REVISED

Geotechnical Investigation – Slope Stability Analysis

150 Kanata Avenue & 1200 Canadian Shield Avenue,
Kanata, Ontario

Prepared for:

Bâtimo Developpement Inc.
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TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by Bâtimo Developpement Inc. (Client) to conduct a Slope Stability Analysis on the existing slope located adjacent to the northwest boundary of 150 Kanata Avenue & 1200 Canadian Shield Avenue, Kanata, Ontario (Site). The Site location is shown on Figure 1.

Based on information provided by the Client, it is Pinchin's understanding that the Site is proposed to be developed with a seven to nine storey residential/commercial building complete with a single level underground parking garage under the west portion of the Site (Phase I) and two levels of underground parking under the northeast portion of the Site (Phase II). It is noted that the northwest boundary of the Site is located adjacent to the base of an existing embankment and the Client is proposing to construct a retaining wall to support the existing embankment.

Pinchin's geotechnical comments and recommendations are based on the results of the Geotechnical Investigation and our understanding of the project scope.

The purpose of the Geotechnical Investigation was to delineate the subsurface conditions and soil engineering characteristics by advancing a total of two (2) boreholes (Boreholes BH201 and BH202), at the Site.

It is noted that Pinchin previously completed a Geotechnical Investigation for the proposed development at the Site, and the information obtained during the previous investigation will be utilized to aid in the completion of the Slope Stability Analysis:

- "Revision 3, Geotechnical Investigation – Proposed Mixed-Use Development, 150 Kanata Avenue & 1200 Canadian Shield Avenue, Kanata, Ontario", dated March 9, 2023, Pinchin File:290435.001 (Pinchin 2023 Report).

Abbreviations, terminology, and principal symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

2.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is located on the northwest corner of the intersection of Kanata Avenue and Maritime Way, approximately 300 metres northwest of Highway 417 in Ottawa, Ontario. The Site is currently undeveloped and consists of a heavily forested area with a combination of mature trees and wild undergrowth. The Site topography varies and typically slopes down from north to south, with a low-lying area located on the southeast corner of the Site that is upwards of 5 to 6 m below the existing street level, at its deepest point. The lands adjacent to the Site are either undeveloped or developed with a combination of multi unit residential buildings and commercial retail buildings.

Data obtained from the Ontario Geological Survey Maps, as published by the Ontario Ministry of Natural Resources, indicates that the majority of the Site is located on Precambrian bedrock, with the exception of the southeast corner of the Site which is located on an organic deposit consisting of peat, much, and marl (Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV). The underlying bedrock at this Site is of the Grenville Supergroup and Flinton Group consisting of classic metasedimentary rocks, conglomerate, wacke, quartz arenite, arkose, limestone, siltstone, chert, minor iron formation, and minor metavolcanic rocks (Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1).

3.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed a field investigation at the Site on February 13, 2023, by advancing a total of two (2) boreholes (Boreholes BH201 and BH202). Borehole BH201 was advanced at the approximate top of the slope to a sampled depth of approximately 2.3 metres below existing ground surface (mbgs) where refusal was encountered on probable bedrock. Borehole BH202 was advanced at the approximate northwest property boundary and consisted of a Dynamic Cone Penetration Test (DCPT) which was advanced to a depth of approximately 2.9 mbgs where refusal was encountered on probable bedrock. The approximate spatial locations of the boreholes advanced at the Site are shown on Figure 2.

The boreholes were advanced with the use of a CME55 track mounted drill rig which was equipped with standard soil sampling equipment. Soil samples were collected from within Borehole BH201 at 0.75 m intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) “N” values (ASTM D1586). The SPT “N” values were used to assess the compactness condition of the non-cohesive soil. It is noted that no soil samples were obtained from Borehole BH202 as it was advanced only to determine the depth to bedrock at the approximate northwest property boundary.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling and are included on the appended borehole logs.

The borehole locations were located at the Site by Pinchin personnel. The approximate geodetic ground surface elevation at each borehole location was referenced to the nearest survey point from the following topographic survey which was provided by the Client:

- “Sketch Showing Existing Elevations – 150 Kanata Avenue, City of Ottawa”, prepared by Annis, O’Sullivan, Vollebekk Ltd., Project No. 23844-23, field work completed April 14, 2023.

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to an independent and accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

Select soil samples collected from the boreholes were submitted to a material testing laboratory to determine the grain size distribution of the soil. A copy of the laboratory analytical reports is included in Appendix III. In addition, the collected samples were compared against previous geotechnical information from the area, for consistency and calibration of results.

4.0 SUBSURFACE CONDITIONS

4.1 Borehole Soil Stratigraphy

In general, the soil stratigraphy encountered within the boreholes comprises surficial organics overlying glacial till and probable bedrock to the maximum borehole refusal depth of approximately 2.9 mbgs. The appended borehole logs provide detailed soil descriptions and stratigraphies, results of SPT and DCPT testing, and groundwater measurements.

Surficial organics were encountered in Borehole BH201 and were measured to be approximately 100 mm thick. It is noted that the surficial organics at the location of Borehole BH202 were previously stripped during the tree clearing operation.

The glacial till was encountered underlying the surficial organics within Borehole BH201 and at the surface within Borehole BH202. The glacial till material consisted of silt and sand containing trace to some clay and trace gravel. The non-cohesive glacial till had a loose to compact relative density based on SPT ‘N’ values of 7 to 24 blows per 300 mm penetration of a split spoon sampler. The results of two particle size distribution analyses completed on samples of the glacial till indicate that the samples contained approximately 1 to 6% gravel, 48 to 51% sand, 35 to 38% silt, and 8 to 13% clay sized particles. The moisture content of the material tested was 18.7%, indicating the material was in a moist condition at the time of sampling.

4.2 Bedrock

Refusal was encountered on probable bedrock in each borehole between approximately 2.3 and 2.9 mbgs. It is noted that no bedrock cores were advanced during the current investigation to confirm the presence of bedrock or to evaluate the Rock Quality Designation (RQD); however, bedrock was confirmed via rock coring within Boreholes BH4 and BH6, as well as Rock Probes RP1 and RP9, which were advanced for the Pinchin 2023 Report. It is noted that Borehole BH6 was advanced at the approximate bottom of the existing slope; as such, the information obtained from this borehole was used to aid in completing the slope stability analysis. The bedrock core recovered from within Borehole BH6 consisted of an upper layer of sandstone bedrock overlying granitic bedrock. A copy of the borehole log for Borehole BH6 is included in Appendix II.

Based on the information obtained from within Boreholes BH201, BH202, and BH6 Pinchin has assumed that bedrock will be located between approximate geodetic elevations 100.5 and 101.0 metres above sea level (masl) within the vicinity of the proposed retaining wall.

4.3 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. At drilling completion, groundwater was not encountered within the boreholes advanced. During the Pinchin 2022 Report groundwater was measured to be located between approximate geodetic elevations 93.1 and 94.1 masl.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.

5.0 RETAINING WALL DESIGN

5.1 Discussion

As previously mentioned, a retaining wall will be constructed to support the existing embankment located northwest of the Site. The retaining wall will be located adjacent to the north side of the entrance driveway on the northwest portion of the Site, approximately 7.0 m south of the property boundary. The following drawing was provided to allow Pinchin to provide the retaining wall recommendations:

- "Site Grading and Drainage Plan - Phase 1", prepared by Equip Laurence, drawing number C-203A, issued for site plan application revision 10 June 14, 2023, project number 600401 (Site Grading Plan).

The Site Grading Plan indicates that the proposed retaining wall will consist of a Redi Rock wall system ranging in height from approximately 0.5 to 1.7 m. The proposed geodetic elevation for the top of the wall ranges from 101.0 to 102.5 masl, while the proposed geodetic elevation for the grade level at the bottom of the wall ranges from 100.5 to 100.8 masl. As such, the proposed retaining wall will be founded on the underlying bedrock surface which is anticipated to be located between approximately 100.5 and 101.0 masl within the vicinity of the proposed retaining wall. Pinchin notes that in order to meet the proposed finished grades, a portion of the bedrock may need to be removed. Recommendations for bedrock removal are included in the Pinchin 2023 Report.

It is noted that Pinchin did not advance boreholes within the proposed retaining wall footprint; as such, the following design recommendations have been based on the information obtained from the boreholes advanced within the vicinity of the proposed retaining wall. Pinchin recommends that the subsurface conditions at the proposed retaining wall location be reviewed during the construction of the retaining wall to confirm the below provided recommendations. In addition, all other relevant geotechnical design recommendations provided in the Pinchin 2023 Report are to be followed.

5.2 Retaining Wall Bearing on Bedrock

For retaining walls established on lean mix concrete overlying weathered bedrock, a factored geotechnical bearing resistance of 500 kPa at Ultimate Limit States (ULS) may be used for design purposes.

Prior to installing foundation formwork, the bedrock is to be reviewed by a geotechnical engineer. Serviceability Limit States (SLS) does not apply when bearing directly on bedrock, since the loads required for unacceptable settlements to occur would be much larger than the factored ULS and would be limited to the elastic compression of the bedrock and concrete.

The bearing resistance of 500 kPa (weathered bedrock) assumes the bedrock is cleaned of all overburden material and any loose rock pieces. The bedrock should be cleaned with air or water pressure exposing clean sound bedrock. If construction proceeds during freezing weather conditions water should not be allowed to pool and freeze in bedrock depressions. All concrete should be installed and maintained above freezing temperatures as required by the concrete supplier.

The bedrock is to be relatively level with slopes not exceeding 10 degrees from the horizontal. Where the bedrock slope exceeds 10 degrees from the horizontal and does not exceed 25 degrees from the horizontal, shear dowels can be incorporated into the design to resist sliding. Where rock slopes are steeper, the bedrock is to be levelled and stepped as required. The change in vertical height will be a function of the rock quality at the proposed foundation location and will need to be determined at the time of construction.

As an alternative to levelling the bedrock, where the bedrock surface is irregular and jagged, it may be more practical to provide a level benching over these areas by pouring lean mix concrete (minimum 10 MPa) prior to placing the modular blocks. A small layer (i.e., 25 to 50 mm) of gravel base material may be required atop the lean mix to aid in setting the blocks in place.

5.3 Estimated Settlement

The retaining wall should be founded on lean mix concrete overlying bedrock, reviewed, and approved by a licensed geotechnical engineering consultant.

Provided the retaining wall is installed in accordance with the recommendations outlined in the preceding sections, settlements are not expected to exceed 25 mm (total settlement) and 19 mm (differential settlement).

5.4 Retaining Wall Drainage and Backfill

To assist in maximizing the service life of the retaining wall, it is recommended that grades at the bottom of the wall be sloped away at a 2% gradient or more, for a distance of at least 2.0 m. In addition, it is recommended to install a drain at the base of the retaining wall backfill material in order to allow for any potential collected water to drain from behind the wall.

The retaining wall drain should consist of a minimum 150 mm diameter fabric wrapped perforated drainage tile surrounded by OPSS 1010 19 mm diameter clear stone with a minimum cover of 150 mm on the top and sides and 50 mm below the drainage tile. The clear stone gravel should be wrapped in a non-woven geotextile (Terrafix 270R or equivalent). The water collected from the weeping tile should be directed through gravity flow to the ends of the retaining wall.

Pinchin recommends that the retaining wall be backfilled with imported OPSS 1010 Granular 'B' Type I material, extending a minimum lateral distance of 600 mm from the edge of the retaining wall. It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure compaction requirements are achieved.

5.5 Lateral Earth Pressure Coefficients and Unit Densities

The retaining wall must also be designed to resist lateral earth pressure. For calculating the lateral earth pressure, the following unfactored strength properties for the in-situ glacial till and imported engineered fill are provided:

Material Type	Effective Friction Angle ø'	Unit Weight γ kN/m^3	Coefficient of At Rest Earth Pressure (k_o)	Coefficient of Active Earth Pressure (k_a)	Coefficient of Passive Earth Pressure (k_p)
Glacial Till	32°	20.0	0.44	0.28	3.54
Granular "B" Type I (OPSS 1010)	32º	21.0	0.47	0.31	3.25

6.0 SLOPE STABILITY ASSESSMENT

6.1 General

The following subsections contain a discussion of Pinchin's Slope Stability Analysis in accordance with the Ministry of Natural Resources and Forestry (MNR) Guidelines. The slope stability analysis was completed for both the existing conditions as well as the proposed conditions. One representative slope cross section (cross section A-A') was analyzed for each condition, through the highest and steepest portion of the embankment. The locations of the slope cross sections are illustrated on Figures 2 (existing conditions) and 4 (proposed conditions). A simplified cross-section of the soil stratigraphy for both the existing conditions and proposed conditions are shown on Figures 3 and 5, respectively.

The elevations of the cross sections are based on a combination of the ground surface elevations obtained by Pinchin personnel during the geotechnical field investigation, and the proposed elevations noted on the Site Grading Plan.

Based on a review of the Site Grading Plan the existing elevation for the northwest property boundary will remain unchanged at geodetic elevation 104.30 masl. The proposed finished grade slopes down from the property boundary to the top of the proposed retaining wall at approximately 4 Horizontal to 1 Vertical (H to V) with the elevation of the top of the retaining wall ranging from 101.0 to 102.5 masl.

The retaining wall will be located at the north edge of the entrance driveway, approximately 7.0 m from the property boundary, and the northwest corner of the proposed building will be located approximately

13.0 m from the property boundary. It is noted that the underside of the footings for the proposed parking garage level on the west portion of the Site will be founded on the underlying bedrock surface.

6.2 Slope Inspection

Visual inspections of the slope were conducted on April 14, 2022 (prior to clearing operations) and February 16, 2023 (upon completion of clearing operations). The inspections involved walking the slope as well as making general observations of the existing surficial conditions at the Site. It is noted that at the time of the February 2023 inspection, the majority of the proposed development area had been cleared of all trees and stripped of all organics.

The slope inclination from the top of the slope to the northwest property boundary is approximately 5H to 1V. The existing slope inclination from the northwest property boundary to the bottom of the slope is approximately 4H to 1V.

The slope embankment which extends beyond the Site boundary is heavily vegetated with mature trees and wild undergrowth noted throughout. The slope was dry at the time of the April 2022 assessment with little to no areas of active erosion observed; however, was partially snow covered at the time of the February 2023 assessment. It is noted that no visible signs of soil slumping, bulging, tension cracks or leaning trees on the face of the slope were observed and it is likely that the slope has not experienced any past slope movements.

The ground surface elevations along the slope embankment were reviewed in conjunction with the results of the slope inspection to determine a Slope Stability Rating in accordance with the Ontario Ministry of Natural Resources (MNR) Ratings Chart. Based on the results of that analysis, the embankment would be considered to have low potential for instability.

6.3 Slope Stability Analysis

The information obtained from Boreholes BH201, BH202 and BH6, as well as the existing and proposed slope cross sections A – A’ were used for the slope stability analysis. The slope analysis was modelled using Slope/W program part of the Geo-Studio 2021 software package. The soil parameters used in the analysis have been estimated based on the results of the field and laboratory testing and are as follows:

Soil Type	Angle of Internal Friction (degrees)	Unit Weight (kN/m^3)	Cohesion (kPa)
Glacial Till	32	20	0

The slope stability analysis was carried out for a number of potential failure modes. The various failures analyzed include shallow transitional type failures of the residual soil, medium depth rotational failures at the bottom and top of the slope, and deep rotational failures through the entire height of the slope.

The recommended factor of safety for the active land-use category (i.e., habitable, or occupied structures near slope; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances) as defined by the MNR guidelines is 1.3 to 1.5. Pinchin recommends the use of a factor of safety of 1.5 for the proposed development.

The results of the analysis indicate that the cross-section profiles have factors of safety against slope failure of 2.47 (existing) and 2.21 (proposed). The factors of safety are closely related to the shallowness of the slope, strength of the soil, and absence of groundwater. The results of the slope stability analysis are included on Figures 3 (existing) and 5 (proposed).

6.4 Conclusion and Recommendations

Based on our analysis, the proposed slope inclination will maintain a factor of safety of greater than 1.5 after completion of the development and construction of the retaining wall.

It is noted that a portion of the slope embankment is currently being utilized as a downhill mountain bike course with various jumps and berms constructed on the embankment itself. Pinchin recommends that these jumps and berms be removed during the development of the Site to prevent any safety hazards associated with biking from the slope onto the proposed development Site. Once the jumps and berms are removed, the vegetation cover should be re-established to limit surface erosion and associated shallow seated failures. This can be done by hydro-seeding and/or applying erosion matting as well as planting of shrubs and trees. The vegetation root system will reinforce the soils within the slope and further reduce soil moisture. It is recommended that the City of Ottawa retain the Client to complete the minor slope rehabilitation while they are already mobilized to the Site, as costs to complete the work after development is completed would be significantly higher.

Any sloped areas which are disturbed during construction should be restored with suitable native vegetation. **Periodic inspections of the slope are recommended throughout the construction process to ensure the slope stability is maintained; this is especially critical during the construction of the proposed retaining wall**. If slope instability is observed the slope should be remediated as soon as practically possible to its original configuration. Slope configurations should not be altered without the guidance of a qualified geotechnical engineer. In particular, the slope should not be steepened beyond the proposed inclination, and fill materials should not be placed on the slope at any time during the construction process.

7.0 TERMS AND LIMITATIONS

This Geotechnical Investigation was performed for the exclusive use of Bâtimo Developpement Inc. (Client) in order to evaluate the subsurface conditions at 150 Kanata Avenue & 1200 Canadian Shield Avenue, Kanata, Ontario. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the

Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

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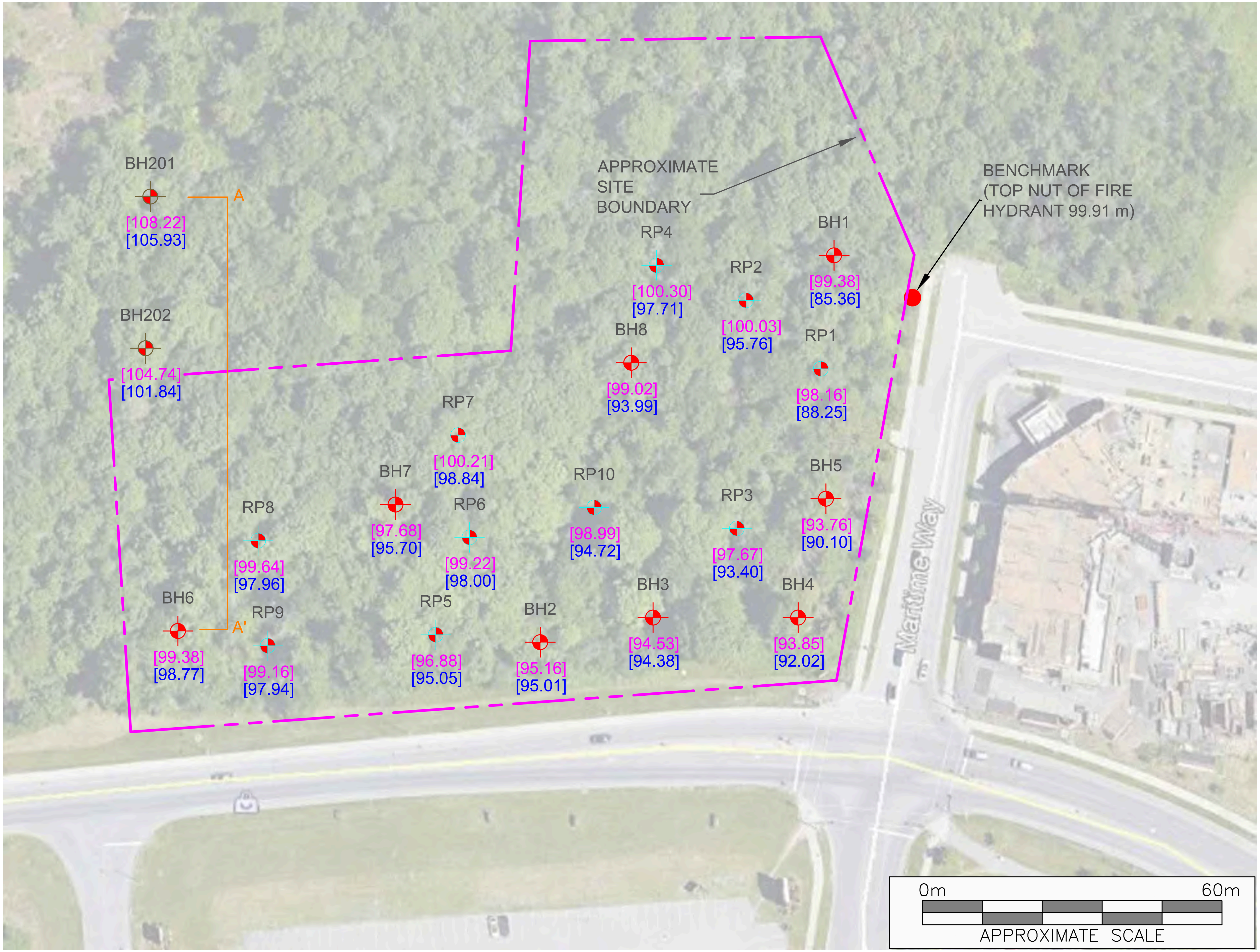
Template: Master Geotechnical Investigation Report – Ontario, GEO, September 2, 2021

FIGURES

PINCHIN

PROJECT NAME	GEOTECHNICAL INVESTIGATION - SLOPE STABILITY ANALYSIS
CLIENT NAME	BATIMO DEVELOPPEMENT INC.
PROJECT LOCATION	150 KANATA AVENUE & 1200 CANADIAN SHIELD AVENUE, OTTAWA, ONTARIO
FIGURE NAME	KEY MAP
FIGURE NO.	1
APPROXIMATE SCALE	AS SHOWN
PROJECT NO.	290435.003
DATE	JUNE 2023



LEGEND

⊕	BOREHOLE LOCATION (PINCHIN 2023 REPORT)
⊕	BEDROCK PROBE LOCATION (PINCHIN 2023 REPORT)
⊕	BOREHOLE LOCATION (SLOPE STABILITY ANALYSIS)
[XX.XX]	GROUND SURFACE ELEVATION (m)
[XX.XX]	BOREHOLE REFUSAL ELEVATION (m)
m	METRES
A A'	CROSS SECTION

PINCHIN

PROJECT NAME
GEOTECHNICAL INVESTIGATION - SLOPE STABILITY ANALYSIS

CLIENT NAME
BATIMO DEVELOPPEMENT INC.

PROJECT LOCATION
150 KANATA AVENUE & 1200 CANADIAN SHIELD AVENUE, OTTAWA, ONTARIO

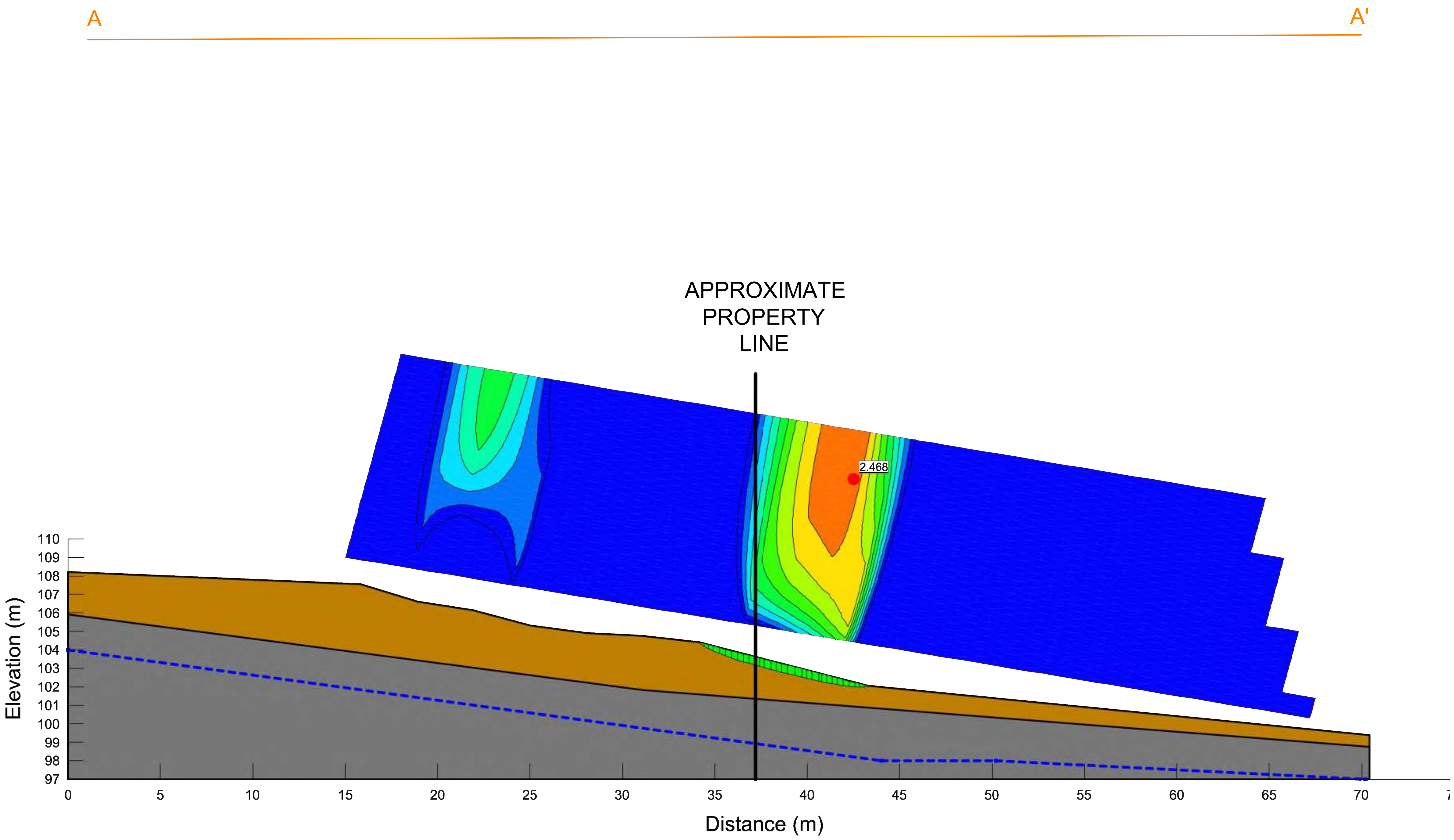
FIGURE NAME
BOREHOLE LOCATION PLAN

APPROXIMATE SCALE
AS SHOWN

PROJECT NO.
290435.003

DATE
JUNE 2023

FIGURE NO.
2



Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
⬛	Bedrock	Bedrock (Impenetrable)				1
🟫	Glacial Till - Sand & Silt	Mohr-Coulomb	20	0	32	

LEGEND

A A'	CROSS SECTION
m	METRES

PINCHIN

PROJECT NAME
GEOTECHNICAL INVESTIGATION - SLOPE STABILITY ANALYSIS

CLIENT NAME
BATIMO DEVELOPPEMENT INC.

PROJECT LOCATION
150 KANATA AVENUE & 1200 CANADIAN SHIELD AVENUE, OTTAWA, ONTARIO

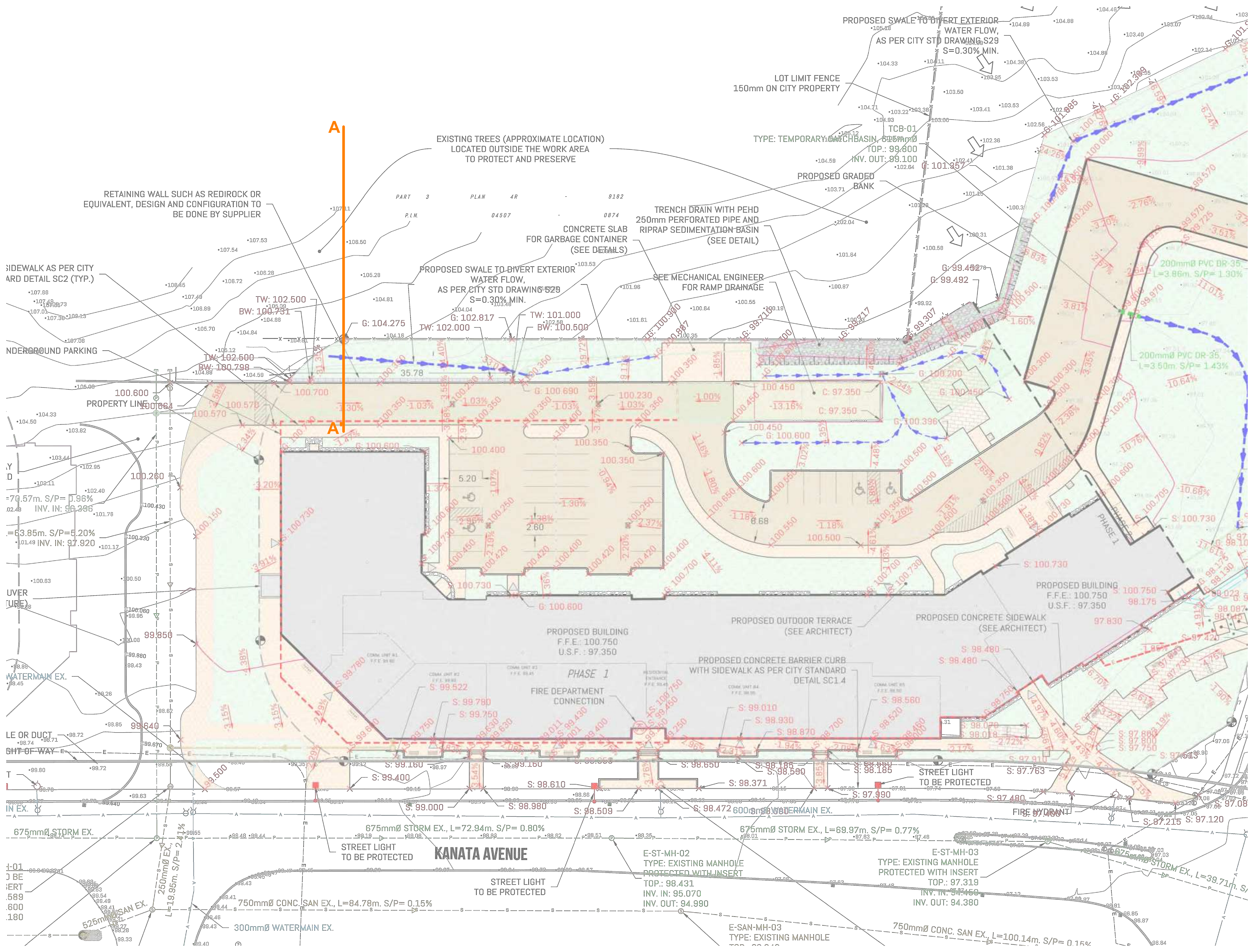
FIGURE NAME
EXISTING CROSS SECTION DETAILS
A - A'

APPROXIMATE SCALE
AS SHOWN

PROJECT NO.
290435.003

DATE
JUNE 2023

FIGURE NO.
3



LEGEND

A — A' CROSS SECTION

PINCHIN

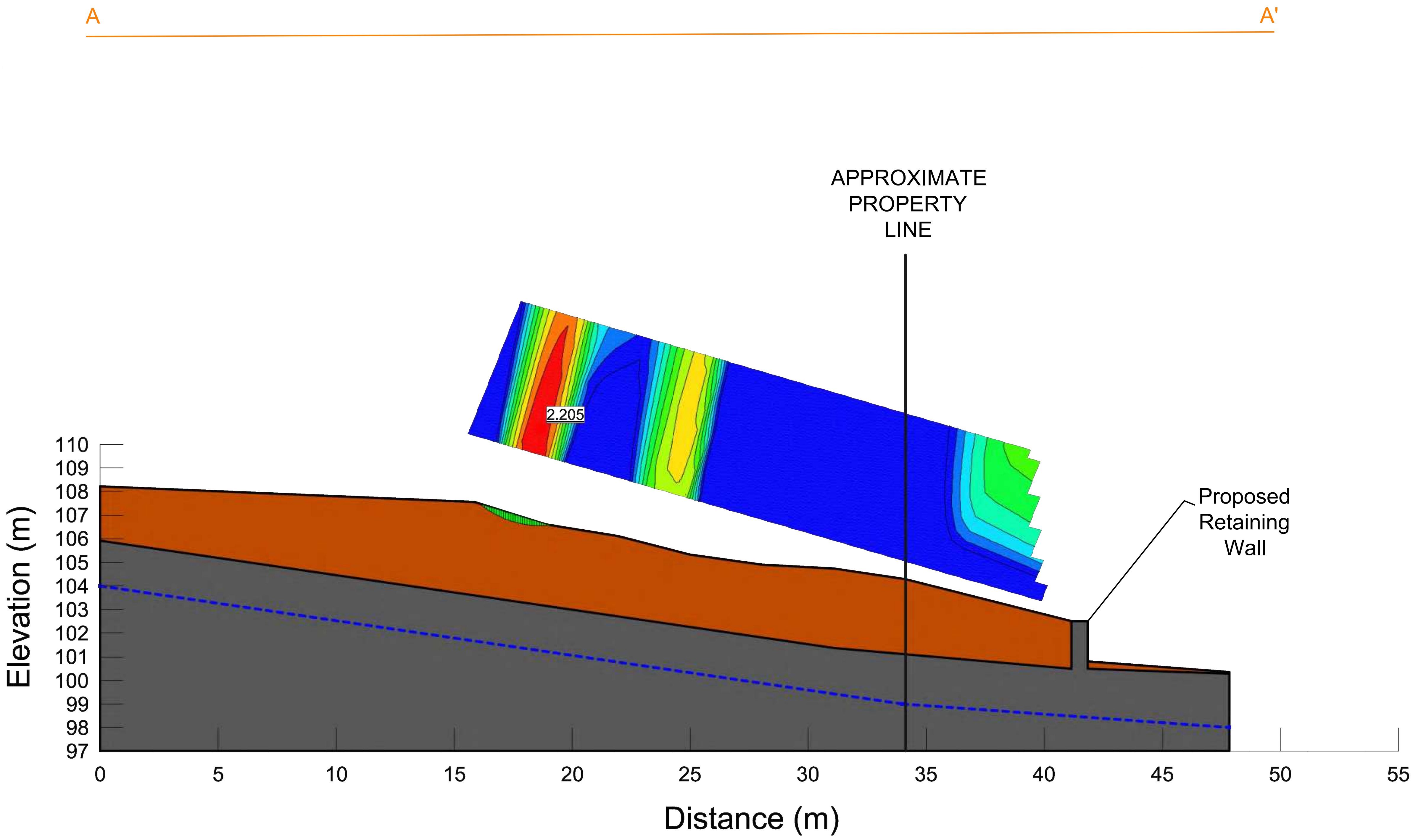
PROJECT NAME
GEOTECHNICAL INVESTIGATION - SLOPE STABILITY ANALYSIS

CLIENT NAME
BATIMO DEVELOPPEMENT INC.

PROJECT LOCATION
150 KANATA AVENUE & 1200 CANADIAN SHIELD AVENUE, OTTAWA, ONTARIO

FIGURE NAME
PROPOSED SITE GRADING PLAN AND CROSS SECTION A - A' LOCATION

APPROXIMATE SCALE	PROJECT NO.
AS SHOWN	290435.003
DATE	FIGURE NO.
JUNE 2023	4



Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
⬛	Bedrock	Bedrock (Impenetrable)				1
🟫	Glacial Till	Mohr-Coulomb	20	0	32	1

LEGEND

A A' CROSS SECTION

m METRES

PINCHIN

PROJECT NAME
GEOTECHNICAL INVESTIGATION - SLOPE STABILITY ANALYSIS

CLIENT NAME
BATIMO DEVELOPPEMENT INC.

PROJECT LOCATION
150 KANATA AVENUE & 1200 CANADIAN SHIELD AVENUE, OTTAWA, ONTARIO

FIGURE NAME
PROPOSED CROSS SECTION DETAILS
A - A'

APPROXIMATE SCALE
AS SHOWN

PROJECT NO.
290435.003

DATE
JUNE 2023

FIGURE NO.
5

APPENDIX I

Abbreviations, Terminology and Principal Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), "N" value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil

Consistency	Undrained Shear Strength (kPa)	SPT N-Index (blows per 300 mm)
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W	Natural water content or moisture content within soil sample
γ	Unit weight
γ'	Effective unit weight
γ_d	Dry unit weight
γ_{sat}	Saturated unit weight
ρ	Density
ρ_s	Density of solid particles
ρ_w	Density of Water
ρ_d	Dry density
ρ_{sat}	Saturated density e Void ratio
n	Porosity
S_r	Degree of saturation
E_{50}	Strain at 50% maximum stress (cohesive soil)

Consistency

W_L	Liquid limit
W_P	Plastic Limit
I_P	Plasticity Index
W_S	Shrinkage Limit
I_L	Liquidity Index
I_C	Consistency Index
e_{max}	Void ratio in loosest state
e_{min}	Void ratio in densest state
I_D	Density Index (formerly relative density)

Shear Strength

C_u, S_u	Undrained shear strength parameter (total stress)
C'_d	Drained shear strength parameter (effective stress)
r	Remolded shear strength
τ_p	Peak residual shear strength
τ_r	Residual shear strength
ø’	Angle of interface friction, coefficient of friction = tan ø’

Consolidation (One Dimensional)

C_C	Compression index (normally consolidated range)
C_r	Recompression index (over consolidated range)
C_S	Swelling index
m_V	Coefficient of volume change
c_V	Coefficient of consolidation
T_V	Time factor (vertical direction)
U	Degree of consolidation
σ'_o	Overburden pressure
σ'_p	Preconsolidation pressure (most probable)
OCR	Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates**:**

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
> 10^{-1}	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
>10^{-7}	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum**.**

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm x } 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	**<25**
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX II

Pinchin's Borehole Logs

Log of Borehole: BH201

Project #: Geotechnical Investigation **Logged By:** MK

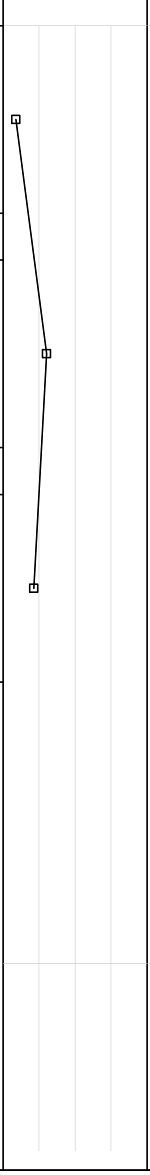
Project: 290435.003

Client: Batimo Developpment Inc.

Location: 150 Kanata Ave. & 1200 Canadian Shield Ave., Kanata, Ontario

Drill Date: February 13, 2023 **Project Manager:** WT

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value 20 40 60	Shear Strength kPa 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
		Ground Surface	108.22											
0		**Organics** ~ 100 mm, frozen												
		Glacial Till Silt and sand, some clay, trace gravel, brown, loose to compact, damp to moist			SS	1	30	7						
1					SS	2	20	24						
					SS	3	70	17						G.S.
2			105.93								18.7			Hyd.
		End of Borehole Borehole terminated at 2.3 mbgs due to auger refusal on probable bedrock. At drilling completion, groundwater was not encountered.												
3														



Contractor: Canadian Environmental Drilling & Contractors Ltd. **Grade Elevation:** 108.22 m

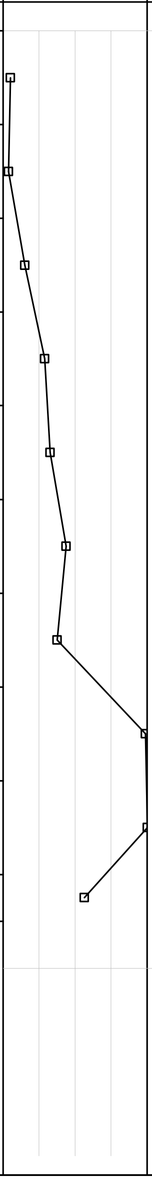
Drilling Method: Hollow Stem Auger/ Split Spoon Sample **Top of Casing Elevation:** N/A

Well Casing Size: N/A **Sheet:** 1 of 1

Log of Borehole: BH202

Project #: Geotechnical Investigation
Logged By: MK
Project: 290435.003
Client: Batimo Developpment Inc.
Location: 150 Kanata Ave. & 1200 Canadian Shield Ave., Kanata, Ontario
Drill Date: February 13, 2023
Project Manager: WT

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value □ 20 40 60 □	Shear Strength △ kPa △ 100 200	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
		Ground Surface	104.74											
0		**Dynamic Cone Penetration Test (DCPT)** Probable glacial till			SS	1	NA	4						
					SS	2	NA	3						
					SS	3	NA	12						
1					SS	4	NA	23						
					SS	5	NA	26						
					SS	6	NA	35						
2					SS	7	NA	30						
					SS	8	NA	79						
					SS	9	NA	80						
			101.84		SS	10	NA	45						
3		End of Borehole Borehole terminated at 2.9 mbgs due to spoon refusal on probable bedrock.												



Contractor: Canadian Environmental Drilling & Contractors Ltd.
Grade Elevation: 104.74 m
Drilling Method: Cone
Top of Casing Elevation: N/A
Well Casing Size: N/A
Sheet: 1 of 1

Log of Borehole: BH6

Project #: 290435.001 **Logged By:** WT

Project: Geotechnical Investigation

Client: Bâtimo Developpement Inc.

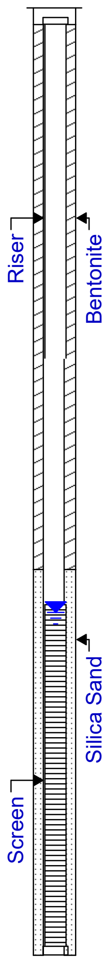
Location: 150 Kanata Ave & 1200 Canadian Shield Ave, Kanata, Ontario

Drill Date: May 18, 2021 **Project Manager:** WT

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
	Ground Surface	99.38
0	**Organics** Black organics, loose, wet	99.08
	Sand Brown sand, trace gravel, trace silt, loose, damp	98.77
1–8	**Bedrock** Limestone bedrock	
		91.15
	End of Borehole Borehole terminated at 4.9 mbgs.	

Monitoring Well Details



Groundwater level = 5.25 mbgs, as measured on June 18, 2021.

SAMPLE

Sample Type	Sampler #	Recovery (%)	SPT N-values	SPT N-values / Shear Strength kPa	Lab Analysis	Moisture (%)	Plasticity Index
SS	1	60	9				
RC	2	100	N/A				37
RC	3	100	N/A				63
RC	4	100	N/A				19
RC	5	100	N/A				13
RC	6	100	N/A				0

SPT N-values: 20 40 60

Shear Strength kPa: 50 100 150 200

Contractor: Strata Drilling Group **Grade Elevation:** 99.38 m

Drilling Method: Hollow Stem Augers / Split Spoon / Diamond Bit **Top of Casing Elevation:** 100.28 m

Well Casing Size: N/A **Sheet:** 1 of 1

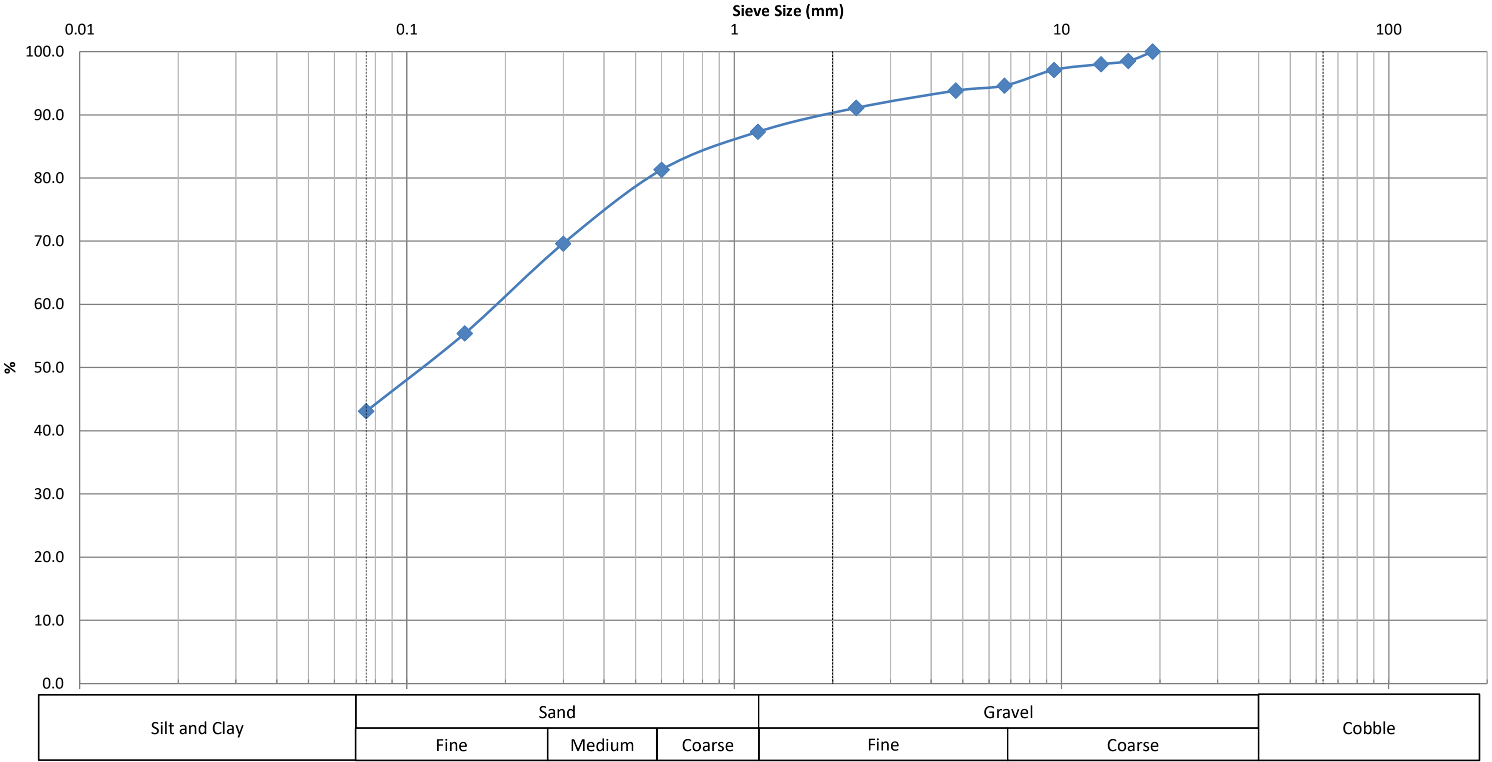
APPENDIX III

Laboratory Testing Reports for Soil Samples

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DESCRIPTION:	Silty Sand	FILE NO:	PM4184
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	41838
PROJECT:	290435.003	INTENDED USE:	-	DATE RECEIVED:	14-Feb-23
		PIT OR QUARRY:	-	DATE TESTED:	16-Feb-23
DATE SAMPLED:	13-Feb-23	SOURCE LOCATION:	BH201	DATE REPORTED:	28-Feb-23
SAMPLED BY:	Client	SAMPLE LOCATION:	5' - 7'	TESTED BY:	CP



Identification	**Soil Classification**					**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
										0.43	19.5
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	19	0.195	0.029	0.01	6.2	50.7		43.1			

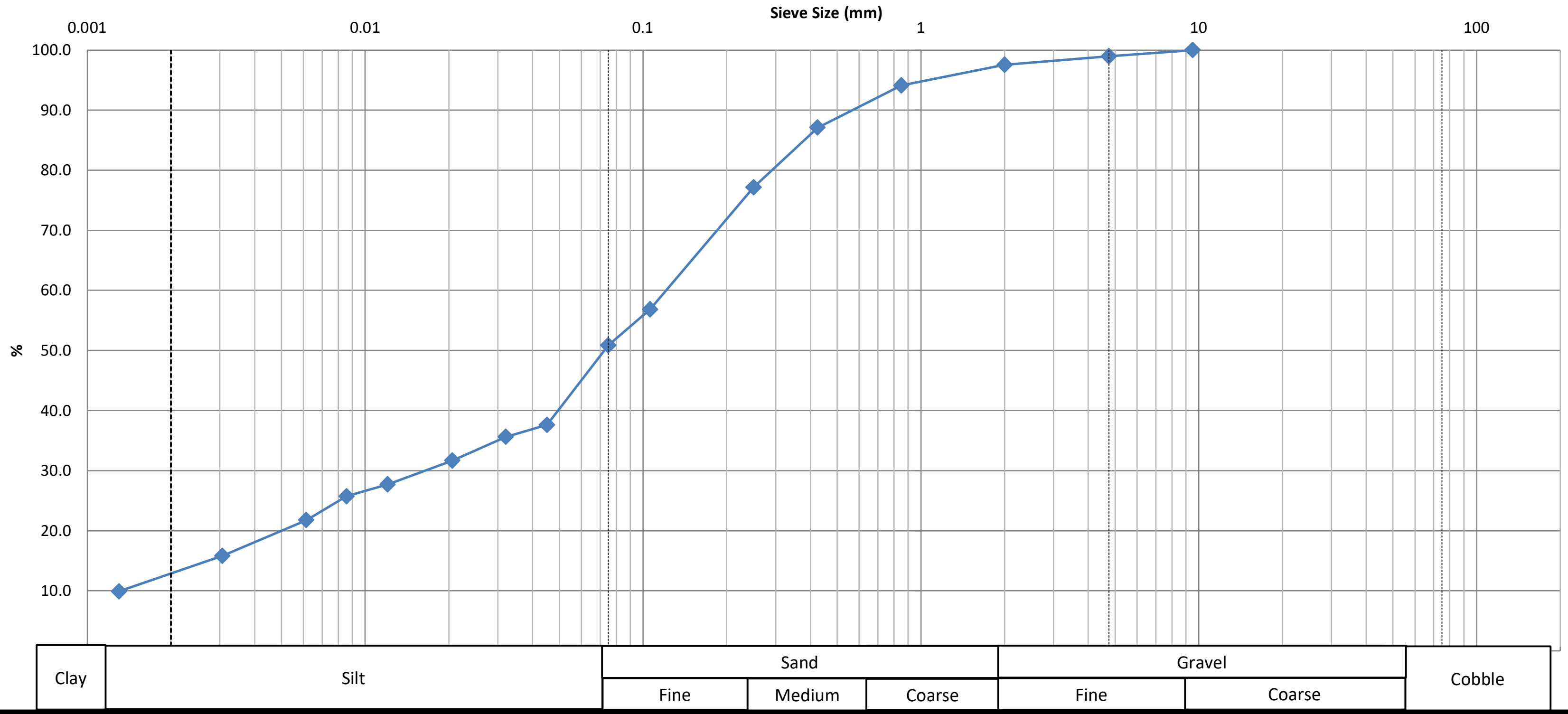
Comments:

REVIEWED BY:	**Curtis Beadow**	**Joe Fosyth, P. Eng.**

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Pinchin	DEPTH:	7.5'	FILE NO:	PM4184
CONTRACT NO.:		BH OR TP No.:	BH201	LAB NO:	41837
PROJECT:	290435.003			DATE RECEIVED:	14-Feb-23
				DATE TESTED:	23-Feb-23
DATE SAMPLED:	13-Feb-23			DATE REPORTED:	28-Feb-23
SAMPLED BY:	Client			TESTED BY:	CP/CS



Identification	**Soil Classification**	**MC(%)**	**LL**	**PL**	**PI**	**Cc**	**Cu**
		18.7					

D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
				1.0	48.1	37.9	13.0

Comments:

REVIEWED BY:

Curtis Beadow

Joe Forsyth, P. Eng.

APPENDIX IV

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in accordance with our recommendations.   Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any ‘other’ activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor’s responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all ‘other’ acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.