Geotechnical Investigation

Proposed Mixed-Use Development

Wateridge Village – Block 12
Ottawa, Ontario

Prepared for Mattamy Homes

Report PG6688-1 dated June 8, 2026

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Mattamy Homes to conduct a geotechnical investigation for the subject site, referred to as Block 12, to be located within the Wateridge Village development in the City of Ottawa (refer to Figure 1 – Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

☐ Determine the subsoil and groundwater conditions at this site by means of boreholes.

☐ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Based on the available concept plan, it is understood that the proposed development will consist of a multi-storey mixed-use residential and commercial building located within the northern portion of the site and a back-to-back townhouse block within the southeast corner of the site. The proposed buildings will either consist of slab-on-grade construction or will have up to a single-basement-level.

The remainder of the site will generally be occupied by asphalt paved parking areas. Walkways and landscaped areas are also anticipated for the development. It is anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was conducted on May 25 and 26, 2023, and consisted of advancing 11 boreholes to a maximum depth of 6.0 m below the existing ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site taking into consideration site features and underground utilities. The test hole locations are presented on Drawing PG6688-1 – Test Hole Location Plan included in Appendix 2 of this report.

The boreholes were completed with a low clearance, track-mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The test hole procedure consisted of augering and rock coring to the required depths at the selected locations, and sampling and testing the overburden and bedrock.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. Rock cores (RC) were obtained using 47.6 mm inside diameter coring equipment.

All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and rock cores were placed in cardboard boxes. All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split spoon and rock core samples were recovered from the boreholes are shown as AU, SS and RC, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Rock samples were recovered using a core barrel and diamond drilling techniques. The bedrock samples were classified on site, placed in hard cardboard core boxes and transported to Paterson's laboratory. The depths at which rock core samples were recovered from the boreholes are presented as RC on the Soil Profile and Test Data sheets in Appendix 1.

The recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are presented on the borehole logs. The recovery value is the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the total length of intact rock pieces longer than 100 mm over the length of the core run. The values indicate the bedrock quality. The subsurface conditions observed at the test pits were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Each borehole was fitted with a flexible polyethylene standpipe to allow for groundwater level monitoring. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1 of this report.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the subject site. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision, handheld GPS and referenced to a geodetic datum. The location of the boreholes is presented on Drawing PG6688-1 – Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

It should be noted that a thin veneer of silty clay was encountered at one borehole location from the field investigation, thereby yielding only one sample of silty clay from the subject site. Laboratory testing was conducted in accordance with the City of Ottawa's *Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines*. However, the laboratory testing was limited to the recovered sample of silty clay.

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of one (1) shrinkage test, one (1) grain size distribution analysis, and one (1) Atterberg limit test were completed on the select soil sample. Moisture content testing was completed on all recovered soil samples.

The results are presented in Subsection 4.2 and on Grain Size Distribution and Hydrometer Testing, and Atterberg Limit Results and Shrinkage Test Results presented in Appendix 1.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site was part of the lots acquired by the Department of National Defense in the 1890's and used as a military base known as CFB Rockcliffe until the early 2010's.

The majority of the subject site was previously occupied by parking and landscaped areas with scattered mature trees and grass covered surfaces. A portion of a previously existing building was located within the northeast corner of the site. Reference should be made to Figure 2 – Aerial Photograph – 2002. The aforementioned building was demolished by 2005, refer to Figure 3 – Aerial Photograph – 2005. More recently, as part of the construction of the overall Wateridge development, portions of the subject site have been used as staging areas. Reference should be made to Figure 4 – Aerial Photograph – 2022.

The site is generally bordered by Tawadina Road to the north, by Bareille-Snow Street to the east and by future residential development areas to the south and west. The ground surface across the subject site generally slopes down from northeast to southwest with a geodetic elevation of 88.5 to 89.5 m and is at-grade with the adjacent roadways and properties.

4.2 Subsurface Profile

Overburden

Generally, the subsurface soil profile encountered at the test hole locations consists of an approximate 0.3 to 1.1 m thickness of fill material underlain by a layer of silty and/or glacial till. The fill material was generally observed to consist of brown silty clay with sand, gravel and crushed stone.

A layer of loose to dense, brown silty sand was encountered underlying the fill material in all boreholes and extended to approximate depths of 0.7 to 2.2 m below the existing ground surface.

An approximate 0.4 m thickness of hard, brown silty clay was encountered at borehole BH 7-23 within the southeast portion of the site, extending to a maximum depth of 1.5 m below the existing ground surface.

A layer of glacial till was encountered underlying the silty sand layer in boreholes BH 2-23, BH 3-23, and BH 5-23, through BH 7-23. The glacial till was observed to consist of loose to dense brown silty sand with gravel cobbles and boulders and extended to approximate depths 0.8 to 2.8 m, where encountered.

Atterberg Limits Testing

Atterberg limits testing was completed on the only silty clay sample recovered from the geotechnical field investigation for the subject site. The results of the Atterberg Limits testing are presented in Table 1 on the next page, and on the Atterberg Limits Results sheet in Appendix 1.

Table 1 – Atterberg Limits Results – Current Investigation

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)	Classification
BH 7-23	SS2	0.6-1.2	65	28	37	CH

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plastic Index; CH: Inorganic Clay of High Plasticity. MH: Inorganic Silt of High Plasticity

Grain Size Distribution and Hydrometer Testing

Grain size distribution and hydrometer testing was completed to classify selected soil samples according to the Unified Soil Classification System (USCS) and determine the hydraulic conductivity of the soil. The results are summarized in Table 2 and are presented and are presented on the Grain-Size Distribution and Hydrometer Testing Results sheets in Appendix 1.

Table 2 – Hydrometer Testing Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 7-23 SS2	1.20	0	1.4	35.6	63.0

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.

Shrinkage Testing

Linear shrinkage testing was completed on a sample recovered at a depth of 1.2 m from BH 7-23 and yielded a shrinkage limit of 18.01% and a shrinkage ratio of 1.79.

Bedrock

Practical refusal to augering was encountered at depths ranging from 0.8 to 2.8 m below the existing ground surface. The bedrock was observed to consist of grey limestone and based on the RQDs of the recovered bedrock core, was generally weathered and of poor quality to approximate depths ranging from 1.5 to 3.0 m, becoming good to excellent in quality with depth. At boreholes BH 1-23 to BH 3-23 and BH 7-23 to BH 9-23, the bedrock was cored to depths ranging from 4.6 to 6.0 m below the existing ground surface.

Based on available geological mapping, the bedrock across the majority of the site consists of shale of the Rockcliffe formation with an overburden thickness ranging from approximately 1 to 4 m. Within the southern portion of the site, the bedrock consists of interbedded limestone and dolomite of the Gull River formation.

Reference should be made to the Soil Profile and Test Data sheets and Log of Borehole Sheets by others in Appendix 1 for specific details of the soil and bedrock profiles encountered at each test hole location.

4.3 Groundwater

Groundwater levels were measured in the installed piezometers during the investigation on June 2, 2023. The measured groundwater level (GWL) readings are presented in Table 3 on the following page and are shown on the Soil Profile and Test Data sheets in Appendix 1.

Table 3 – Summary of Groundwater Level Readings

Test Hole Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Elevation (m)	Recording Date
BH 1-23	89.00	1.64	87.36	June 2, 2023
BH 2-23	89.27	4.45	84.82	
BH 2A-23	88.84	Dry	-	
BH 3-23	89.14	3.77	85.37	
BH 4-23	89.22	Dry	-	
BH 5-23	88.39	Dry	-	
BH 6-23	88.73	Dry	-	
BH 7-23	88.79	1.27	87.52	
BH 8-23	89.36	3.26	86.10	
BH 9-23	89.01	4.01	85.00	

Note:

- Ground surface elevations at borehole locations were surveyed by Paterson and are referenced to a geodetic datum.

The long-term groundwater table can further estimated based on the colour, consistency and moisture content of the recovered soil samples. Based on the groundwater field observations, the long-term groundwater level is anticipated to be located below the bedrock surface. It should be noted that groundwater levels are subject to seasonal fluctuations and may vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is anticipated that the future buildings will be founded over conventional shallow footings placed on an undisturbed, compact to dense silty sand, hard brown silty clay, compact to very dense glacial till, or clean, surface-sounded bedrock bearing surface.

It is anticipated that some bedrock removal may be required for building construction and servicing installation. Therefore, the contractor should be prepared for bedrock removal.

Due to the presence of a silty clay layer, a portion of the proposed development will be subjected to permissible grade raise restrictions.

The above and other considerations are discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing significant amounts of organic materials, or construction debris/remnants should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. Care should be taken not to disturb subgrade soils during site preparation activities.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeters. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Should the proposed townhouse block include a basement level, it is expected that the silty clay layer encountered in BH 7-23 and BH 7A-23 will be subexcavated as part of the excavation work.

Bedrock Removal

Depending on the depth of the proposed footings and site servicing, bedrock removal may be required. Bedrock removal can be accomplished by hoe ramming where only small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings, and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in the proximity of the blasting operations should be carried out prior to commencing site activities.

The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries or claims related to the blasting operations. The blasting operations must be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz).

It should be noted that these guidelines are for today’s construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed buildings.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of the SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Lean Concrete Filled Trenches

Where bedrock is expected below the underside of footing (USF) elevation, lean concrete (minimum 17 MPa 28-day compressive strength) can be used to reinstate the subgrade from the bedrock surface to the USF elevation. Typically, the excavation side walls will be used as the form to support the lean concrete. The trench excavation should be at least 150 mm wider than all sides of the footings. The additional width of the concrete poured against an undisturbed trench sidewall will suffice in providing a direct transfer of the footing load to the underlying bedrock. Once the trench excavation is approved by the geotechnical engineer, lean concrete can be poured up to the proposed founding elevation. The trenches should be infilled with lean concrete (minimum 17 MPa, 28-day strength).

Protection of Subgrade and Bearing Surfaces

It is expected that site grading and preparation will consist of stripping of the soils containing significant amounts of organic materials and existing fill within the design underside of footing elevation. The contractor should take appropriate precautions to avoid disturbing the subgrade and bearing surfaces from construction and worker traffic. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional engineered fill.

Where the silty sand subgrade is observed to be in a loose state of compaction, proof-rolling under dry conditions and above freezing temperatures should be completed by an adequately sized roller making several passes to achieve optimum compaction levels. The compaction program should be reviewed and approved by the geotechnical consultant. In poor performing areas, consideration may be given to removing the poor performing soil and replace with an approved engineered fill such as OPSS Granular A or Granular B Type II compacted to a minimum 98% of the material's SPMDD.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, compact to dense silty sand or hard brown silty clay or on engineered fill placed directly over the undisturbed compact to dense silty sand or hard brown silty clay bearing surfaces, can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was incorporated in calculating the bearing resistance values at ULS.

Footings placed on an undisturbed, compact to dense glacial till, or on engineered fill placed directly over the undisturbed compact to dense glacial bearing surface, can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was incorporated in calculating the bearing resistance values at ULS.

Where the silty sand subgrade is observed to be in a loose state of compaction, proof-rolling under dry conditions and above freezing temperatures should be completed by an adequately sized roller making several passes to achieve optimum compaction levels. The compaction program should be reviewed and approved by the geotechnical consultant. Soft or poor performing areas should be subexcavated and replaced with an approved engineered fill such as OPSS Granular A or Granular B Type II compacted to a minimum of 98% of the material's SPMDD.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen, or disturbed soil, have been removed, in the dry, prior to the placement of concrete footings.

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided above will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Footings supported directly on clean, surface-sounded bedrock, or on lean concrete which is placed directly over clean, surface sounded bedrock, can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **1,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

A clean surface-sounded bedrock bearing surface should be free of loose materials, and have no near or surface seams, voids, fissures, or open joints which can be detected from surface sounding with a rock hammer.

Footings bearing on a clean, surface-sounded bedrock and designed using the above-noted bearing resistance values will be subjected to negligible post-construction total and differential settlements.

Permissible Grade Raise Recommendations

Due to the presence of the silty clay layer observed within the southern portion of the site, a permissible grade raise restriction of **3.0 m** is recommended within this area. The recommended permissible grade raise area is defined in Drawing PG6688-2 – Permissible Grade Raise Plan presented in Appendix 2. It should be noted that if a basement level is proposed for the townhouse block which in turn requires the full excavation of the thin silty clay deposit, the permissible grade raise restriction provided herein does not apply to the building.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements. Provided sufficient time is available to induce the required settlements, consideration could be given to surcharging the subject site.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to stiff silty clay above the groundwater table when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil of the same or higher capacity as that of the bearing medium.

Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1H:6V (or flatter) passes only through sound bedrock. A heavily fractured, weathered bedrock bearing medium will require a lateral support zone of 1H:1V (or flatter).

Bedrock/Soil Transition

Where a footing is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the portion placed on a soil bearing medium to reduce the potential long-term total and differential settlements. Also, at the soil/bedrock transitions, it is recommended that a minimum depth of 500 mm of bedrock be removed from below the founding elevation for a minimum length of 2 m on the bedrock side. This area should be subsequently reinstated with an engineered fill, such as OPSS Granular A or Granular B Type II and compacted to a minimum of 98% of the material SPMDD.

The width of the sub-excavation should be a minimum of 500 mm greater than the width of the footing. Steel reinforcement, extending a minimum of 3 m on both sides of the 2 m long transition, should be placed in the top portions of the footing and foundation walls.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class X_C**, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2024. If the underside of footings are within 3 m of the bedrock surface, a higher seismic site class, such as Class X_A or X_B, may be achievable, if confirmed by a site-specific shear wave velocity test at the subject site.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2024 for a full discussion of the earthquake design requirements.

5.5 Floor Slab Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil and/or approved fill is considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction.

Where the subgrade consists of existing fill, a vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. Any poor performing areas should be removed and reinstated with an engineered fill, such as Granular B Type II.

For structures with slab-on-grade construction, it is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A crushed stone. For structures with basement slabs, it is recommended that the upper 300 mm of sub-floor fill consists of 19 mm clear crush stone.

All backfill material within the footprint of the proposed buildings should be placed in a maximum 300 mm thick loose layers and compacted to a minimum of 98% of the material's SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

5.6 Pavement Structure

For preliminary design purposes, the following pavement structures, presented in Tables 4 and 5, are recommended for car parking areas and access lanes.

Table 4 – Recommended Asphalt Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** – Superpave 12.5 Asphaltic Concrete
150	**BASE** – OPSS Granular A Crushed Stone
300	**SUBBASE** – OPSS Granular B Type II
SUBGRADE – Either fill, in situ soils or OPSS Granular B Type I or II material placed over in situ soil or bedrock.	

Table 5 – Recommended Asphalt Pavement Structure – Local roadways

Thickness (mm)	Material Description
40	**Wear Course** – Superpave 12.5 Asphaltic Concrete
50	**Binder Course** – Superpave 19.0 Asphaltic Concrete
150	**BASE** – OPSS Granular A Crushed Stone
400	**SUBBASE** – OPSS Granular B Type II
SUBGRADE – Either fill, in situ soils or OPSS Granular B Type I or II material placed over in situ soil or bedrock.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for each proposed structure which has below-grade space. The system should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the structure. The pipe should have positive outlet, such as a gravity connection to the storm sewer, or to the sump pit where sump pumps are proposed at the residential dwellings.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or an approved equivalent. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover (or insulation equivalent) should be provided in this regard.

Other exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure. These footings should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

Where footings are founded directly on clean, surface-sounded bedrock with no near-surface cracks or fissures and is approved by Paterson personnel at the time of the excavation, the minimum soil cover, listed above, is not required.

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations).

Unsupported Side Slopes

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent material specifications and standard detail drawings from the department of public works and services, infrastructure services branch of the City of Ottawa.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. The bedding should extend to the spring line of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material’s standard Proctor maximum dry density.

Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe, should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to a minimum of 99% of its SPMDD.

It should generally be possible to re-use the site generated fill materials (moist, not wet) above the cover material if excavation and filling operations are carried out in dry and non-freezing weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavation should be low to moderate and controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

Under the current regulations enacted by the Ministry of Environment, Conservation and Parks (MECP), any dewatering in excess of 50,000 L/day requires a registration on the Environmental Activity and Sector Registry (EASR), so long as that dewatering is related to construction. If the dewatering is not related to construction, a Permit to Take Water obtained from the MECP will be required.

In the event that an EASR is required to facilitate dewatering of the proposed development, a minimum of three to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan, to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. Should a Permit to Take Water be required, a minimum of five to six months should be allotted for completion of the permit, due to the minimum review period imposed by the MECP.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderate to aggressive corrosive environment.

6.8 Landscaping Considerations

Based on the subsurface profile at the test hole locations, a low to medium sensitivity clay soil was encountered within the southern portion of the subject site. Based on our Atterberg limits test results, the modified plasticity index does not exceed 40% in the area. The following tree planting setbacks are recommended for the low to medium sensitivity area.

Large trees (mature height over 14 m) can be planted within these areas where a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be reduced to 4.5 m for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the conditions noted below are met:

- ☐ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan.

☐ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

☐ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

☐ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

☐ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

7.0 Recommendations

It is recommended that the following be carried out by Paterson once detailed plans of the proposed development have been prepared:

☐ Review detailed grading, servicing, landscaping and structural plan(s) from a geotechnical perspective.

It is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

☐ Observation of all bearing surfaces prior to the placement of concrete.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Sampling and testing of the concrete and fill materials used.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Observation of all subgrades prior to backfilling and follow-up field density tests to determine the level of compaction achieved.

☐ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

All excess soil must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management.*

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Mattamy Homes or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

NPatey

Nicole Patey, P.Eng.

LICENSED PROFESSIONAL ENGINEER
June 8, 2026
K. A. PICKARD
100531344
PROVINCE OF ONTARIO

Kevin A. Pickard, P.Eng.

Report Distribution:

- ☐ Mattamy Homes (digital copy)
- ☐ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERGS TESTING RESULTS

GRAIN SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

SHRINKAGE ANALYSIS REULTS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372618.2** **NORTHING: 5035288** **ELEVATION:** 89.00

PROJECT: Proposed Mixed Use Development

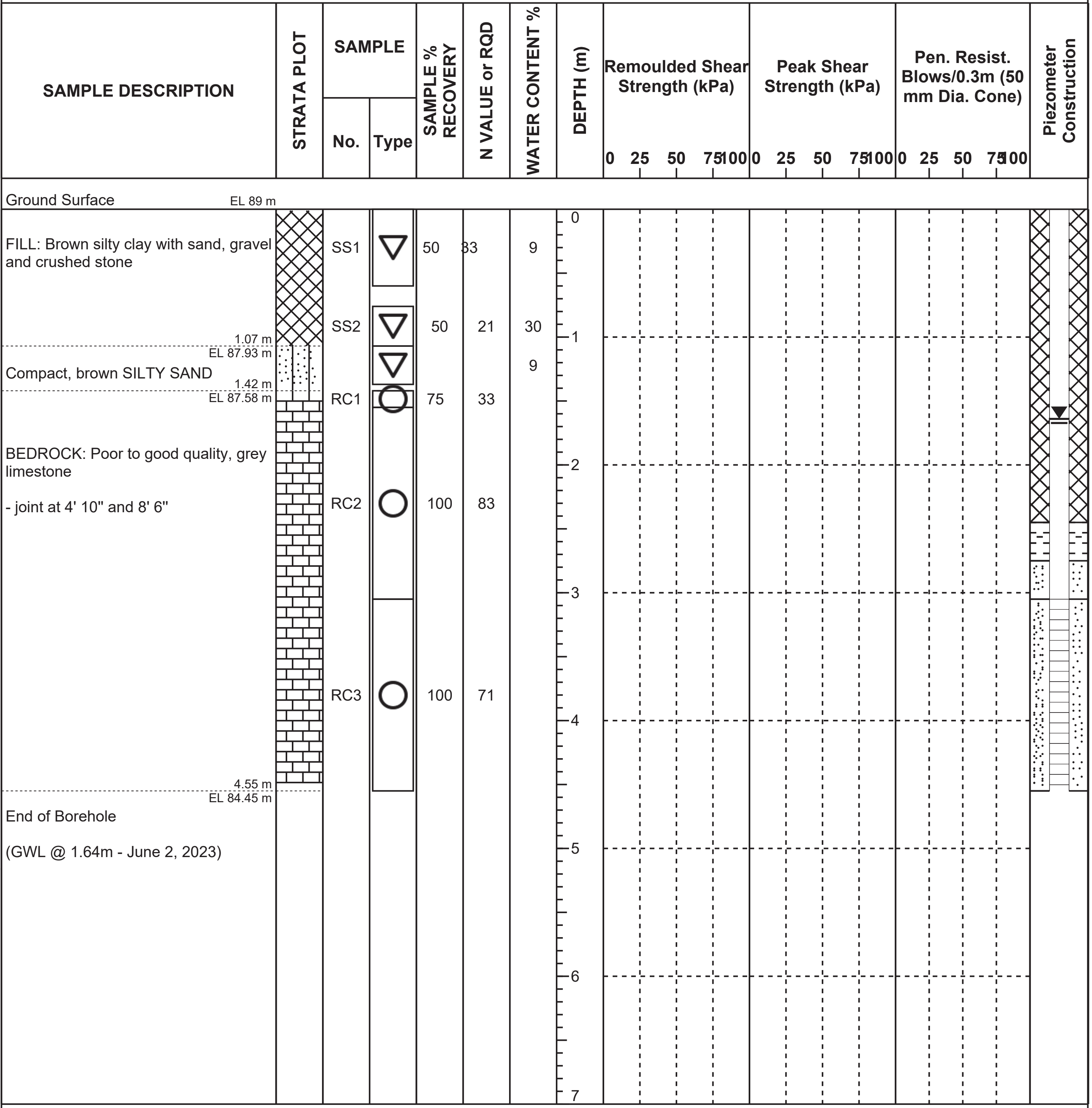
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 1-23



SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %
Ground Surface EL 89 m						
FILL: Brown silty clay with sand, gravel and crushed stone		SS1	▽	50	33	9
		SS2	▽	50	21	30
1.07 m EL 87.93 m Compact, brown SILTY SAND			▽			9
1.42 m EL 87.58 m BEDROCK: Poor to good quality, grey limestone - joint at 4' 10" and 8' 6"		RC1	○	75	33	
		RC2	○	100	83	
		RC3	○	100	71	
4.55 m EL 84.45 m End of Borehole (GWL @ 1.64m - June 2, 2023)						

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 -Ottawa, On.

DATUM: Geodetic **EASTING:** 372638.8 **NORTHING:** 5035293 **ELEVATION:** 89.27

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. PG6688

HOLE NO. BH 2-23

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 25 50 75 100	Peak Shear Strength (kPa) 0 25 50 75 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100	Piezometer Construction
Ground Surface EL 89.27 m											
							0				
FILL: Brown silty clay with sand, gravel and crushed stone		SS1	▽	42	14	11					
		SS2	▽	6	50+	27					
			▽			21	1				
1.07 m EL 88.2 m											
Compact to dense, brown SILTY SAND											
1.58 m EL 87.69 m											
BEDROCK: Poor to good quality, grey limestone							2				
		RC1	○	100	86						
							3				
		RC2	○	100	75						
							4				
4.57 m EL 84.7 m											
End of Borehole											
(GWL @ 4.45m - June 2, 2023)							5				
							6				
							7				

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372627.5** **NORTHING: 5035282** **ELEVATION:** 88.84

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 2A-23

SAMPLE DESCRIPTION	STRATA PLOT	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 25 50 75 100	Peak Shear Strength (kPa) 0 25 50 75 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100	Piezometer Construction
Ground Surface EL 88.84 m											
FILL: Brown silty clay with sand, gravel and crushed stone							0				
1.07 m EL 87.77 m							1				
Compact to dense, brown SILTY SAND											
1.52 m EL 87.32 m											
Glacial Till: Loose, brown SILTY SAND gravel, cobbles and boulders		SS1	▽	42	7	10					
							2				
		SS2	▽	26	7	13					
2.8 m EL 86.04 m											
End of Borehole							3				
Practical refusal to augering at 2.80m depth											
(BH dry - June 2, 2023)											
							4				
							5				
							6				
							7				

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372647.9** **NORTHING: 5035255** **ELEVATION:** 89.14

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 3-23

SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)
Ground Surface EL 89.14 m						0
FILL: Brown silty clay with sand, gravel and crushed stone	SS1	▽	75	23	18	
0.3 m EL 88.84 m		▽			18	
Compact, brown SILTY SAND	SS2	▽	75	27	19	1
1.07 m EL 88.07 m		▽			33	
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders	RC1	○	88	88		
1.4 m EL 87.74 m						2
BEDROCK: Good to excellent quality, grey limestone	RC2	○	100	95		3
	RC3	○	98	97		4
4.6 m EL 84.54 m						
End of Borehole						5
(GWL @ 3.77m - June 2, 2023)						6
						7

STRATA PLOT

Remoulded Shear Strength (kPa) 0 25 50 75 100

Peak Shear Strength (kPa) 0 25 50 75 100

Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100

Piezometer Construction

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372651.8** **NORTHING: 5035268** **ELEVATION:** 89.22

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 4-23

SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)
Ground Surface EL 89.22 m						0
FILL: Brown silty clay with sand, gravel and crushed stone	SS1	▽	58	14	26	
0.69 m EL 88.53 m						
Loose, brown SILTY SAND	SS2	▽	67	7	23	1
	SS3	▽	33	50+	16	
1.62 m EL 87.6 m						
End of Borehole						
Practical refusal to augering at 1.62m depth.						2
(BH dry - June 2, 2023)						
						3
						4
						5
						6
						7

Remoulded Shear Strength (kPa): 0 25 50 75 100

Peak Shear Strength (kPa): 0 25 50 75 100

Pen. Resist. Blows/0.3m (50 mm Dia. Cone): 0 25 50 75 100

STRATA PLOT

Piezometer Construction

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING:** 372614.8 **NORTHING:** 5035234 **ELEVATION:** 88.39

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

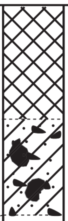
DATE: May 25, 2023

FILE NO. PG6688

HOLE NO. BH 5-23

SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)
Ground Surface EL 88.39 m						0
FILL: Brown silty clay with sand and gravel 0.69 m EL 87.7 m	SS1	▽	75	9	22	
GLACIAL TILL: Brown silty clay with sand and gravel, cobbles and boulders 1.27 m EL 87.12 m	SS2	▽	73	10	24	1
End of Borehole Practical refusal to augering at 1.27m depth. (BH dry - June 2, 2023)						

STRATA PLOT

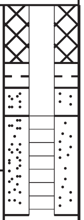


Remoulded Shear Strength (kPa) 0 25 50 75 100

Peak Shear Strength (kPa) 0 25 50 75 100

Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100

Piezometer Construction



DEPTH (m): 0 1 2 3 4 5 6 7

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372606.3** **NORTHING: 5035269** **ELEVATION:** 88.73

PROJECT: Proposed Mixed Use Development

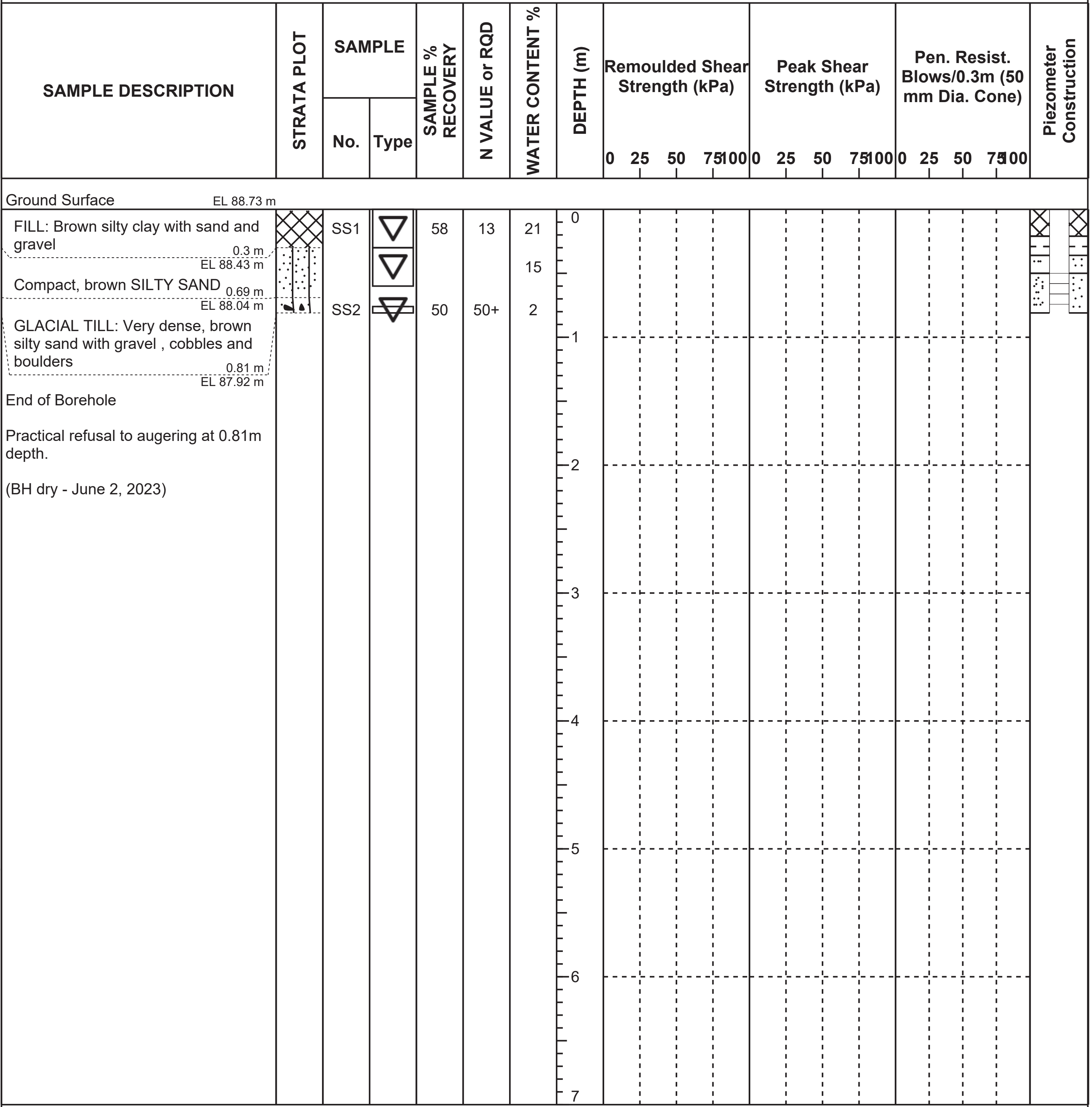
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 6-23



SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %
Ground Surface EL 88.73 m					
FILL: Brown silty clay with sand and gravel 0.3 m EL 88.43 m	SS1	▽	58	13	21
Compact, brown SILTY SAND 0.69 m EL 88.04 m		▽			15
GLACIAL TILL: Very dense, brown silty sand with gravel , cobbles and boulders 0.81 m EL 87.92 m	SS2	▽	50	50+	2

End of Borehole

Practical refusal to augering at 0.81m depth.

(BH dry - June 2, 2023)

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372650.4** **NORTHING: 5035238** **ELEVATION:** 88.79

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

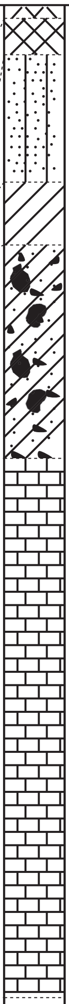
FILE NO. **PG6688**

HOLE NO. BH 7-23

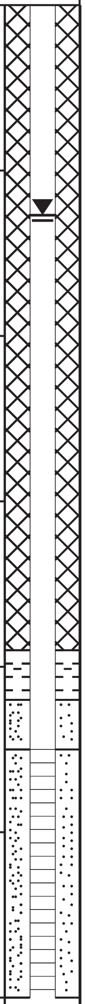
SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %
Ground Surface EL 88.79 m					
FILL: Crushed stone and gravel 0.08 m EL 88.71 m	SS1	▽	58	14	17
FILL: Brown silty clay with sand and gravel 0.3 m EL 88.49 m		▽			25
Compact, brown SILTY SAND, trace gravel 1.07 m EL 87.72 m	SS2	▽	67	13	19
Hard, brown SILTY CLAY 1.45 m EL 87.34 m		▽			37
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 2.74 m EL 86.05 m	SS3	▽		50+	13
BEDROCK: Very poor to excellent quality, grey limestone	RC1	○	80	0	
	RC2	○	100	100	
6 m EL 82.79 m	RC3	○	100	97	
End of Borehole (GWL @ 1.27m - June 2, 2023)					

DEPTH (m)	Remoulded Shear Strength (kPa) 0 25 50 75 100	Peak Shear Strength (kPa) 0 25 50 75 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100
0			
1			
2			
3			
4			
5			
6			
7			

STRATA PLOT



Piezometer Construction



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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING:** 372650.4 **NORTHING:** 5035238 **ELEVATION:** 88.79

PROJECT: Proposed Mixed Use Development

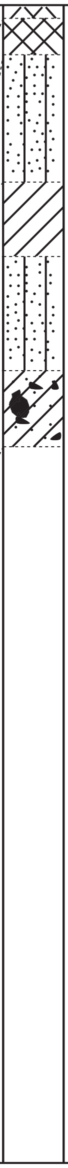
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 26, 2023

FILE NO. PG6688

HOLE NO. BH 7A-23



SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)	Remoulded Shear Strength (kPa) 0 25 50 75 100	Peak Shear Strength (kPa) 0 25 50 75 100	Pen. Resist. Blows/0.3m (50 mm Dia. Cone) 0 25 50 75 100	Piezometer Construction
Ground Surface EL 88.79 m						0				
FILL: Crushed stone and gravel 0.08 m EL 88.71 m										
FILL: Brown silty clay with sand and gravel 0.3 m EL 88.49 m										
Compact, brown SILTY SAND, trace gravel 1.07 m EL 87.72 m						1				
Hard, brown SILTY CLAY 1.52 m EL 87.27 m										
Loose, brown SILTY SAND with gravel 2.21 m EL 86.58 m	SS1	▽	58	4	11	2				
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 2.67 m EL 86.12 m	SS2	▽	56	50+	23					
End of Borehole Practical refusal to augering at 2.67m depth.						3				
						4				
						5				
						6				
						7				

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SOIL PROFILE AND TEST DATA

GEOTECHNICAL INVESTIGATION

Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING:** 372649.5 **NORTHING:** 5035290 **ELEVATION:** 89.36

PROJECT: Proposed Mixed Use Development

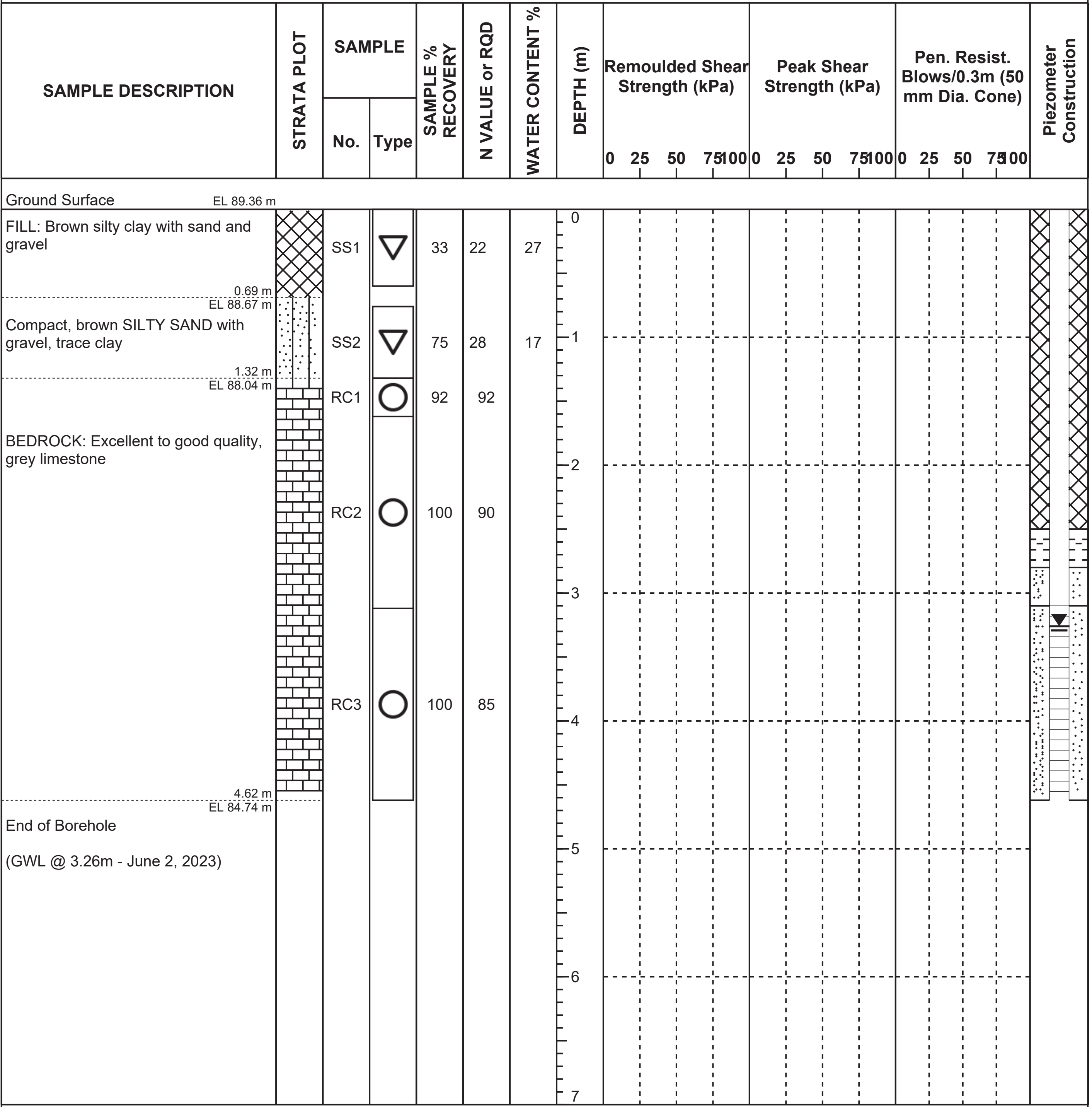
BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. PG6688

HOLE NO. BH 8-23



SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %
Ground Surface EL 89.36 m					
FILL: Brown silty clay with sand and gravel	SS1	▽	33	22	27
0.69 m EL 88.67 m					
Compact, brown SILTY SAND with gravel, trace clay	SS2	▽	75	28	17
1.32 m EL 88.04 m					
BEDROCK: Excellent to good quality, grey limestone	RC1	○	92	92	
	RC2	○	100	90	
	RC3	○	100	85	
4.62 m EL 84.74 m					
End of Borehole					
(GWL @ 3.26m - June 2, 2023)					

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PATERSON GROUP

SOIL PROFILE AND TEST DATA
GEOTECHNICAL INVESTIGATION
Wateridge Block 12 - Ottawa, On.

DATUM: Geodetic **EASTING: 372607.1** **NORTHING: 5035290** **ELEVATION:** 89.01

PROJECT: Proposed Mixed Use Development

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: May 25, 2023

FILE NO. **PG6688**

HOLE NO. BH 9-23

SAMPLE DESCRIPTION	SAMPLE No.	SAMPLE Type	SAMPLE % RECOVERY	N VALUE or RQD	WATER CONTENT %	DEPTH (m)
Ground Surface EL 89.01 m						
FILL: Brown silty clay with sand and gravel	SS1	▽	33	19	15	0
0.3 m EL 88.71 m		▽			11	
Dense, brown SILTY SAND	SS2	▽	80	50+	8	
1.3 m EL 87.71 m						1
BEDROCK: Good quality, grey limestone	RC1	○	100	87		
						2
- mud seam at 3.9m depth, and at 9' 3" depth, 10' 5" depth.	RC2	○	100	76		
						3
	RC3	○	100	78		4
4.67 m EL 84.34 m						
End of Borehole						5
(GWL @ 4.01m - June 2, 2023)						
						6
						7

Remoulded Shear Strength (kPa): 0 25 50 75 100

Peak Shear Strength (kPa): 0 25 50 75 100

Pen. Resist. Blows/0.3m (50 mm Dia. Cone): 0 25 50 75 100

Piezometer Construction

DISCLAIMER: THE DATA PRESENTED IN THIS LOG IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHO IT WAS PRODUCED. THIS LOG SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) ‘N’ value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of “P” denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	‘N’ Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	‘N’ Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC% - Natural water content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic Limit, % (water content above which soil behaves plastically)
PI - Plasticity Index, % (difference between LL and PL)

Dxx - Grain size at which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu - Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

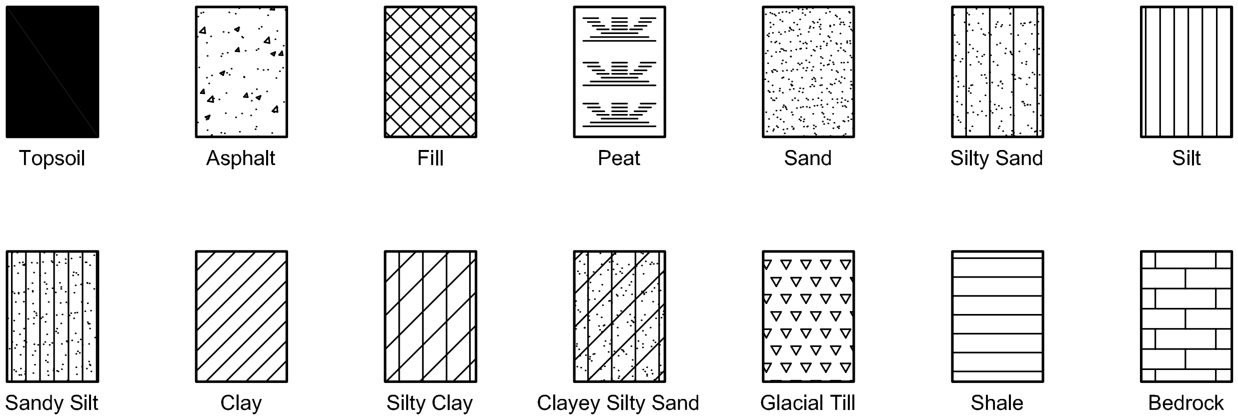
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

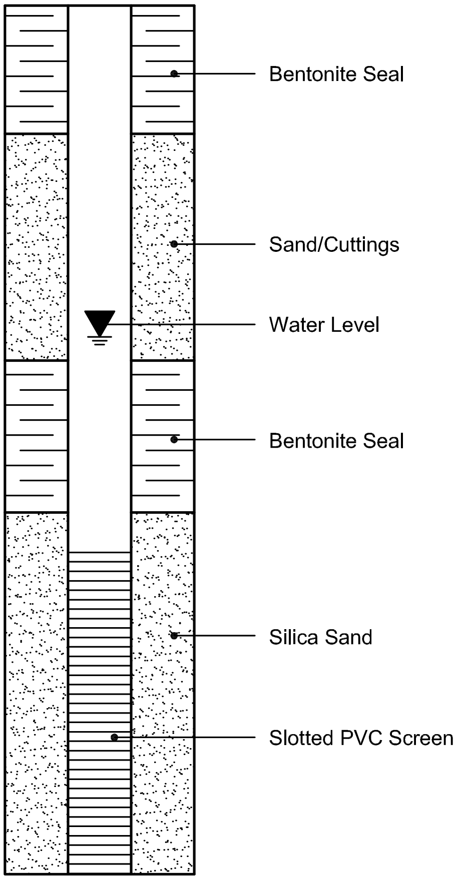
SYMBOLS AND TERMS (continued)

STRATA PLOT

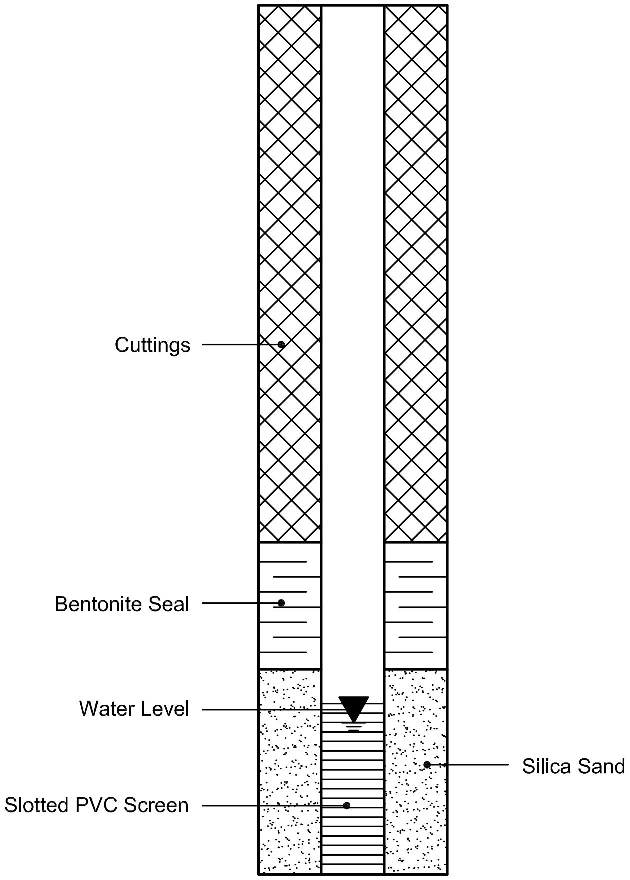


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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consulting engineers

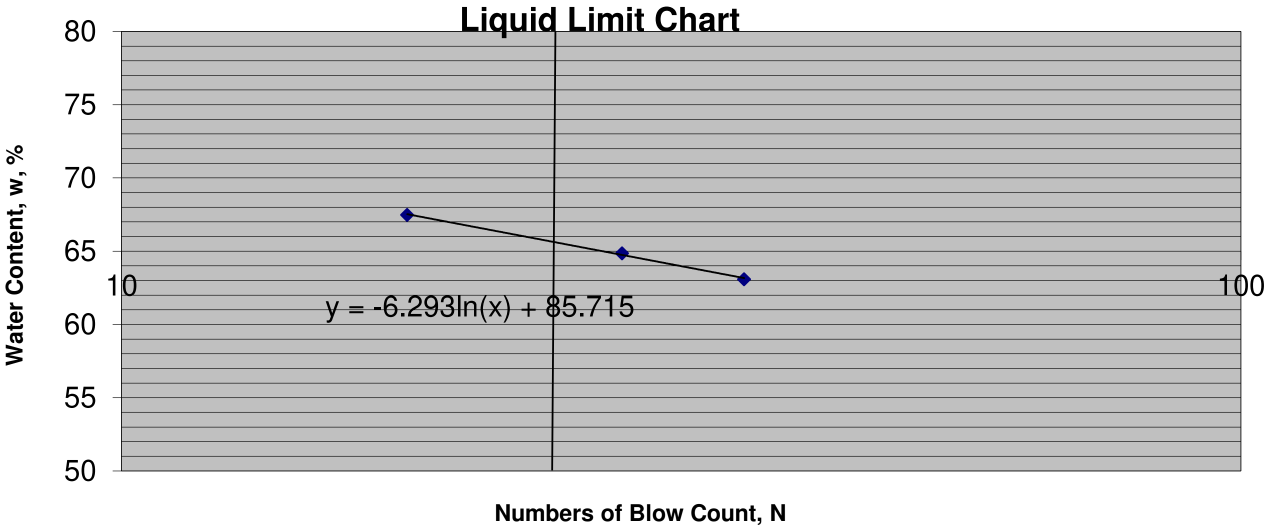
ATTERBERG LIMITS
LS-703/704

CLIENT:	Mattamy Homes	FILE NO.:	PG6688
PROJECT:	Wateridge Village Block 12	DATE SAMPLED:	25-May-23
LOCATION:	BH7-23 SS2 (2.6"-4.6")	DATE REPORTED:	08-Jun-23

CAN NO.	**X91**	**X23**	**X33**				
WT. OF CAN	5.02	4.95	4.45				
WT. OF SOIL & CAN	11.43	13.11	11.20				
WT. OF DRY SOIL & CAN	8.95	9.90	8.48				
WT. OF MOISTURE	2.48	3.21	2.72				
WT. OF DRY SOIL & CAN	3.93	4.95	4.03				
WATER CONTENT, w, %	**63.1**	**64.85**	**67.49**				
NO. OF BLOWS, N	36	28	18				

CAN NO.	**1B**	**X32**
WT. OF CAN	5.10	5.00
WT. OF SOIL & CAN	10.80	11.28
WT. OF DRY SOIL & CAN	9.56	9.92
WT. OF MOISTURE	1.24	1.36
WT. OF DRY SOIL & CAN	4.46	4.92
WATER CONTENT, w, %	**27.8**	**27.64**

RESULTS	
LIQUID LIMIT	**65**
PLASTIC LIMIT	**28**
PLASTICITY INDEX	**37**
NATURAL MOISTURE CONTENT	

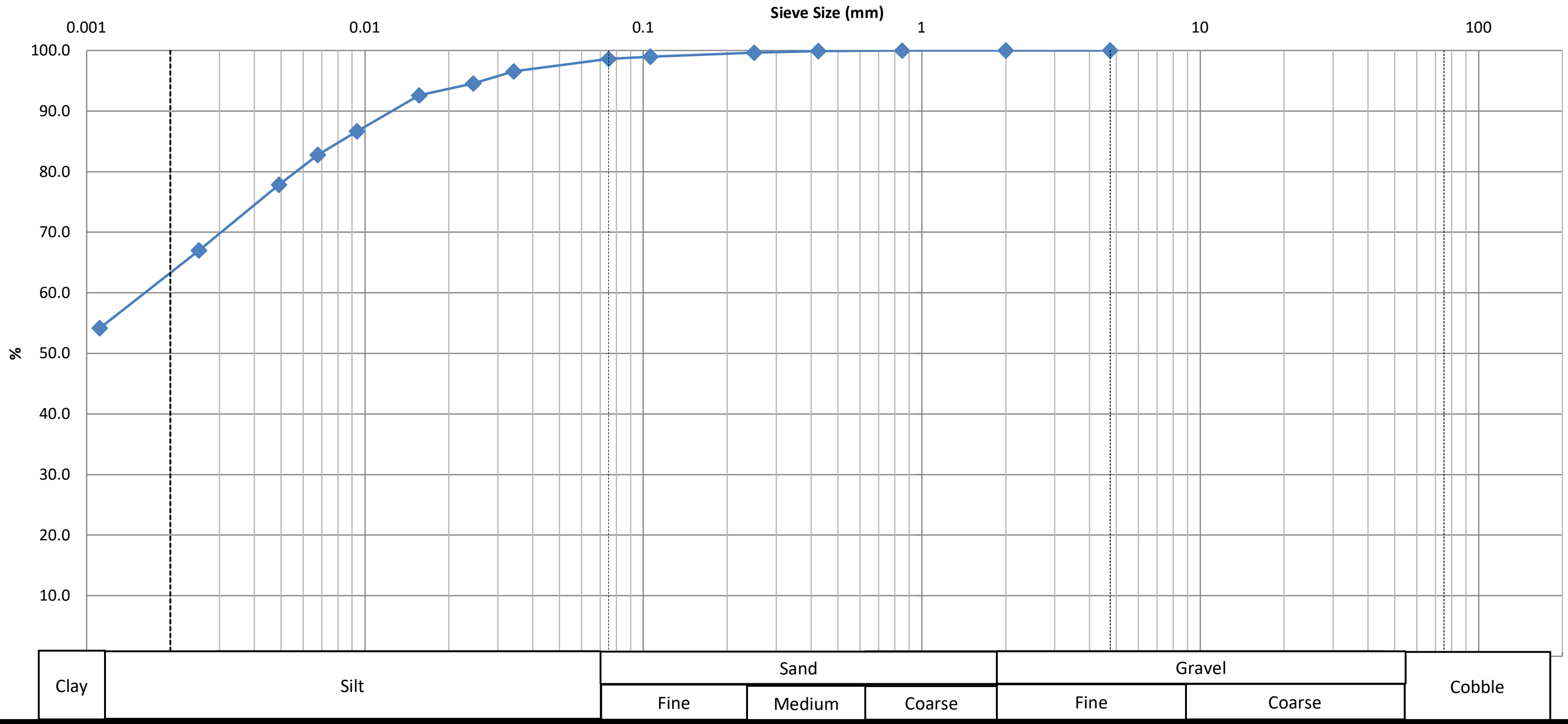


TECHNICIAN:	**REVIEWED BY:**		

PATERSON GROUP

SIEVE ANALYSIS
ASTM C136

CLIENT:	Mattamy Homes	DEPTH:	2'6" - 4'6"	FILE NO:	PG6688
CONTRACT NO.:		BH OR TP No.:	BH7-23 SS2	LAB NO:	43561
PROJECT:	Wateridge Village Block 12			DATE RECEIVED:	12-Jun-23
				DATE TESTED:	13-Jun-23
DATE SAMPLED:	25-May-23			DATE REPORTED:	21-Jun-23
SAMPLED BY:	AE			TESTED BY:	DK



Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		29.6					

	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
					0.0	1.4	35.6	63.0

Comments:

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

PATERSON
GROUP

HYDROMETER
LS-702 ASTM-422

CLIENT:	Mattamy Homes	DEPTH:	2'6" - 4'6"	FILE NO.:	PG6688
PROJECT:	Wateridge Village Block 12	BH OR TP No.:	BH7-23 SS2	DATE SAMPLED	25-May-23
LAB No. :	43561	TESTED BY:	DK	DATE RECEIVE	12-Jun-23
SAMPLED BY:	AE	DATE REPT'D:	21-Jun-23	DATE TESTED:	13-Jun-23

SAMPLE INFORMATION

SAMPLE MASS	SPECIFIC GRAVITY
116.5	2.700

INITIAL WEIGHT	50.00	**HYGROSCOPIC MOISTURE**		
WEIGHT CORRECTED	45.44	TARE WEIGHT	0.00	ACTUAL WEIGHT
WT. AFTER WASH BACK SIEVE	0.72	AIR DRY	128.20	128.20
SOLUTION CONCENTRATION	40 g/L	OVEN DRY	116.50	116.50
		CORRECTED	0.909	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
26.5			
19			
13.2			
9.5			
4.75	**0.0**	0.0	**100.0**
2.0	**0.0**	0.0	**100.0**
Pan	**116.5**		
0.850	**0.01**	0.0	**100.0**
0.425	**0.05**	0.1	**99.9**
0.250	**0.18**	0.4	**99.6**
0.106	**0.51**	1.0	**99.0**
0.075	**0.70**	1.4	**98.6**
Pan	**0.72**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (^{o}C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	8:40	55.0	6.0	23.0	0.0342	96.5	**96.5**
2	8:41	54.0	6.0	23.0	0.0245	94.5	**94.5**
5	8:44	53.0	6.0	23.0	0.0157	92.6	**92.6**
15	8:54	50.0	6.0	23.0	0.0094	86.7	**86.7**
30	9:09	48.0	6.0	23.0	0.0068	82.7	**82.7**
60	9:39	45.5	6.0	23.0	0.0049	77.8	**77.8**
250	12:49	40.0	6.0	23.0	0.0025	67.0	**67.0**
1440	8:39	33.5	6.0	23.0	0.0011	54.2	**54.2**

Moisture = 29.6%

REVIEWED BY:	**C. Beadow**	**Joe Forsyth, P. Eng.**

PATERSON GROUP

Linear Shrinkage
ASTM D4943-02

CLIENT:	Mattamy Homes	DEPTH	2'-6" to 4'-6"	FILE NO.:	PG6688
PROJECT:	Wateridge Village Block 12	BH OR TP No:	BH7-23 SS2	DATE SAMPLED	25-May-23
LAB No:	43561	TESTED BY:	CP/MO	DATE RECEIVED	12-Jun-23
SAMPLED BY:	AE	DATE REPORTED:	21-Jun-23	DATE TESTED	13-Jun-23

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(8)	Calibration (Two Trials)		Tin NO.(x22)
Tare	5.07	Tin	4.88	4.89
Soil Pat Wet + Tare	64.69	Tin + Grease	5.07	5.06
Soil Pat Wet	59.62	Glass	48.97	48.97
Soil Pat Dry + Tare	40.33	Tin + Glass + Water	91.65	91.65
Soil Pat Dry	35.26	Volume	37.61	37.62
Moisture	**69.09**	**Average Volume**	**37.62**	

Soil Pat + String	35.44
Soil Pat + Wax + String in Air	36.6
Soil Pat + Wax + String in Water	15.69
Volume Of Pat (Vdx)	20.91

RESULTS:

Shrinkage Limit	**18.01**
Shrinkage Ratio	**1.798**
Volumetric Shrinkage	**91.848**
Linear Shrinkage	**19.520**

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

Certificate of Analysis

Client: **Paterson Group Consulting Engineers**

Client PO: 57572

Report Date: 01-Jun-2023

Order Date: 26-May-2023

Project Description: PG6688

	Client ID:	BH2A-23 SS2	-	-	-
	Sample Date:	25-May-23 00:00	-	-	-
	Sample ID:	2321433-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	88.9	-	-	-
General Inorganics					
pH	0.05 pH Units	7.62	-	-	-
Resistivity	0.1 Ohm.m	32.8	-	-	-
Anions					
Chloride	10 ug/g dry	<10	-	-	-
Sulphate	10 ug/g dry	209	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 – AERIAL PHOTOGRAPH – 2002

FIGURE 3 – AERIAL PHOTOGRAPH – 2005

FIGURE 4 – AERIAL PHOTOGRAPH – 2022

DRAWING PG6688-1 – TEST HOLE LOCATION PLAN

DRAWING PG6688-2 – PERMISSIBLE GRADE RAISE PLAN

DRAWING PG6688-3 – TREE PLANTING SETBACK PLAN

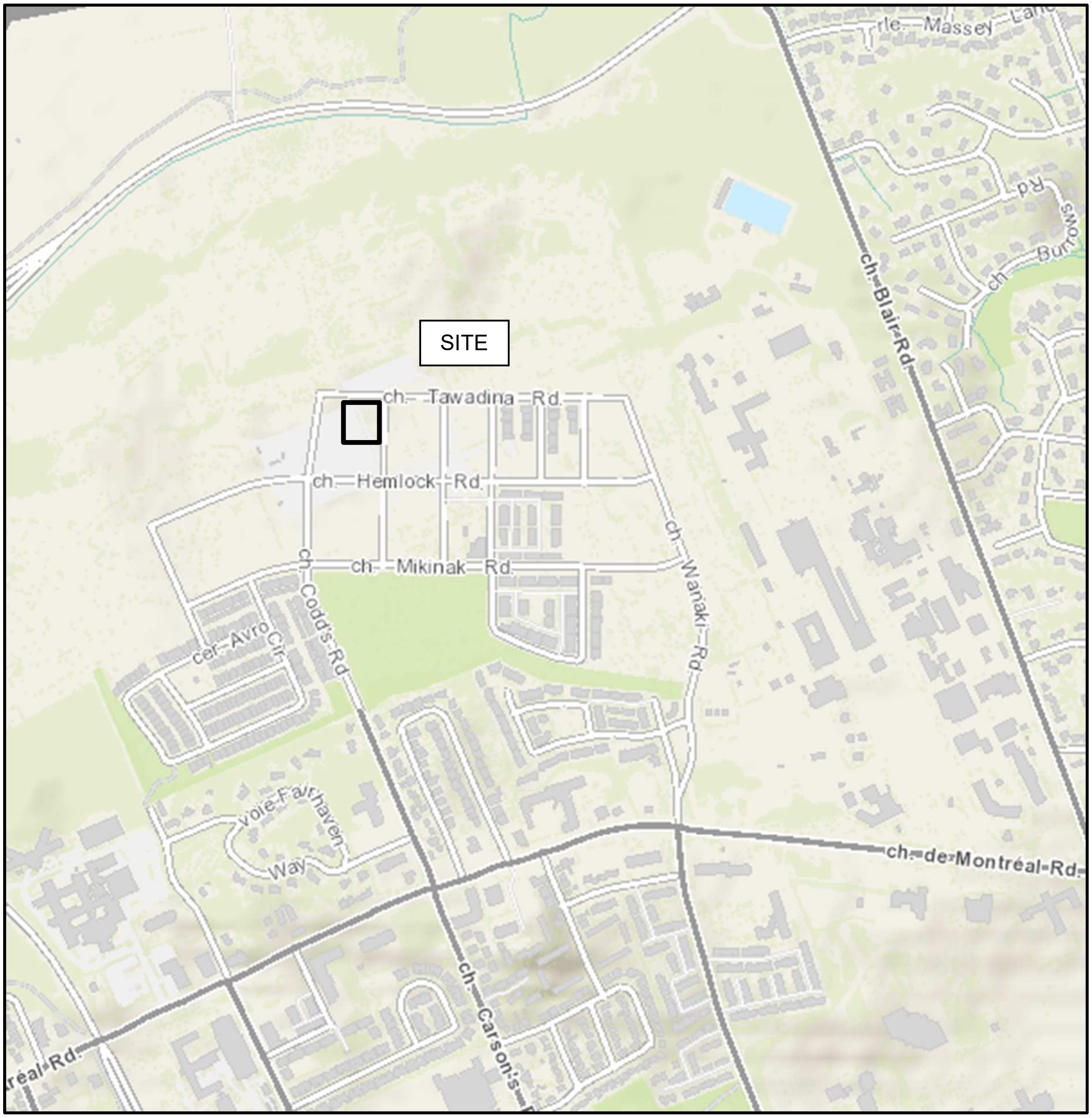


FIGURE 1

KEY PLAN

PATERSON GROUP

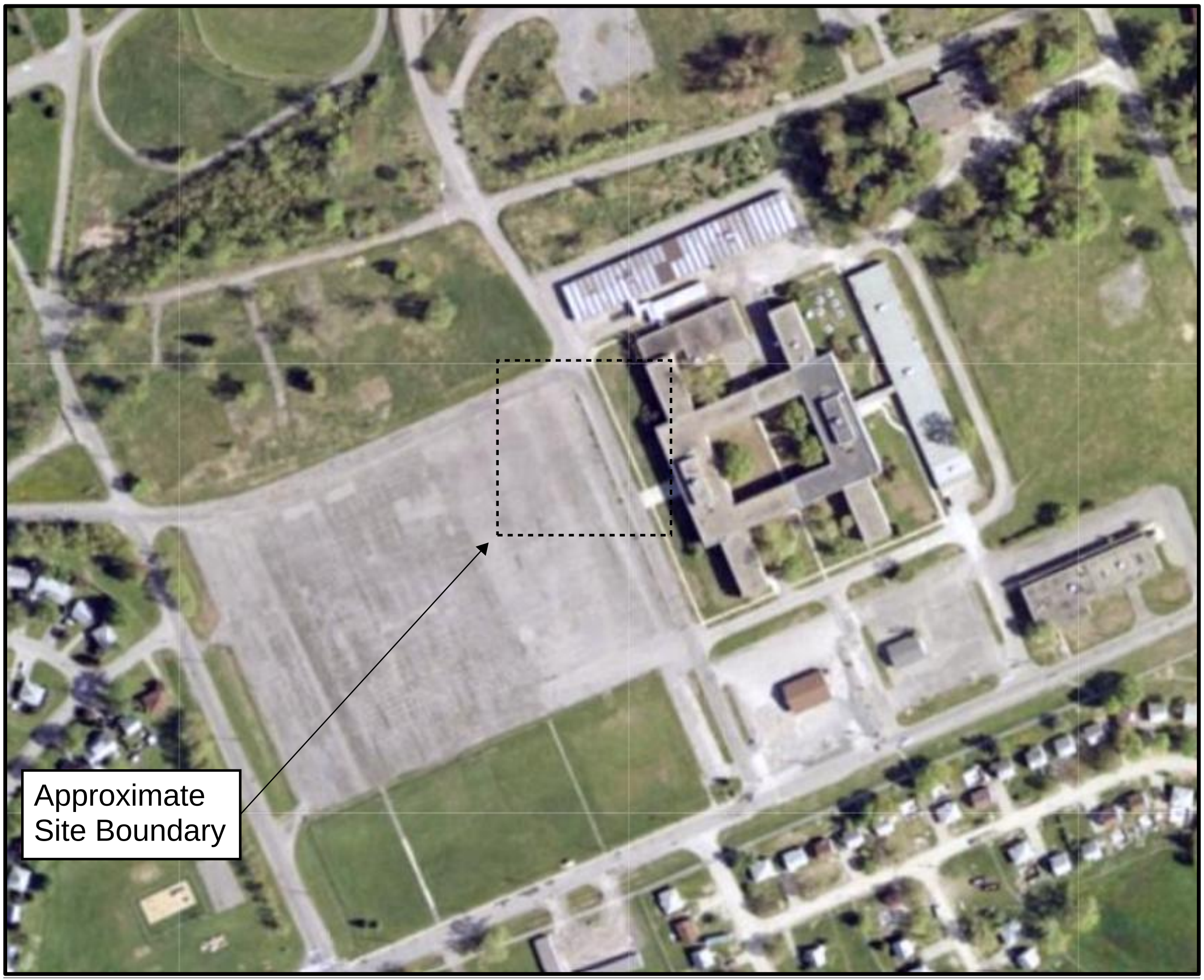


FIGURE 2

Aerial Photograph - 2002

PATERSON
GROUP

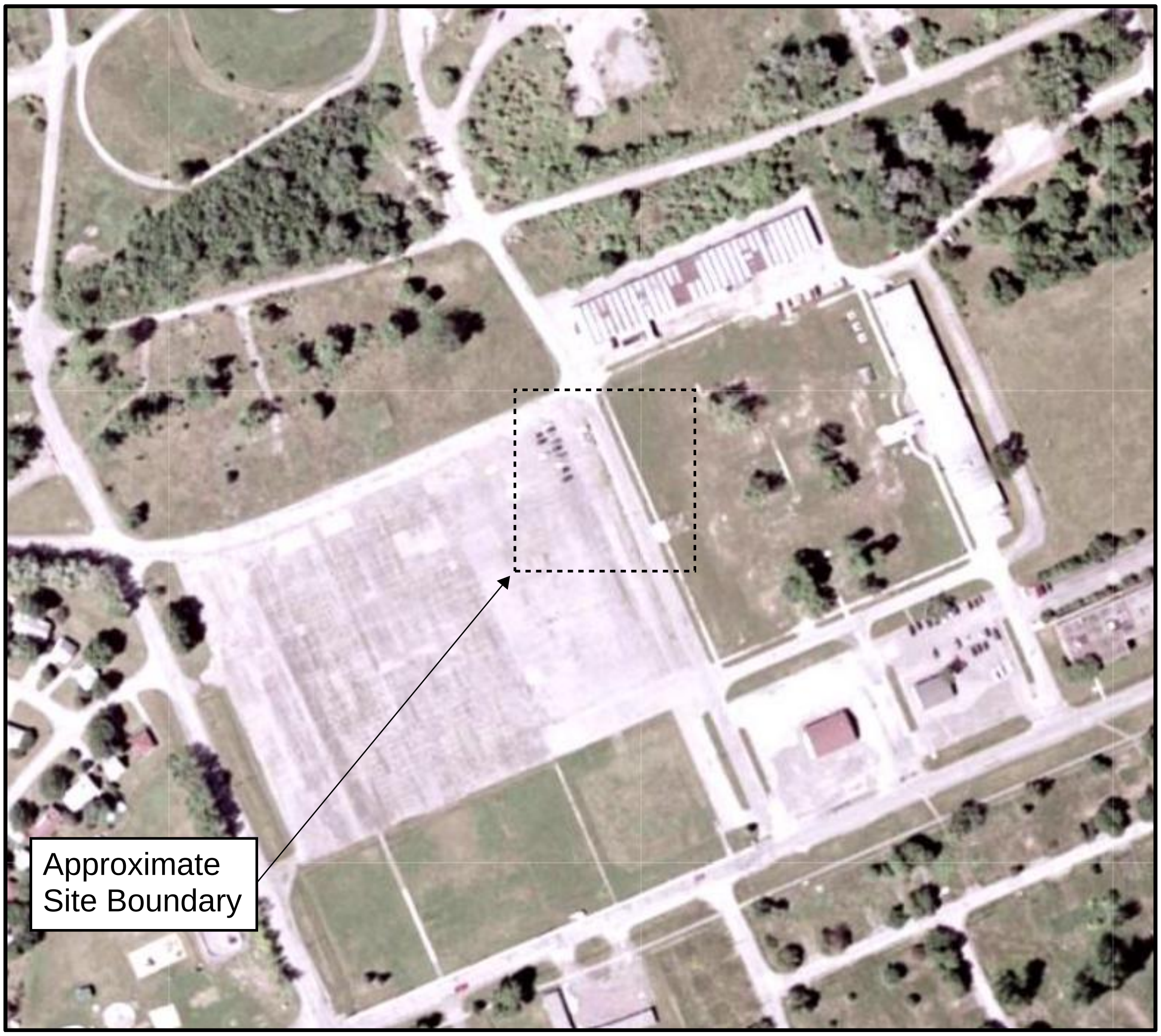


FIGURE 3

Aerial Photograph - 2005

PATERSON
GROUP

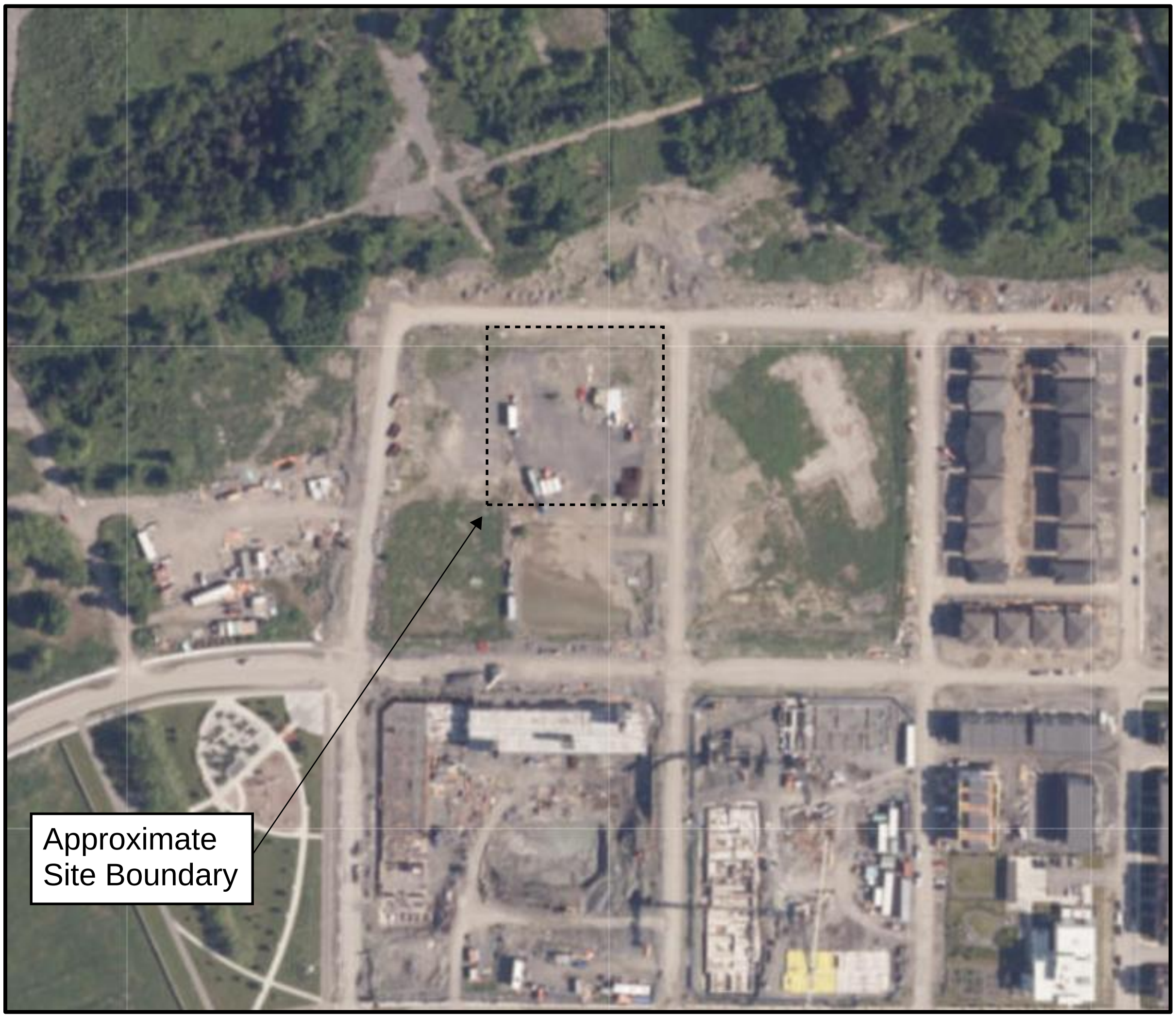
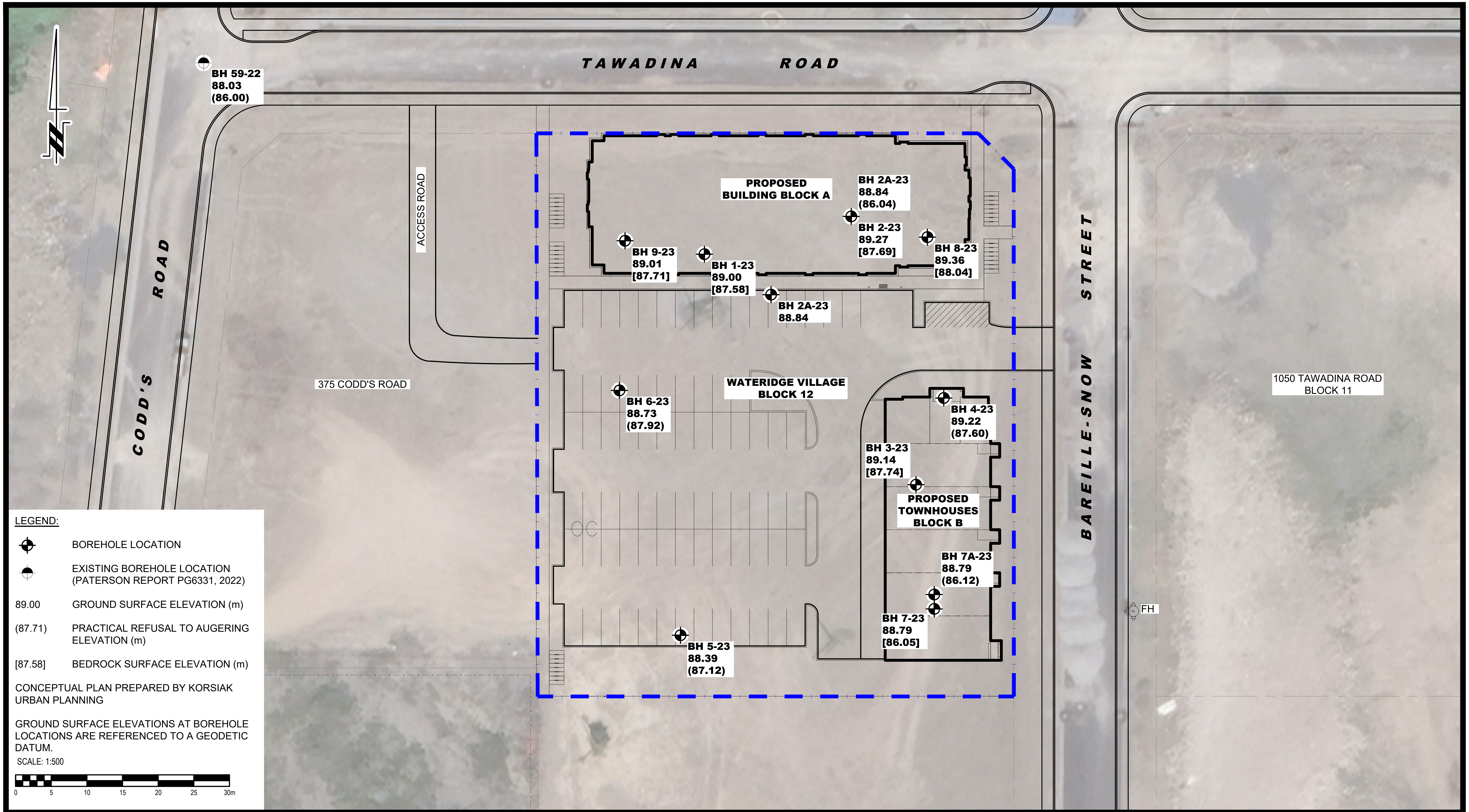


FIGURE 4

Aerial Photograph - 2022

PATERSON
GROUP



LEGEND:

⊕	BOREHOLE LOCATION
◓	EXISTING BOREHOLE LOCATION (PATERSON REPORT PG6331, 2022)
89.00	GROUND SURFACE ELEVATION (m)
(87.71)	PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
[87.58]	BEDROCK SURFACE ELEVATION (m)

CONCEPTUAL PLAN PREPARED BY KORSIAK URBAN PLANNING

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:500

0 5 10 15 20 25 30m

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
WATERIDGE VILLAGE - BLOCK 12

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500
Date: 04/2026
Drawn by: GK
Report No.: PG6688-1
Checked by: NP
Dwg. No.: PG6688-1
Approved by: KP
Revision No.:

11x17

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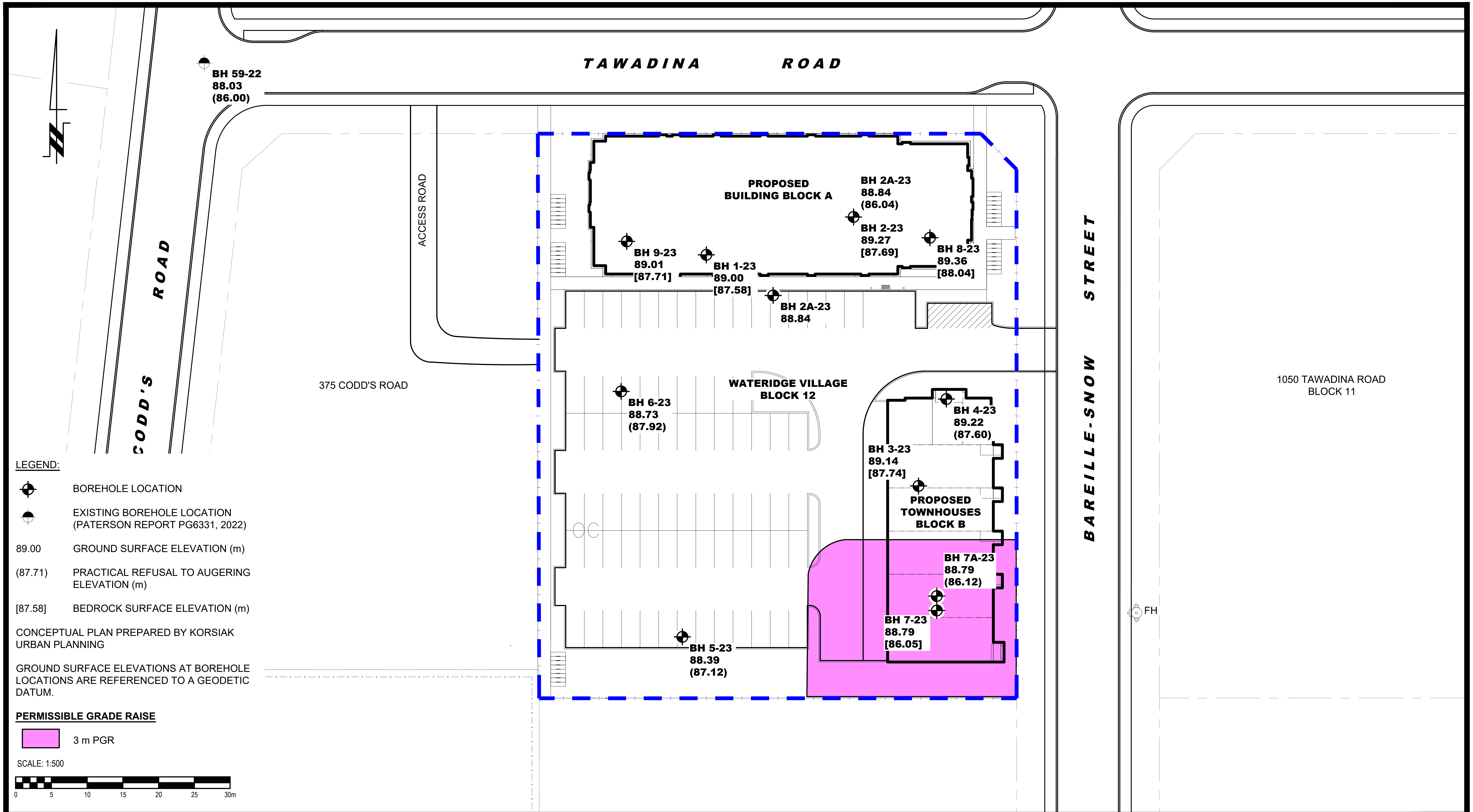

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⌖	BOREHOLE LOCATION
◓	EXISTING BOREHOLE LOCATION (PATERSON REPORT PG6331, 2022)
89.00	GROUND SURFACE ELEVATION (m)
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CONCEPTUAL PLAN PREPARED BY KORSIAK URBAN PLANNING

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

PERMISSIBLE GRADE RAISE

🟪 3 m PGR

SCALE: 1:500

0 5 10 15 20 25 30m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
WATERIDGE VILLAGE - BLOCK 12

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:500
Date: 04/2026
Drawn by: GK
Report No.: PG6688-1
Checked by: NP
Dwg. No.: PG6688-2
Approved by: KP
Revision No.:

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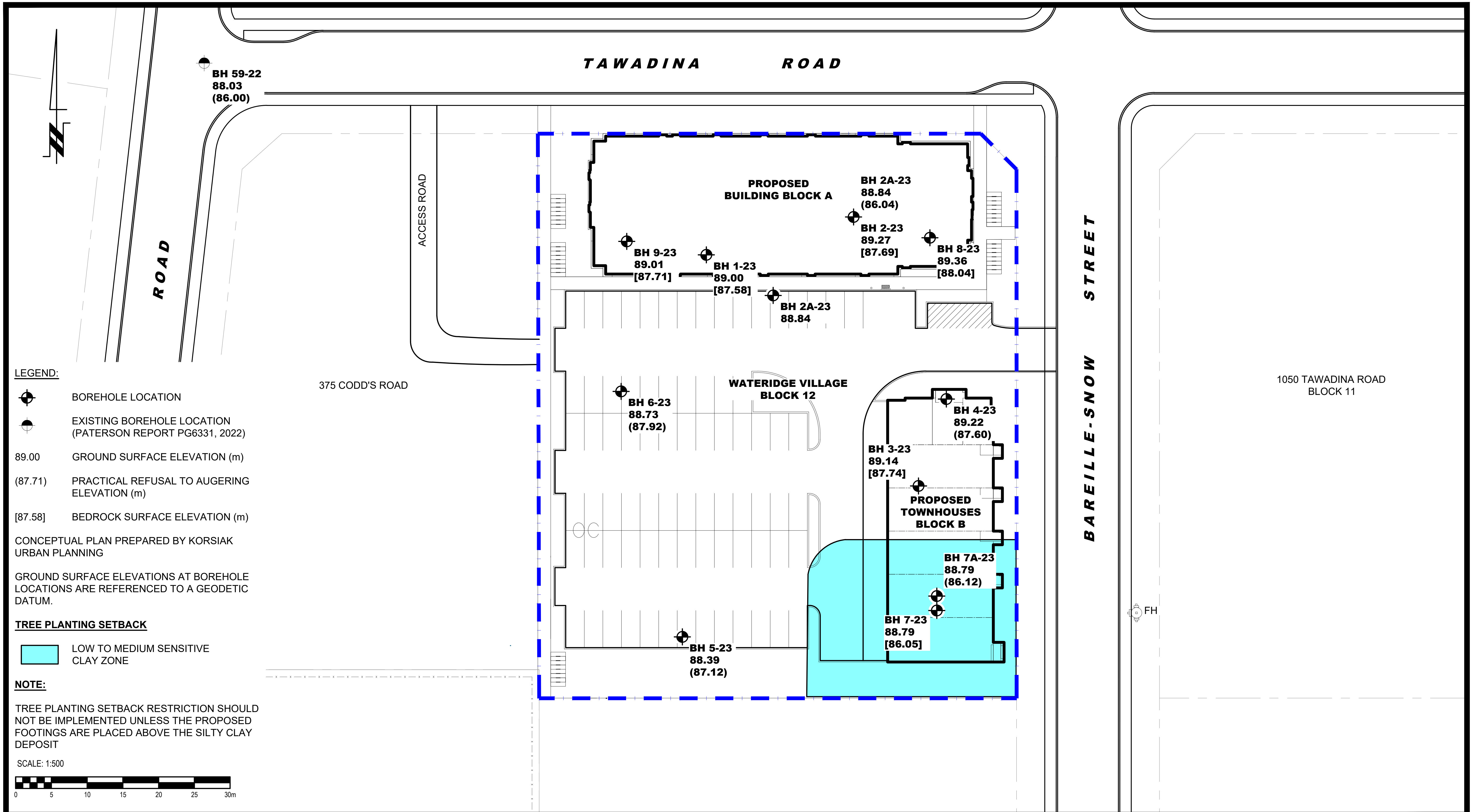

LEGEND:

⌖	BOREHOLE LOCATION
◓	EXISTING BOREHOLE LOCATION (PATERSON REPORT PG6331, 2022)
89.00	GROUND SURFACE ELEVATION (m)
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[87.58]	BEDROCK SURFACE ELEVATION (m)

CONCEPTUAL PLAN PREPARED BY KORSIAK URBAN PLANNING

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

TREE PLANTING SETBACK

🟦	LOW TO MEDIUM SENSITIVE CLAY ZONE

NOTE:

TREE PLANTING SETBACK RESTRICTION SHOULD NOT BE IMPLEMENTED UNLESS THE PROPOSED FOOTINGS ARE PLACED ABOVE THE SILTY CLAY DEPOSIT

SCALE: 1:500

0 5 10 15 20 25 30m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

MATTAMY HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
WATERIDGE VILLAGE - BLOCK 12

OTTAWA, ONTARIO

Title:

TREE PLANTING SETBACK PLAN

Scale: 1:500	Date: 04/2026
Drawn by: GK	Report No.: PG6688-1
Checked by: NP	Dwg. No.: PG6688-3
Approved by: KP	Revision No.:

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