole observations and a hydrogeological study would be required to understand groundwater patterns and specific dewatering requirements throughout the site.

The recommended foundation design is to consist of piles foundations to help minimize the amount of excavations throughout the site. Insulated grade beams should be used within the building footprint to reduce the excavations within the building footprint. Excavations should extend no more than 1.0 m below ground surface to minimize the above impacts. If excavations extend no more than 1.0 m depth, some ground water seepage is anticipated; however, it should be controllable with filtered sumps and pumps.

If these recommendations are followed, a Permit to Take Water (PTTW) from the Ministry of the Environment, Conservation, and Parks (MECP) is not anticipated based on the assumed typical excavation depths.

If excavations below the water table are required, and active dewatering program would be required, and hydrogeological assessment of the site would be required.

5.5 Foundation Design

5.5.1 Micro-pile Foundations

Based on the competency of the soils at the Site, the piles should extend to a minimum of 16 meters below ground surface in order to be founded in dense to hard native soils. It is understood that previously at the site, buildings were founded on heavy wall 0.422" end bearing 5" diameter pipe piles and are what the following design criteria are based on – should a different design be chosen for the proposed building foundations, Cambium should be consulted to review the design. Based on SPT N values obtained during the site investigation for the soils below 16 mbgs until refusal depths, as well as the length and diameter of the piles, the geotechnical resistance of such piles embedded into the dense to hard native soils is 90 kN at serviceability limit state (SLS) and 135 kN at ultimate limit state (ULS) (per Decourt, 1995 as outlined in the Canadian Foundation Engineering Manual 4th Edition, Section 18.2.3.3). The geotechnical resistance of such piles is based on the following three criteria:

- Piles are advanced to a minimum of 16 mbgs.
- Piles are embedded a minimum of 1 meter into dense to hard soils (based on advancement rates).
- Piles have been advanced to complete refusal (no vertical movement).

Pile installation refusal should be determined in consultation with the installation contractor but should generally consist of a criteria requiring no vertical movement of the pile during driving over a specified period of time. Full time observation of pile installation should be conducted by Cambium to confirm achievement of the aforementioned criteria and pile refusal.

5.5.2 Slab On Grade

All organic material and deleterious material must be removed prior to constructing the slab on grade. It is recommended that the slab be provided with a capillary moisture barrier. This is made by placing the slab on a minimum 200 mm layer of clear stone and nominally compacted by vibration to a dense state. Alternatively, the capillary moisture barrier can be composed of a

200 mm thick layer of OPSS.MUNI 1010 Granular A, compacted to a minimum 98% of the SPMDD. Under slab drainage is not required beyond the capillary moisture barrier provided the floor slab elevation is set at 300 mm or higher than the exterior grade.

The modulus of subgrade reaction appropriate for slab on grade design on the soils at the site is as follows:

Subgrade Material	Underlying Material	Subgrade Reaction
Granular A / Clearstone	Engineered Fill Over Coarse-Grained Soils	30 mPa/m
Granular A / Clearstone	Engineered Fill Over Fine Grained Soils	20 mPa/m

The subgrade for the slab must be inspected and approved by Cambium, prior to the placement of an aggregate base. If there are areas containing excessive amounts of deleterious/organic material or moisture, they must be locally sub-excavated and backfilled with approved clean earth fill or Engineered Fill such as OPSS Granular B (Type I or II) and compacted to a minimum of 98% SPMDD.

5.6 Backfill and Compaction

Excavated native soils are not appropriate for use as fill below grading areas provided due to the significant amount of fine material. Geotechnical inspections and testing of engineered fill are required to confirm acceptable quality.

Grade beam backfill should consist of free draining imported granular material as required. The onsite soils will not provide proper drainage; therefore, this can be accomplished using well graded Granular B Type I or II material complying with OPSS 1010. If a drainage layer membrane is used against the foundation, then Granular B material may not be required, but the proposed backfill material should be inspected and approved by a geotechnical engineer prior to placement. Backfill should be placed in lifts not exceeding 200 mm in thickness and compacted to 98% of SPMDD. Placement of engineered fill should be verified by onsite compaction testing during construction.

5.6.1 Engineered Fill

When any fill is treated as an engineered fill to support structural elements such as foundations and or floor slabs, the following is recommended for the construction of engineered fill:

I. Remove any and all existing vegetation, surficial topsoil/ organics, organic fills or fills and any loose soils to a competent subgrade for a suitable envelope;

II. As a minimum, the area of the engineered fill should extend horizontally 1 meter beyond the outside edge of the foundations then extend downward at a 1:1 slope to the competent native soil;

III. The subgrade or base of the engineered fill area must be approved by Cambium prior to placement of any new fill, to ensure that suitability of subgrade condition;

IV. Place approved OPSS 1010 SSM or Granular 'B' Type I material at a moisture content at or near optimum moisture in suitable maximum 200 mm thick lifts, compacted to 100% of SPMDD. Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill and reviewed by Cambium;

V. Full time testing and inspection of the engineered fill will be required for it to be used as a founding material, as outlined in Section 4.2.2.2 of the Ontario Building Code.

5.7 Lateral Earth Pressures

The design of the grade beams and mircropiles should consider the horizontal soil loads, as well as surcharge loads that may occur during or after construction. The backfill materials should consist of imported free-draining granular soils (e.g., OPSS Granular B, Type I or Granular A and Granular B Type II) as approved by a Geotechnical Engineer.

The backfill materials should be placed in lifts not exceeding 200 mm thick. The layers should be compacted to at least 98% of SPMDD. Lateral earth pressure coefficients (K) are shown in Table 6. It is assumed that potential lateral loads will result from cohesion less, frictional materials.

Table 6 Lateral Earth Pressure Coefficients

Soil	Bulk Unit Weight γ (kN/m³)	Internal Friction Angle Φ' (°)	Active earth pressure coefficient Ka (Rankine)	Passive earth pressure coefficient Kp (Rankine)	At-rest earth pressure coefficient Ko (Rankine)
Compacted Granular A and Granular B Type II	22	34	0.28	3.54	0.44
Compacted Granular B Type I	21	32	0.31	3.25	0.47
Native Silt Dominate Soils*	18	30	0.33	3.00	0.5

**Values derived from empirical relationships based on soil types and SPT N-values*

The earth pressure coefficient adopted will depend on whether the retaining structure is restrained, or some movement can occur such that the active state of earth pressure can develop. The use of vibratory compaction equipment immediately behind the retaining walls should be restricted in size.

The coefficients provided in Table 6 assume that the surface of the granular backfill or native material is horizontal against any proposed retaining wall, and the wall is vertical and smooth. Cambium should be contacted to provide updated lateral earth pressure coefficients should the assumptions differ to those noted.

The following formula may be used to calculate active lateral thrust (Pa) on yielding retaining structures;

$$P_a = (\mathrm{H}/2)(\mathrm{K_a})(\gamma \mathrm{H} + 2\mathrm{q})$$

where,

H = Height of retaining structure (m)

γ = unit weight of retained soil (kN/m³)

q = surcharge (kPa)

Unit weights found in Table 6 should be used for compacted loadings of the appropriate material.

Where traffic loads are expected within 3 meters of the foundation walls, or temporary shoring, a vehicle surcharge pressure of at least 3 and up to 6 kPa should be applied to the upper 3 meters of the wall; the actual surcharge pressure should depend on the type of traffic. Where construction equipment will be working behind the walls within a horizontal distance equal to the wall height (1H:1V), the design should include a surcharge pressure of 15 kPa. The above pressures should be assumed to act over the entire width of the retaining wall.

5.7.1 Earthquake Induced Pressures

Earthquakes will induce additional pressures on retaining structures or foundation walls. For active earth pressure loads:

$$P_{ae} = \frac{1}{2}\gamma H^2(1 - k_v)K_{ae}$$

Where,

P_{ae} = resultant active lateral earth load inducing static and dynamic loads;

γ = unit weight of the soil behind the wall;

k_v = vertical component of the earthquake acceleration (as a decimal fraction of the acceleration due to gravity);

k_h = horizontal component of the earthquake acceleration (as a decimal fraction of the acceleration due to gravity); and

K_{ae} = horizontal component of active earth pressure coefficient including effects of earthquake loading;

And

$$K_{ae} = \frac{\cos(\delta + \alpha cos^2(\phi' - \varphi - i))}{cos^2 i \ \cos\delta \cos(\delta + i + \varphi)(1 + X_a^{1/2})^2}$$

$$X_a = \frac{\sin(\delta + \varphi')\sin(\phi' - \varphi - \beta)}{\cos(\delta + i + \varphi)\cos(\beta - i)}$$

$$\varphi = \tan^{-1}[k_h/(1 - k_v)]$$

$$i = 90 - \alpha$$

For the site, γ is as provided in Table 6, α=90° and i=0. Using Coulomb's theory, the angle of wall friction (δ) is related to both the internal angle of friction of the soil (Φ') as provided in Table 6 and the roughness of the wall. For smooth vertical walls δ=0, and the recommended maximum value for rough concrete walls δ = 14. If the walls are not smooth, Cambium would recommend reviewing the design δ values.

5.8 Subdrains

Provisions should be made for draining any permanent or long-standing grade beam backfill to prevent buildup of hydrostatic pressures; this could consist of geotextile-wrapped perforated plastic sub-drain appropriately sloped and drained to the stormwater management system or other suitable frost-free outlet, or geotextile-wrapped perforated plastic sub-drains draining through the wall itself would be considered suitable provided they could be kept frost-free.

5.9 Buried Utilities

Trench excavations above the groundwater table should generally consider Type 3 soil conditions, which require side slopes no steeper than 1H:1V, otherwise shoring would be required. Any excavations below the water table should generally consider Type 4 soil conditions which require unsupported side slopes of 3H:1V or flatter.

Bedding and cover material for any services should consist of OPSS 1010 Granular A or B Type II, placed in accordance with pertinent Ontario Provincial Standard Drawings (OPSD 802.013). The bedding and cover material shall be placed in maximum 200 mm thick lifts and should be compacted to at least 98% of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 98% of SPMDD, taking care not to damage the utility pipes during compaction. If bedding is being placed in wet conditions consideration should be given to using 19 mm crushed clear stone underlain by a geotextile (Terrafix 270R or similar).

5.10 Seismic Site Classification

The Ontario Building Code (OBC) specifies that the structures should be designed to withstand forces due to earthquakes. For the purpose of earthquake design, geotechnical information shall be used to determine the "Site Class". The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the OBC (2012). The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated on the basis of rational analysis of undrained shear strength (s_u) or penetration resistances (N_{60} values). Based on the explored soil properties and in accordance with Table 4.1.8.4.A, it is recommended that Site Class "E" (soft soil) be applied for utilities at the Site.

Peak ground acceleration and spectral acceleration (period of 0.2 seconds) for the site are calculated to be 0.099g and 0.160g respectively using the 2015 National Building Code Seismic Hazard Calculation. Calculation results are shown in Appendix C.

5.11 Design Review and Inspections

Testing and inspections should be carried out during construction operations to examine and approve subgrade conditions, fill material, compaction of pipe bedding, trench backfill, granular base courses, and asphaltic concrete.

We should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed. It is important that onsite geotechnical supervision be provided at this site for excavation and backfill procedures, deleterious soil removal, subgrade inspections and compaction testing.

6.0 Closing

Please note that this work program and report are governed by the attached Qualifications and Limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (613) 389-2323.

Respectfully submitted,

Cambium Inc.

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7.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

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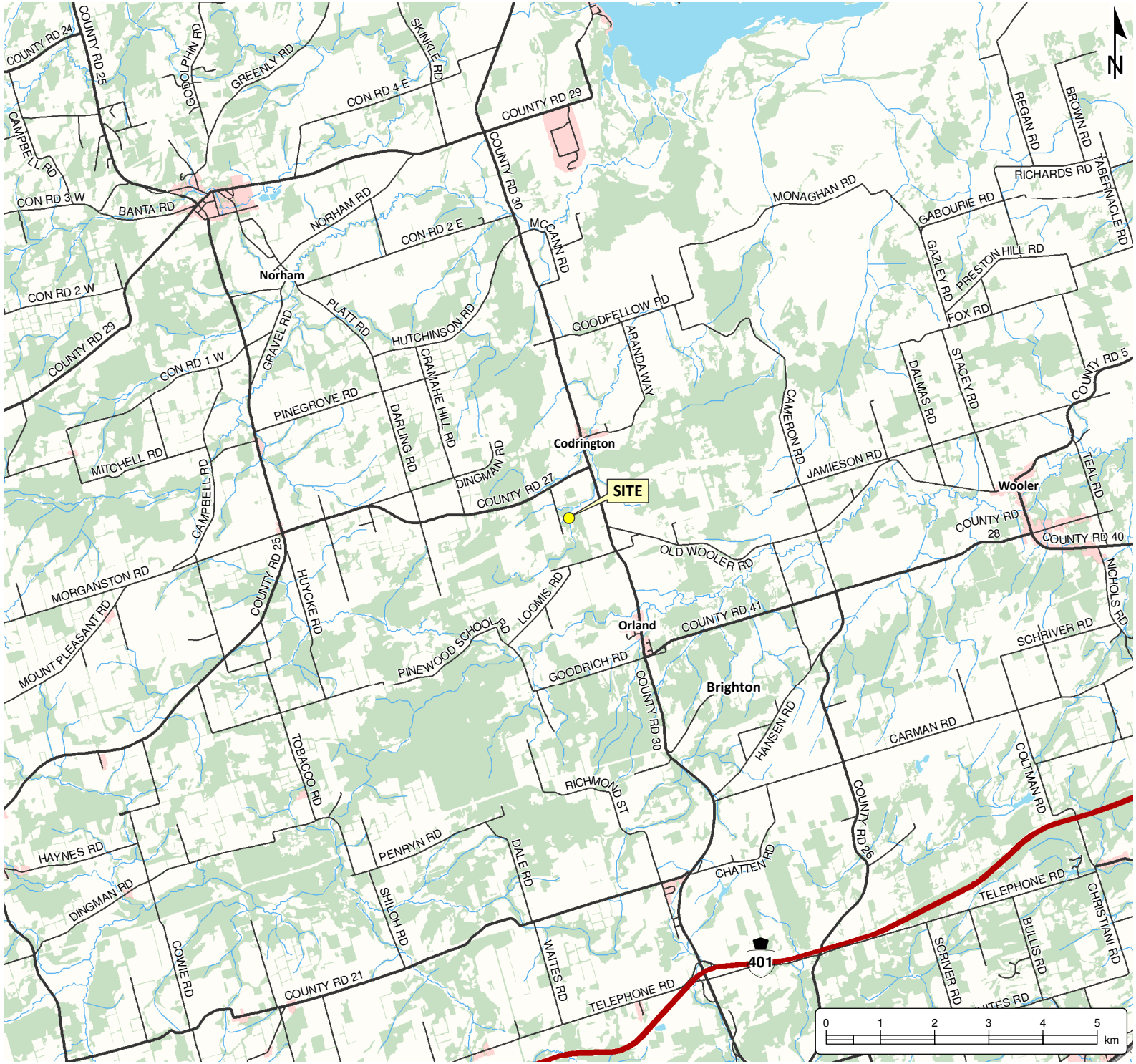
Appended Figures

GEOTECHNICAL INVESTIGATION

MINISTRY OF NATURAL RESOURCES AND FORESTRY
15 Fish Hatchery Road,
Codrington, Ontario



LEGEND

- Highway
- Major Road
- Minor Road
- Railroad
- Watercourse
- Water Area
- Wooded Area
- Built Up Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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SITE LOCATION MAP

Project No.: 4161-005		Date: March 2023 Rev.:	
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 18N	
Created by: DBB	Checked by: MG	Figure:	1

O:\GIS\MXDs\4100-41994161-005 Min of Natural Resources & Forestry - GEO - Codrington Fisheries\2023-03-21 FIG 1 - Site Location Map.mxd

GEOTECHNICAL INVESTIGATION

MINISTRY OF NATURAL RESOURCES AND FORESTRY
15 Fish Hatchery Road,
Codrington, Ontario

LEGEND

- Benchmark
- Borehole
- Proposed Building (approximate)

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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BOREHOLE LOCATION PLAN

Project No.:	4161-005	Date:	March 2023
		Rev.:	
Scale:	1:750	Projection:	NAD 1983 UTM Zone 18N
Created by:	DBB	Checked by:	MG
Figure:	2		

O:\GIS\MXDs\4100-41994161-005 Min of Natural Resources & Forestry - GEO - Codrington Fisheries\2023-03-21 FIG 2 - Borehole Location Plan.mxd

Appendix A

Borehole Logs

Client: MNRF **Project Name:** Cod. Fisheries - Proposed Building Addition **Log of Borehole:** BH101-23

Contractor: Canadian Environmental Drilling **Method:** Truck Mounted Solid Stem Auger Page: 1 of 3

Location: 15 Fish Hatchery Road, ON **Elevation:** 195.75 mREL **Date Completed:** Mar. 1, 2023

Project No.: 4161-005 **UTM:** 18 T **N:** 4892074.1 **E:** 275801

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. ✦ rem V. ⊕) (20 40 60 80) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
195.8	0	**TOPSOIL:** 125 mm Topsoil	195.62	1A	SS			42.6%			
		(SW) gravelly SAND: brown, moist, compact, trace silt	0.13	1B	SS	55	14	9.6%	14		
195.2	0.5		194.99								
		(ML) sandy CLAYEY SILT: grey, moist, firm, trace gravel	0.76 / 194.68	2A	SS			25.5%			
194.8	1	**(SP) SAND and SILT:** dark brown, moist, loose, some organics	1.07	2B	SS	75	5	81.0%	5		
194.2	1.5	Becomes Very Loose, increase in Sand, Organics content		3	SS	70	2		102%		
193.8	2		193.46								
193.2	2.5	**(ML) CLAYEY SILT:** grey, WTPL, very soft, trace sand	2.29	4	SS	67	0	38.7%			2.6m: Atterberg Limit test conducted - Liquid Limit: 29.8%, Plastic Limit: 16.9%, Plasticity Index: 12.9%.
192.8	3		192.7								
		(ML) SILT and CLAY: grey, wet, soft, trace sand	3.05	5A	SS	100	3	43.7%	3		
192.2	3.5			5B					7.2 27.1 ✦ ⊕		Shear Vane test conducted - Peak Shear Strength: 27.1 kPa, Remolded Shear Strength: 7.2 kPa.
191.8	4										
191.2	4.5	Becomes Very Soft		6A	SS	100	0	55.0%			
190.8	5			6B					7.2 24.6 ✦ ⊕		Shear Vane test conducted: Peak Shear Strength: 24.6 kPa, Remolded Shear Strength: 7.2 kPa.
190.2	5.5										
189.8	6										
189.2	6.5		189.04	7	SS	100	1	49.2%	1		
			6.71	8			2		2		Borehole advancement terminated, Dynamic Penetration Test initiated.
188.8	7			9			2		2		
188.8			188.25								
			7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2A	4	13	53	30
SS4	0	3	69	28

1m = 24 units

Logged By: FI **Input By:** FI

Client: MNRF **Project Name:** Cod. Fisheries - Proposed Building Addition **Log of Borehole:** BH101-23

Contractor: Canadian Environmental Drilling **Method:** Truck Mounted Solid Stem Auger Page: 2 of 3

Location: 15 Fish Hatchery Road, ON **Elevation:** 195.75 mREL **Date Completed:** Mar. 1, 2023

Project No.: 4161-005 **UTM:** 18 T **N:** 4892074.1 **E:** 275801

SUBSURFACE PROFILE				SAMPLE							
Elevation (m)	Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. ✦ rem V. ⊕) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
188.2	7.5			10			3		3		
				11			3		3		
187.8	8			12			3		3		
				13			3		3		
187.2	8.5			14			3		3		
				15			4		4		
186.8	9			16			4		4		
				17			5		5		
186.2	9.5			18			4		4		
				19			4		4		
185.8	10			20			5		5		
				21			3		3		
185.2	10.5			22			5		5		
				23			5		5		
184.8	11			24			7		7		
				25			11		11		
184.2	11.5			26			8		8		
				27			6		6		
183.8	12			28			7		7		
				29			7		7		
183.2	12.5			30			12		12		
				31			12		12		
182.8	13			32			13		13		
				33			15		15		
182.2	13.5			34			13		13		
				35			13		13		
181.8	14										
181.2	14.5										
			180.75 / 15								
181.3											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2A	4	13	53	30
SS4	0	3	69	28

1m = 24 units

Logged By: FI **Input By:** FI

Client:	MNRF	**Project Name:**	Cod. Fisheries - Proposed Building Addition	**Log of Borehole:**	BH101-23
Contractor:	Canadian Environmental Drilling	**Method:**	Truck Mounted Solid Stem Auger	Page:	3 of 3
Location:	15 Fish Hatchery Road, ON	**Elevation:**	195.75 mREL	**Date Completed:**	Mar. 1, 2023
Project No.:	4161-005	**UTM:**	18 T **N:** 4892074.1 **E:** 275801		

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. / rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
180.8	15			36			17		17		
				37			14		14		
180.2	15.5			38			17		17		
179.8	16			39			20		20		
				40			20		20		
179.2	16.5			41			32		32		
				42			24		24		
178.8	17			43			31		31		
178.2	17.5			44			25		25		
				45			27		27		
177.8	18			46			31		31		
177.2	18.5			47			20		20		
				48			21		21		
176.8	19			49			22		22		
				50			25		25		
176.2	19.5			51			35		35		
175.8	20			52			27		27		
				53			35		35		
175.2	20.5			54			33		33		
				55			50/8"		50		
174.8	21		Borehole terminated @ 20.9m due to practical refusal. (174.82 / 20.93)								Borehole terminated. Dynamic Penetration Test terminated. Borehole caving observed at 5.6 mbgs. Groundwater encountered at 2.3 mbgs. Standing water observed at 0.9 mbgs.
174.2	21.5										
173.8	22										
173.8											

1m = 24 units

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2A	4	13	53	30
SS4	0	3	69	28

Logged By: FI **Input By:** FI

Client:	MNRF	**Project Name:**	Cod. Fisheries - Proposed Building Addition	**Log of Borehole:**	BH102-23
Contractor:	Canadian Environmental Drilling	**Method:**	Truck Mounted Solid Stem Auger	Page:	1 of 3
Location:	15 Fish Hatchery Road, ON	**Elevation:**	195.72 mREL	**Date Completed:**	Mar. 1, 2023
Project No.:	4161-005	**UTM:**	18 T **N:** 4892064 **E:** 275800		

SUBSURFACE PROFILE				SAMPLE							
Elevation (m) / Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. +, rem V. ⊕) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
195.7 / 0		**TOPSOIL:** 125 mm Topsoil	195.59	1A	SS						
		(SW) gravelly SAND: brown, moist, compact, trace silt	0.13	1B	SS	55	13	7.8%	100% 13		
195.2 / 0.5		Becomes Very Loose	194.86	2A	SS			63.9%			
		(SP) SAND and SILT: brown, moist, very loose, some organics	0.86	2B	SS	25	2		100% 2		
194.7 / 1											
194.2 / 1.5		Decrease in Silt content	193.99	3A	SS				100%		
		(ML) SILT and CLAY: grey, wet, very soft, some sand	1.73	3B	SS	67	1	28.0%	1		
193.7 / 2				3C					7.2 + 65		Shear Vane Test conducted - Peak Shear Strength: 65.0 kPa. Remolded Shear Strength: 7.2 kPa.
193.2 / 2.5											
192.7 / 3											
		Becomes Soft, decrease in Sand content		4	SS	100	2	48.8%	2		
192.2 / 3.5											
191.7 / 4											
191.2 / 4.5											
		Becomes Very Soft		5	SS	100	1	53.3%	1		
190.7 / 5											
190.2 / 5.5											
189.7 / 6											
189.2 / 6.5			189.01	6	SS	100	1	46.4%	1		
			6.71	7			2		2		Borehole advancement terminated. Dynamic Penetration Test initiated.
188.7 / 7				8			2		2		
188.8			188.22								
			7.5								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3B	0	6	56	38

1m = 24 units

Logged By: FI **Input By:** FI

Client:	MNRF	**Project Name:**	Cod. Fisheries - Proposed Building Addition	**Log of Borehole:**	BH102-23
Contractor:	Canadian Environmental Drilling	**Method:**	Truck Mounted Solid Stem Auger	Page:	2 of 3
Location:	15 Fish Hatchery Road, ON	**Elevation:**	195.72 mREL	**Date Completed:**	Mar. 1, 2023
Project No.:	4161-005	**UTM:**	18 T **N:** 4892064 **E:** 275800		

SUBSURFACE PROFILE			SAMPLE						
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. / rem V.) 20 40 60 80 SPT (N) 20 40 60 80	Well Installation	Log Notes
188.2 / 7.5			9			3		3		
			10			3		3		
187.7 / 8			11			3		3		
			12			4		4		
187.2 / 8.5			13			3		3		
			14			6		6		
186.7 / 9			15			4		4		
			16			4		4		
186.2 / 9.5			17			6		6		
			18			7		7		
185.7 / 10			19			6		6		
			20			5		5		
185.2 / 10.5			21			6		6		
			22			6		6		
184.7 / 11			23			7		7		
			24			11		11		
184.2 / 11.5			25			8		8		
			26			11		11		
183.7 / 12			27			15		15		
			28			18		18		
183.2 / 12.5			29			21		21		
			30			20		20		
182.7 / 13			31			20		20		
			32			23		23		
182.2 / 13.5			33			25		25		
181.7 / 14										
181.2 / 14.5										
181.3 / 180.72 / 15										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3B	0	6	56	38

1m = 24 units

Logged By: FI **Input By:** FI

Client: MNRF **Project Name:** Cod. Fisheries - Proposed Building Addition **Log of Borehole:** BH102-23

Contractor: Canadian Environmental Drilling **Method:** Truck Mounted Solid Stem Auger Page: 3 of 3

Location: 15 Fish Hatchery Road, ON **Elevation:** 195.72 mREL **Date Completed:** Mar. 1, 2023

Project No.: 4161-005 **UTM:** 18 T **N:** 4892064 **E:** 275800

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. / rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
180.7 — 15			34			32		32		
180.2 — 15.5			35			26		26		
			36			25		25		
179.7 — 16			37			21		21		
			38			25		25		
179.2 — 16.5			39			28		28		
			40			22		22		
178.7 — 17			41			23		23		
178.2 — 17.5			42			26		26		
			43			26		26		
177.7 — 18			44			26		26		
			45			25		25		
177.2 — 18.5			46			26		26		
			47			21		21		
176.7 — 19			48			25		25		
			49			34		34		
176.2 — 19.5			50			25		25		
			51			29		29		
175.7 — 20			52			29		29		
			53			33		33		
175.2 — 20.5			54			36		36		
			55			33		33		
174.7 — 21			56			41		41		
			57			50/10"		50		
174.2 — 21.5										Borehole terminated. Dynamic Penetration Test terminated. Borehole caving observed at 3.6 mbgs. Groundwater encountered at 1.5 mbgs. Standing water observed at 0.9 mbgs.
173.7 — 22		173.62								
173.8		Borehole terminated @ 22.1m (22.1) due to practical refusal.								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3B	0	6	56	38

1m = 24 units

Logged By: FI **Input By:** FI

Appendix B

Physical Laboratory Results

Grain Size Distribution Chart

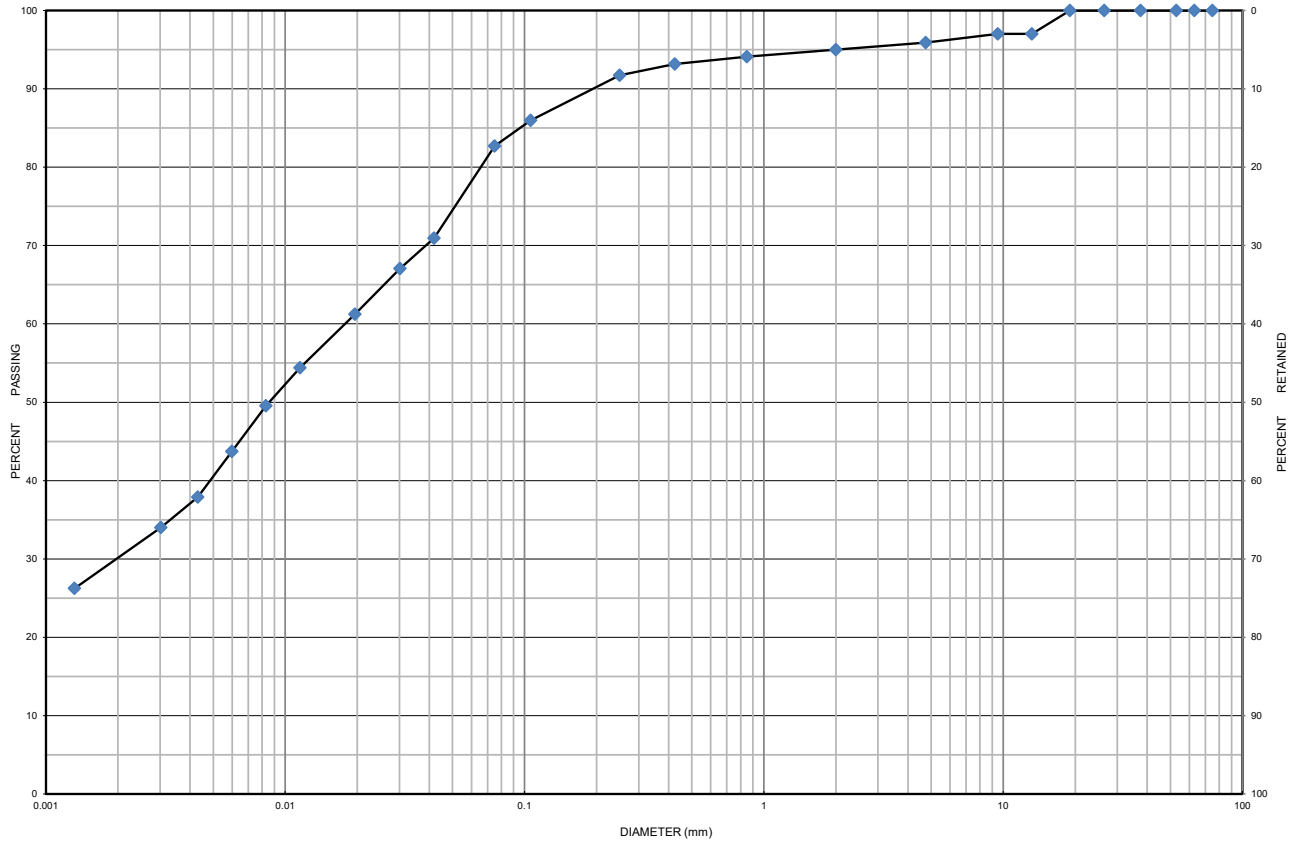
Project Number: *4161-005* **Client:** *Ministry of Natural Resources & Forestry*

Project Name: *Codrington Fisheries Facility – Proposed Building*

Sample Date: *March 1, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 101-23 SS 2A* **Depth:** *0.8 m to 1.1 m* **Lab Sample No:** *S-23-0439*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-23	SS 2A	0.8 m to 1.1 m	4	13	53	30	24.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Silt, some Sand, trace Gravel	ML	0.018	0.002	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *March 14, 2023*

(Senior Project Manager)

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Grain Size Distribution Chart

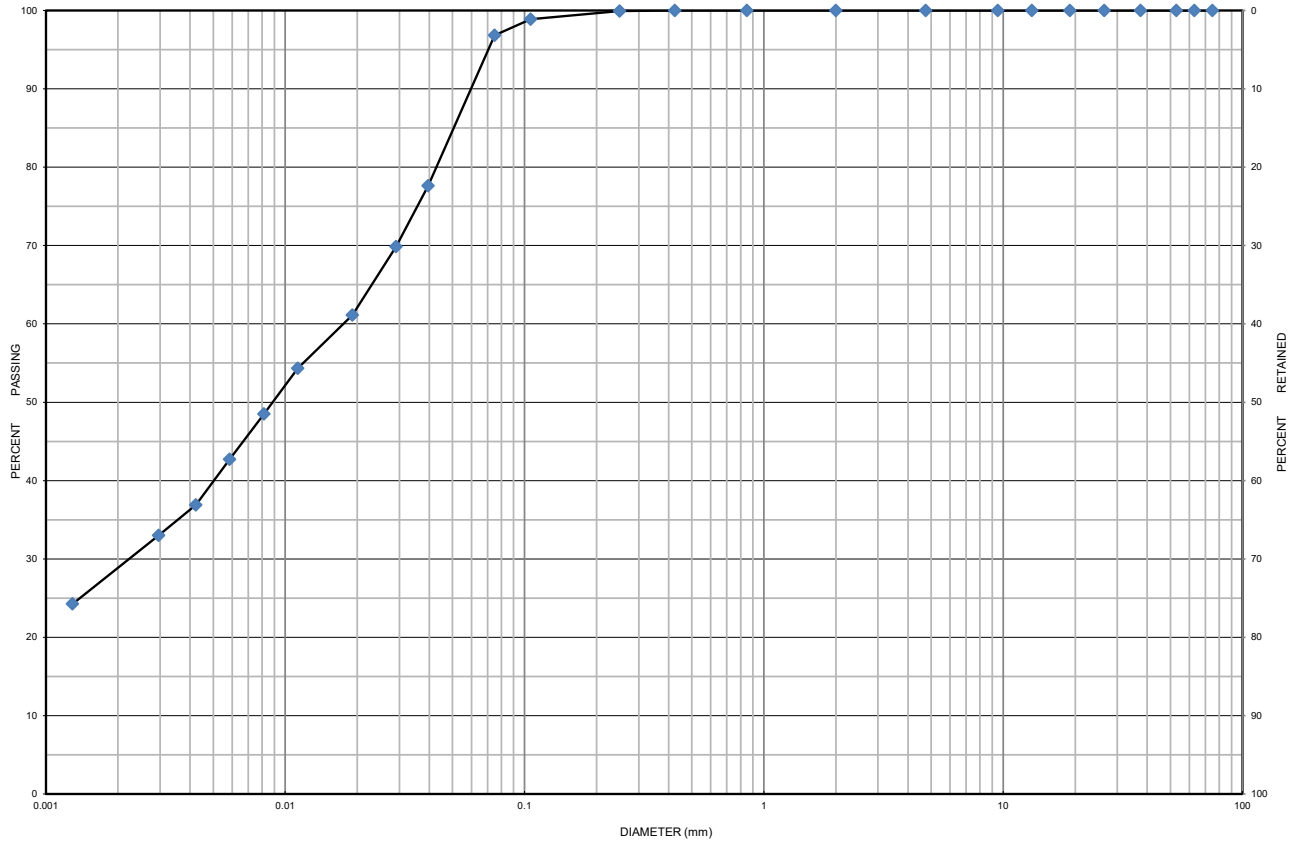
Project Number: *4161-005* **Client:** *Ministry of Natural Resources & Forestry*

Project Name: *Codrington Fisheries Facility – Proposed Building*

Sample Date: *March 1, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 101-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-0440*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-23	SS 4	2.3 m to 2.9 m	0	3	69	28	27.4

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Silt, trace Sand	CL	0.018	0.002	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *March 14, 2023*

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Plasticity Chart

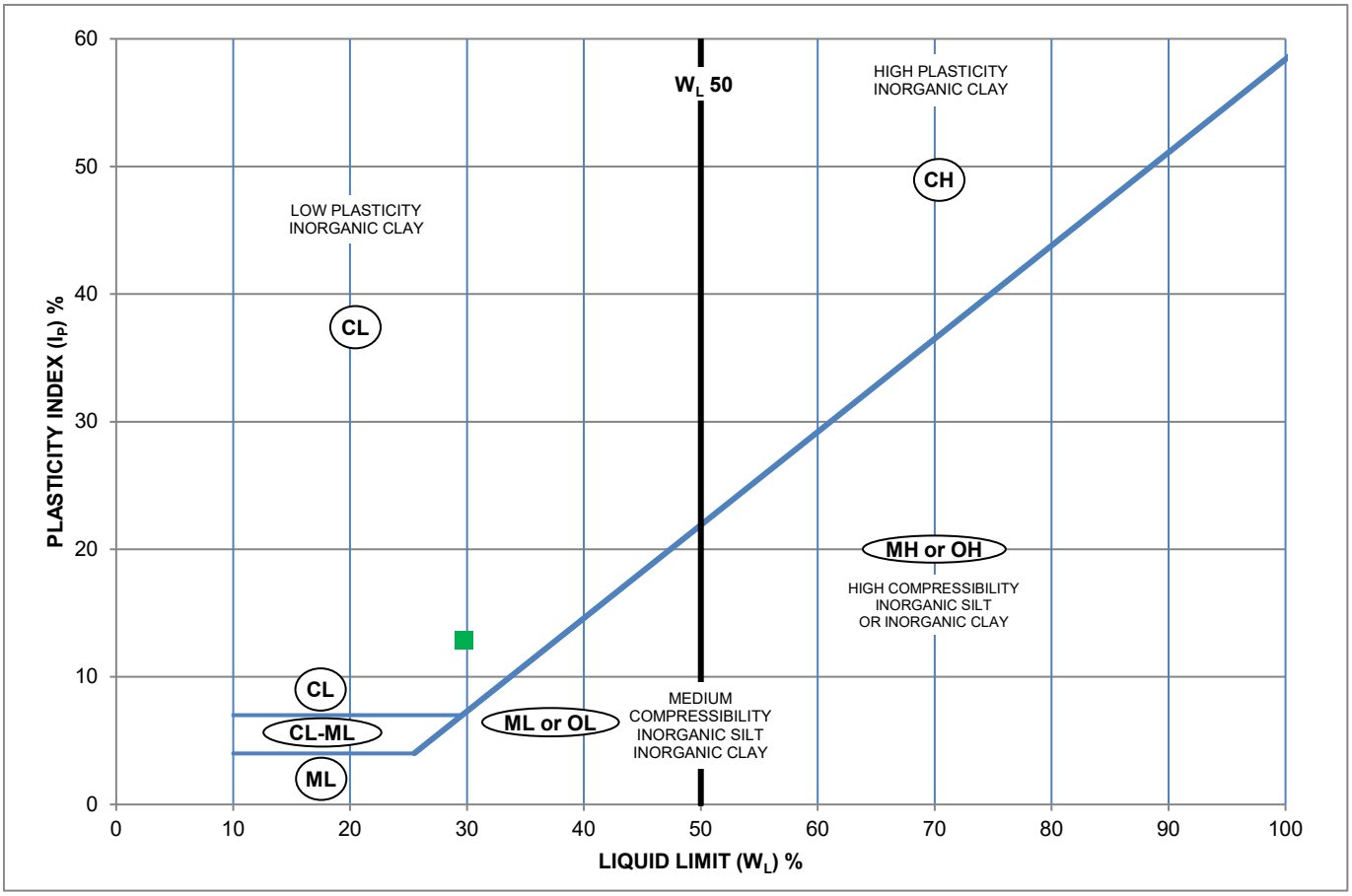
Project Number: *4161-005* **Client:** *Ministry of Natural Resources & Forestry*

Project Name: *Codrington Fisheries Facility – Proposed Building*

Sampled By: *Farhan Imtiaz - Cambium Inc.* **Sample Date:** *March 1, 2023*

Hole No.: *BH 101-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-0440*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 101-23	SS 4	2.3 m to 2.9 m	Low to medium plasticity Clay

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
29.8	***16.9***	***12.9***

Additional information available upon request

Issued By: _____ *Date Issued:* *March 14, 2023*

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Grain Size Distribution Chart

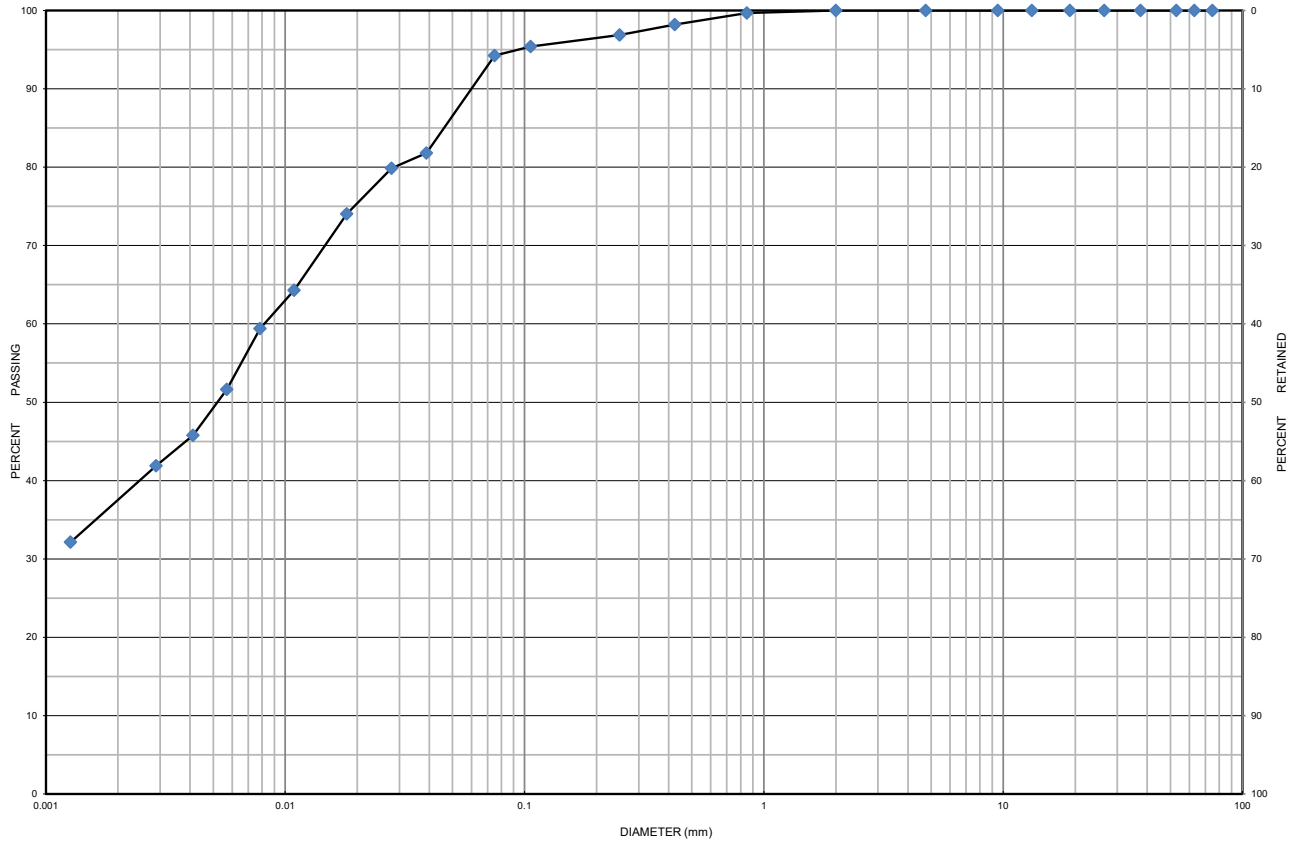
Project Number: *4161-005* **Client:** *Ministry of Natural Resources & Forestry*

Project Name: *Codrington Fisheries Facility – Proposed Building*

Sample Date: *March 1, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 102-23 SS 3B* **Depth:** *1.7 m to 2.1 m* **Lab Sample No:** *S-23-0441*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-23	SS 3B	1.7 m to 2.1 m	0	6	56	38	28.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clay and Silt, trace Sand	CL	0.008	-	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *March 14, 2023*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St. | Peterborough | ON | K9H 1E5

Moisture Content

Project Number: 4161-005
Project Name: Codrington Fisheries Facility – Proposed Building
Client: Ministry of Natural Resources & Forestry
Date Taken: 2023-03-01

Lab Number: S-23-0438
Date Tested: 2023-03-07
Tested By: D. Rock

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
101	1A	0.00-0.13	25.1	42.6	NR
101	1B	0.13-0.61	2.9	9.6	
101	2A	0.76-1.07	13.5	25.5	NR
101	2A	0.76-1.07	103.3	24.8	NR
101	2B	1.07-1.37	69.8	81.0	NR
101	3	1.52-2.13	17.2	229.3	6
101	4	2.29-2.90	191.6	27.4	NR
101	4	2.29-2.90	22.1	38.7	NR
101	5	3.05-3.66	23.4	43.7	
101	6	4.57-5.18	26.8	55.0	
101	7	6.10-6.71	29.0	49.2	
102	1A	0.00-0.13	23.8	111.2	6
102	1B	0.20-0.61	3.0	7.8	
102	2A	0.76-0.86	13.3	63.9	5
102	2B	0.86-1.37	6.8	178.9	6
102	3A	1.52-1.73	16.1	143.8	6
102	3B	1.73-2.13	73.7	28.0	NR
102	4	3.05-3.66	16.4	48.8	
102	5	4.57-5.18	23.2	53.3	
102	6	6.10-6.71	17.5	46.4	

1 – Contains organics
2 – Contains rubble
3 – Hydrocarbon Odour
4 – Unknown Chemical Odour
5 – Saturated – free water visible
6 – Very moist – near optimum moisture content
7 – Moist – below optimum moisture
8 – Dry – dry texture – powdery
9 – Very small – caution may not be representative
10 – Hold sample for gradation analysis

Appendix C

Seismic Hazard Calculations

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 44.147N 77.803W **User File Reference:** 15 Fish Hatchery Road, Codrington. ON 2023-03-21 19:07 UT

Requested by: Cambium Inc.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.138	0.076	0.046	0.015
Sa (0.1)	0.177	0.104	0.066	0.023
Sa (0.2)	0.160	0.099	0.065	0.024
Sa (0.3)	0.130	0.083	0.056	0.021
Sa (0.5)	0.102	0.066	0.045	0.017
Sa (1.0)	0.059	0.038	0.026	0.008
Sa (2.0)	0.030	0.019	0.012	0.003
Sa (5.0)	0.008	0.005	0.003	0.001
Sa (10.0)	0.003	0.002	0.001	0.000
PGA (g)	0.099	0.058	0.037	0.013
PGV (m/s)	0.085	0.052	0.034	0.010

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information