Updated REPORT ON

Preliminary Geotechnical Investigation
Proposed Residential Development
496857 Grey Road 2
Town of Blue Mountain, Ontario

PREPARED FOR:

Homefield Communities

DS Project No: 23-301-100
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1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Homefield Communities to undertake a preliminary geotechnical investigation for the proposed residential development located at 496857 Grey Road 2 in the Town of Blue Mountain, Ontario.

It is understood that the proposed development will consist of construction of low-rise residential subdivision (standard and Back to Back townhouses) and a SWM pond (in area of Borehole BH23-4). All the residential blocks are assumed to be with or without basements, subject to long-term groundwater conditions and design grades.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions at borehole locations and from the findings in the boreholes to make preliminary engineering recommendations pertaining to the geotechnical design of underground utilities, roads and to comment on the foundation conditions for the building construction.

This geotechnical investigation is preliminary, based on a limited number of boreholes. More boreholes are recommended for the final design of the proposed development.

It should be noted that DS consultants Ltd. Is providing only preliminary geotechnical investigation report. It is understood that another consultant will provide hydrogeological recommendations in a separate report.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Homefield Communities and its architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

A total of five (5) boreholes (BH23-1 to BH23-5, see **Drawing 1** for borehole location plan) were drilled to depths ranging from 6.2 to 6.6m. Boreholes BH23-4 was drilled in the area of the proposed SWM pond.

The boreholes were drilled with solid and hollow stem augers by a drilling sub-contractor under the direction and supervision of DS Consultants Ltd. personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the DS Consultants Ltd. laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents. Grain size analyses of seven (7) soil samples were conducted and the results are presented in **Drawings 7 and 8**.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Monitoring wells of 50mm diameter were installed in all the boreholes for the long-term groundwater levels monitoring.

The elevation surveying of the borehole locations was undertaken by DS personnel, using the differential GPS unit. It should be noted that the elevations at the as-drilled borehole/well locations were not provided by a professional surveyor and should be considered approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

3. SUBSURFACE CONDITIONS

The borehole location plan is shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes by DS are presented in the individual borehole logs presented on **Drawings 2 to 6**.

3.1 SUBSURFACE SOIL CONDITIONS

Organic Material (Topsoil):

A layer of organic material/topsoil, varying in thickness from 50 to 230mm, was observed at the surface of all the boreholes.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow test pits should be carried out to explore the thickness of topsoil across the site.

Fill Material:

Fill materials consisting of sandy silt and sand to sand and gravel were encountered below the organic/topsoil layer in all the boreholes and extended to approximate depths varying from 0.8 to 1.6 m below the ground surface.

The fill was brown to dark brown in color and contained some to trace of organics, rootlets, silt, clay, gravel and stone fragments. The moisture content of this moist to wet fill layer varied from 7 to 40%.

The type/quantity and extent of the existing granular fill/fill layers can be explored by further test pit investigation prior to excavations.

It is strongly recommended that the proposed test pit investigation be carried out to confirm the type and depth of fill/organic material.

Silty Sand to Sandy Silt (Till)/Silt (Till)/Sand and Gravel/Gravel and cobbles Cohesionless deposits:

Silty Sand to Sandy Silt (Till)/silt (till)/Sand and Gravel/Gravel and cobbles cohesionless deposits extended below the fill to the maximum explored depth of all the boreholes. These cohesionless deposits contained some to trace of clay, silt, gravel, cobbles, boulders and stones.

This deposit was found in a compact to very dense state, with SPT 'N' values ranging from 15 to over 100 blows per 300 mm of penetration. Frequent cobbles, boulders and stones were inferred within these deposits during drilling. The moisture content of the moist to wet sandy/gravelly deposits varied from 7 to 23%.

Grain size analyses of seven (7) soil samples from this cohesionless deposit (BH23-1/SS6, BH23-2/SS3 and SS6, BH23-3/SS3 and SS6, BH23-4/SS6 and BH23-5/SS6) were conducted and the results are presented on **Drawings 7 and 8**, with the following fractions:

Clay: 3 to 10%

Silt: 14 to 51%

Sand: 28 to 54%

Gravel 8 to 33%

3.2 GROUNDWATER CONDITIONS

The groundwater levels in the monitoring wells at BH23-1 to BH23-5 were measured on December 5, 2023 and are presented in Table 1.

Table 1: Groundwater Levels Observed in Monitoring Wells

Monitoring Well No.	Ground Surface Elevation (m)	Date of Drilling	Date of Observation	Groundwater Table Depth (mbgs)	Elevation of Groundwater Table (m)
BH23-1	190.8	Nov 23, 2023	Dec 5, 2023	1.2	189.6
BH23-2	188.2	Nov 22, 2023	Dec 5, 2023	1.8	186.4
BH23-3	187.2	Nov 22, 2023	Dec 5, 2023	1.0	186.2
BH23-4	182.2	Nov 22, 2023	Dec 5, 2023	2.3	179.9
BH23-5	184.2	Nov 22, 2023	Dec 5, 2023	0.4	183.8

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Furter groundwater monitoring process is required to determine the long-term groundwater levels.

In addition, due to the high groundwater levels, further details on the extent and the conditions of the groundwater, as well as the recommended groundwater control should be provided in the hydrogeology study by others.

3.3 SUBSURFACE SOIL CONDITIONS (SWM POND – BH23-4)

Organic Material (Topsoil):

A layer of organic material/topsoil, about 130mm, was observed at the surface of Borehole, BH23-4.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow test pits should be carried out to explore the thickness of topsoil across the site.

Fill Material:

Fill materials consisting of sand and gravel were encountered below the organic/topsoil layer in the borehole and extended to approximate depth of 1.0 m below the ground surface. The fill was brown to dark brown in color and contained trace rootlets. The moisture content of this moist to wet fill layer varied from 13 to 19%.

The type/quantity and extent of the existing granular fill/fill layers can be explored by further test pit investigation prior to excavations.

It is strongly recommended that the proposed test pit investigation be carried out to confirm the type and depth of fill/organic material.

Silty Sand to Sandy Silt/Silt Till/Sand and Gravel/Gravel and cobbles Cohesionless deposits:

Silty Sand to Sandy Silt)/silt till/Sand and Gravel/Gravel and cobbles cohesionless deposits extended below the fill to the maximum explored depth of the borehole BH23-4. These cohesionless deposits contained some to trace of clay, silt, gravel, cobbles, boulders and stones.

This deposit was found in a dense to very dense state, with SPT 'N' values ranging from 45 to over 100 blows per 300 mm of penetration. Frequent cobbles, boulders and stones were inferred within these deposits during drilling. The moisture content of the sandy/silty/gravelly deposits varied from 8 to 12%.

Grain size analyses of one (1) soil sample from this cohesionless deposits (BH23-4/SS6) were conducted and the results are presented on **Drawings 7 and 8**, with the following fractions:

Clay: 10%

Silt: 51%

Sand: 30%

Gravel 9%

3.4 GROUNDWATER CONDITIONS (SWM POND – BH23-4)

The groundwater level in the monitoring well at BH23-4 was measured on December 5, 2023 at approximate depth of 2.3m below ground surface, at approximate elevations of 179.9m.

However, it should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Furter groundwater monitoring process is required to determine the long-term groundwater levels.

In addition, further details on the extent and the conditions of the groundwater, as well as the recommended groundwater control should be provided in the hydrogeology study by others.

4. DISCUSSION AND RECOMMENDATIONS

4.1 SITE GRADING AND ENGINEERED FILL

The site will be developed as residential subdivision with residential lots, underground services, roads and driveways. In the areas where earth fill is required for site grading purposes, an engineered fill can be constructed below house foundations, roads, boulevards, etc.

In all boreholes organic material (topsoil) followed by fill materials were encountered at the upper levels to depths ranging from 0.8 to 1.6 m. All topsoil/organic materials must be removed and this fill can be sub-excavated and replaced with engineered fill using selected on site material.

Prior to placement of engineered fill, all existing surficial organic material/topsoil, fill materials and weathered/disturbed/loose native soils containing topsoil/organics should be stripped to expose the inorganic native subgrade. The exposed subgrade should then be proof rolled with a heavy smooth roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer.

Dewatering system will be required for excavations below groundwater table. The hydrogeology study, by others, should provide further details on the extent and the conditions of the groundwater, as well as the recommended groundwater control.

General guidelines for the placement and preparation of engineered fill are presented on **Appendix A** of this report. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The following is a recommended procedure for an engineered fill:

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained, and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements (where applicable), garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS. Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre- and post-fill location and elevations will also be required.

4. The area must be stripped of all topsoil, fill materials, weathered/disturbed and less competent native soils, to be confirmed on site during grading/excavation process. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill must be in 200 mm lifts and compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.

6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

10. After completion of the pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain, and frost.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

4.2 ROADS

The internal roads within the proposed residential development can be categorized mainly as local roads with a curb and gutter arrangement.

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and any other organic and otherwise unsuitable and less competent subsoil, will generally consist of sand/sand and gravel/sandy silt to silty sand.

Based on the expected subgrade soil type from the field and laboratory investigations, assuming traffic usage will be internal local roads, and DS's experience with similar subdivision projects the following minimum pavement thickness is recommended for roads to be constructed within the subdivision:

Internal Local Roads

- 40 mm HL3 Hot Mix Asphalt (HMA) Surface Course PGAC 58-28
- 50 mm HL8 HMA Base Course PGAC 58-28
- 150 mm OPSS 1010 Granular 'A' Base
- 400 mm OPSS 1010 Granular 'B' Type I Subbase

Total Pavement Thickness = 640 mm
Granular Base Equivalency (GBE) = 598 mm

The foregoing designs assume that construction is carried out during dry periods and that the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather, and heaving or rolling of the subgrade is experienced, additional thickness of granular subbase material may be required to facilitate construction. The need for filter fabric/geo-grid can be evaluated during construction stage. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.2.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil and any organic material, fill (if encountered), weathered or otherwise unsuitable/loose soils to the full depth of the roads, both in cut and fill areas. After stripping of topsoil/organic soil, additional engineered fill may be required and based on profile grades of the new residential roads within the subdivision. Following stripping, the site should be graded to the subgrade level and approved.

The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes.

Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer.

The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly

to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering is required to allow the surface water to escape towards the sides, where it can be removed by means of subdrains. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 98% of its SPMDD or as per the Town Standards. The compaction of the new fill should be checked by frequent field density tests.

In addition, a hydrogeology study is recommended for further details on the extent and the conditions of the groundwater, as well as the recommended groundwater control.

4.2.2 ROAD CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and subbase course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading, and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and subbase materials to ensure that the required degree of compaction is achieved.

4.2.3 DRAINAGE

The frost penetration depth is an average of 1.5 m in the area. Since it is unrealistic to construct the pavement with non-frost susceptible materials to the frost depth, the need for adequate drainage cannot be overemphasized. As such, to ensure pavement structure performance and maximum life expectancy, drainage measures should be implemented into the construction of the roadway.

The installation of full-length subdrains on all roads with curb and gutter is recommended. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. As discussed in Section 4.2.1, by means of good planning any water trapped in the granular subbase materials should be drained rapidly towards subdrains or other interceptors.

4.3 SEWERS

As a part of the site development, a network of new watermains, storm and sanitary sewers will be constructed. It is assumed that the trenches will generally be within 4 to 5 m below the existing grade.

The type of material for the pipes to be used for watermains or sewers will be the choice of civil engineer.

4.3.1 TRENCHING

The boreholes show that below the existing topsoil, the trenches will be mostly dug through silty/sandy/gravelly sand soils/cobbles and boulders. Water seepage in excavations above groundwater can be controlled by conventional pumping methods. Positive dewatering will be required prior to any excavation in silty sand/sandy silt/sand and gravel or other cohesionless soils (sand, silt, sand & gravel, sandy silt to silty sand till) below the groundwater table; otherwise, it will result in unstable base and flowing sides (subject to depth of excavations, groundwater conditions and Hydrogeology report recommendations). It is recommended that the groundwater table be lowered to a minimum depth of 1 m below the base of the excavation.

A hydrogeology study is recommended for further details on the extent and the conditions of the groundwater, as well as the recommended groundwater control.

Excavations in fill and native soils can be carried out with heavy hydraulic backhoe.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and native soil (silty sand till, sand, silt, sandy silt to silty sand and sand and gravel) can be classified as Type 3 Soil above the groundwater table and Type 4 Soil below the groundwater table.

Boulders, cobbles and stones/rocks are present in in the soil deposits. Therefore, provisions can be made in the excavation contract for the removal of possible boulders in the glaciolacustrine deposits and obstructions in any fill material.

4.3.2 BEDDING

The undisturbed native soils encountered in the boreholes are considered to be competent to provide adequate support for the sewer pipes and will allow the use of normal Class B type bedding. The recommended minimum thickness of Class B bedding below the invert of the pipes is 150 mm. The

thickness of the bedding may, however, need to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt.

It is recommended that the bedding material consist of well-graded granular material such as Granular 'A' (OPSS 1010). To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the uniformly graded bedding material.

4.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the existing native soils can be reused as backfill material provided its moisture content is within 2 percent of optimum moisture content. Selected imported fill material may also be used following approval from this office.

These native sand soils have very few fines and can be compacted using handheld equipment. Some of the native soils are acceptable for use as granular B as seen in **Drawing 9**. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) is permissible, subject to approval by the geotechnical engineer.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.0 m of the subgrade, underneath the road base, the compaction should be increased to 98% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

Granular B material should be used as backfill for trenches located under slab on grade or paved areas. Compaction of the granular soils should be carried out with vibratory compactors and loose lifts not exceeding about 200 mm.

Imported granular fill, which can be compacted with handheld equipment, should be used in confined areas.

Some of the excavated soils are free draining. Where free draining backfill is required, the selected native soils should be reviewed by this office to confirm their compliance with granular B gradations. Imported granular fill such as OPSS Granular B may also be used.

4.4 FOUNDATION CONDITIONS

It is understood that the proposed development will consist of construction of low-rise residential subdivision (standard and back to back townhouses) throughout the site and a SWM pond (in the area

of BH23-4). All the residential blocks are assumed to be with or without basement, subject to long-term groundwater conditions and design grades.

The design grades are not known at this stage. Therefore, our recommendations are preliminary and must be confirmed/updated when the detailed design grading plans are available.

4.4.1 Residential Houses

Subject to design grades, due to the difference in ground elevations, and based on the borehole information and the variable soil conditions and the presence of fill, the proposed townhouses can be supported by conventional footings founded on the competent undisturbed native soils. Soil bearing resistance and founding depths/elevations are presented in Table 3.

Table 3: Bearing Values and Founding Levels of Footings on Native Soils

BH No.	Borehole Elevation (m)	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH23-1	190.8	150	225	1.8	189.0
BH23-2	188.2	150	225	1.0	187.2
BH23-3	187.2	150	225	1.0	186.2
BH23-4	182.2	150	225	1.2	181.0
BH23-5	184.2	150	225	1.2	183.0

The encountered sand at the base of footings can be easily disturbed by construction activities. A concrete skim coat, about 50 mm in thickness, on the founding subgrade immediately after its approval might be required, on a case-by-case basis, to prevent its disturbance by construction activities.

Again, due to the difference in ground elevations and subject to design grades, should the proposed footings be founded above the competent native soils, then the proposed houses can also be supported by spread and strip footings founded on engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements on **Appendix A** and section 4.1 of this report are adhered to.

4.4.2 General Foundation Notes

Positive dewatering will be required for foundation installations below groundwater, subject to depth pf excavations, groundwater monitoring results and the hydrogeology report recommendations.

Low strength concrete (to be determined by the structural engineer) to bring the subgrade up to the specified underside of foundation elevations, subject to design grades.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.5 metres of soil cover for frost protection.

All footings bases must be inspected by this office to confirm the bearing capacity values, prior to pouring concrete.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing capacities have been calculated by DS from the limited borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by DS to validate the information for use during the construction stage.

4.5 EARTH PRESSURES AND RETAINING WALLS

The lateral earth pressures acting on basement walls, and retaining walls may be calculated from the following expression:

$$p = k (\gamma h + q)$$

where, p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient, see Table 4

γ = Unit weight of backfill, a value of 21 kN/m3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

The designer of the retaining walls must ensure that the retaining wall is stable and safe in terms of bearing capacity, horizontal sliding, overturning and global (slope) stability.

The retaining walls can be founded on undisturbed native soils and/or engineered fill for bearing capacity values of 150 kPa at SLS and 225 kPa at ULS, as recommended for footings in Section 4.5.1 of the report.

Recommended soil parameters for the design and analyses of the retaining wall are presented on **Table 4** below.

Table 4: Design Parameters for Retaining Walls

Soil Parameter	Recommended Value
Soil friction angle – Native soil and engineered fill, ϕ (degree)	30
Soil cohesion – Native soil and engineered fill, c (kPa)	0
Soil unit weight, γ (kN/m^3)	21
Coefficient of earth pressure on vertical wall, K - Assuming horizontal/level ground behind wall	0.40
Coefficient of passive earth pressure on vertical wall, K_p For native soils or engineered fill: - Assuming horizontal/level ground in front of wall	3.0

A friction coefficient of μ = 0.50 (unfactored) can be used between the wall base and native soil or engineered fill.

Passive earth pressure should be ignored for the soil above the frost depth of 1.5 m.

A drainage system behind the retaining wall must be constructed to prevent the build-up of any hydrostatic pressure on the wall. The wall should incorporate a subdrain system placed at the lowest feasible level behind the wall. A 100 mm diameter perforated flexible weeping tile should be enveloped within a bed of 19 mm crushed clear stone, which is in turn fully wrapped in an approved filter membrane (Terrafix 270R or equivalent). The subdrain should discharge to a positive, frost-free outlet.

4.6 FLOOR SLAB AND PERMANENT DRAINAGE

Due to the highly permeable soils (sand, silty sand, sand and gravel) at the site, any basement should be constructed above groundwater table. For any basement below groundwater table, hydrogeological study must be carried out for the feasibility to install permanent perimeter and underfloor drainage systems.

The floor slab can be supported on grade provided all organic materials/topsoil, fill and surficial softened/disturbed native soils are removed and the base thoroughly proof rolled.

The fill required to raise the grade can consist of inorganic soil, approved by this office, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system as shown in Drawing 9 will be required around the exterior basement walls due to depth of groundwater, and presence of free draining native soils, subject to design grades.

Feasibility studies of permanent underfloor drainage and perimeter drainage must be carried out in the hydrogeological investigation, to estimate seepage rates into the permanent drainage systems.

4.7 STORMWATER MANAGEMENT POND

The following pond design information was provided by Tatham Engineering (Drawing No. PND 1, dated August 28, 2024):

- Bottom of Forebay: Elev. 181.0 m
- Bottom of Wet Land: Elev. 181.7 m
- Normal Water Level (NWL): Elev. 182.0 m
- Top of Pond: Elev. 184.0 m

Borehole BH23-4 was drilled in the proposed pond area. Based on the subsurface conditions encountered in Borehole BH23-4, the soils at the pond sides and base after removing the existing topsoil/fill and disturbed materials will consist of sand and gravel. During the borehole drilling, wet soils were encountered at about 1 m below ground surface. The groundwater level in the monitoring well at BH23-4 was measured on December 5, 2023 at approximate depth of 2.3m below existing ground surface, at approximate elevation of 179.9m. However, it should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Long term groundwater table is expected to be higher. Furter groundwater monitoring process is required to determine the long-term groundwater levels.

Due to the sandy/gravelly soil conditions at the site, a liner will be required in order to retain water in the pond. It is recommended that a clay liner of min. 0.6 m thick be installed at the bottom and side slopes of the pond, extending to the high water Level. The clay liner should consist of inorganic silty clay material, containing minimum 20% clay (finer than 0.002 mm) and having a plasticity index (PI) of minimum 8. The clay liner material should be compacted to 100% of Standard Proctor Maximum Dry

Density (SPMDD). Alternatively, a BENTOFIX "CNS Series" or GCL can be used (designed by specialist contractor) instead of the clay liner.

Where a berm (embankment) is required to raise the grade for the side slopes of the pond, the berm material should consist of inorganic silty clay material with minimum clay content of 20% and minimum plasticity Index of 8, compacted to 100% of SPMDD. Prior to the construction of the berm, all topsoil, fill, loose/disturbed soils and other unsuitable materials within the footprint of the berm embankment must be removed, and the excavation base must be thoroughly proof rolled. The excavation base must be inspected and approved by the geotechnical engineer prior to placing the berm fill.

For excavations below groundwater table, a dewatering system must be utilized to lower the groundwater table at least 1.0 below the bottom of excavations.

The sloped sides of the pond should be constructed at a 3 horizontal to 1 vertical (3H:1V) or flatter above the pond water. Below the high water level of the pond, the side slopes should be 4H:1V or flatter. The native sandy soils are subject to erosion from rainfall events and therefore the final grade of the pond should be covered with topsoil and vegetation.

Further borehole investigation to confirm the subsurface soil and groundwater conditions will be required prior to finalizing the pond design. Further groundwater level measurements are required to determine the long-term groundwater table and to evaluate the uplift stability of the liner.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation.

Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become

apparent during construction, which could not be detected or anticipated at the time of the site investigation.

The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably.

The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

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

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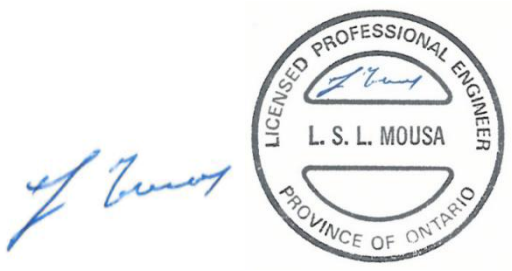
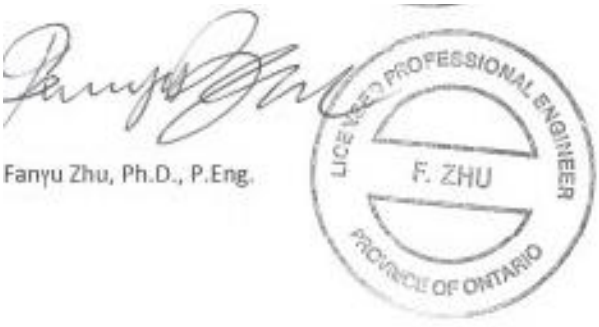


Labib Mousa, P.Eng.

Alka Sangar, M.Eng., P.Eng.



Fanyu Zhu, Ph.D., P.Eng.

Drawings

J:\2023 Projects\23-301-100 Geo - 496857 Grey Road 2, Town of Blue Mountain, Ontario\Geotechnical

Legend

Monitoring Well

DS CONSULTANTS LTD.
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Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
496857 Grey Road 2, Town of Blue Mountain, ON

Title: **BOREHOLE LOCATION PLAN**

N

Client: HOMEFIELD COMMUNITIES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	L.M	K.T	December 2023
Rev: 0	Scale: As Shown	Project No.: 23-301-100	Figure No.: 1

Image/Map Source: *Google Satellite Image*

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-1

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932642.81 E 544944.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-23-2023

REF. NO.: 23-301-100
ENCL NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
190.8					
190.6 0.0	**TOPSOIL:** 150mm				
0.2	**FILL:** sandy silt, some clay, trace rootlets, some gravel, trace organics, dark brown, moist, loose	1	SS	7	
	stone fragments, wet at 0.8m	2	SS	9	190
189.2	wet sand at 1.5m				
1.6	**SAND AND GRAVEL:** trace silt, with cobbles/boulders, brown, wet, very dense	3	SS	50/ 130mm	189
188.7	grey below 1.8m				
2.1	**SANDY SILT TO SILTY SAND TILL:** trace clay, trace to some gravel, with cobbles/boulders, brown to grey, very moist to wet, very dense	4	SS	50/ 130mm	
		5	SS	50/ 75mm	188
					187
	gravelly at 4.6m	6	SS	50/ 130mm	186
					185
184.6		7	SS	50/ 130mm	
6.2	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	1.18

W. L. 189.6 m
Dec 05, 2023

Auger grinding at 1.5m

Auger grinding at 3.1m

Auger grinding at 4.6m

33 45 17 6

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-2

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932695.67 E 545205.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.2							
0.0 / 188.0	**TOPSOIL:** 230mm						
0.2 / 187.4	**FILL:** sand and gravel, trace topsoil, dark brown, moist, loose	1	SS	9		188	
0.8 / 187.2	**SAND:** some gravel, trace silt, brown, wet, compact						
1.0 / 186.7	**SANDY SILT TILL:** some clay, trace gravel, brown, wet, compact	2	SS	15		187	
1.5	**SILTY SAND:** gravelly, trace clay, with cobbles/rock fragments, brown, wet, compact	3	SS	29	▽		25 44 25 7
2 / 185.9					W. L. 186.4 m Dec 05, 2023	186	
2.3	**SANDY SILT TO SILTY SAND TILL:** trace clay, some gravel, with cobbles/boulders, grey, very moist to wet, very dense	4	SS	71			
3		5	SS	50/ 150mm		185	
4						184	auger grinding at 4.6m 17 28 47 8
5		6	SS	50/ 75mm		183	
6 / 182.0							
6.2	**END OF BOREHOLE:**	7	SS	50/ 50mm		182	

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	1.81

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH23-3

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932693.05 E 545523.36

DRILLING DATA
Method: Solid Stem Auger/Hollow Stem Auger
Diameter: 150mm/200mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.2												
186.9 / 0.3	**TOPSOIL:** 50mm											
	FILL: sand and gravel, trace rootlets, trace silt, dark brown, very moist, loose		1	SS	7		187					
186.4												
0.8	**GRAVELLY SAND:** some silt, trace clay, with cobbles/boulders, brown, wet, compact		2	SS	17	▽						
							W. L. 186.2 m Dec 05, 2023					
			3	SS	16							29 54 14 3
184.9							185					
2.3	**SANDY SILT TILL:** trace clay, trace gravel, with cobbles/boulders, grey, very moist, dense to very dense		4	SS	46							
			5	SS	68		184					Switched to Hollow Stem
							183					
			6	SS	50/ 130mm							8 32 51 9
							182					
			7	SS	50/ 130mm		181					
180.6												
6.6	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Dec. 5, 2023 1.0											

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-4

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932792.79 E 545632.71

DRILLING DATA
Method: Solid Stem Auger/Hollow Stem Auger
Diameter: 150mm/200mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
182.2						
182.0 0.0	**TOPSOIL:** 130mm					
0.1	**FILL:** sand and gravel, trace rootlets, dark brown to brown, very moist to wet, loose to dense	1	SS	14	182	
181.2		2	SS	45		
1.0 181.0	**SAND AND GRAVEL:** trace silt, with cobbles/boulders, brown, wet, dense				181	
1.2	**SILTY SAND TO SANDY SILT TILL:** trace to some clay, trace gravel, with cobbles/boulders, brown to grey, very moist to wet, dense to very dense	3	SS	50/ 130mm		
		4	SS	50/ 100mm	180	W. L. 179.9 m Dec 05, 2023 Switched to Hollow Stem Auger @2.3m
		5	SS	50/ 130mm	179	
					178	
		6	SS	50/ 100mm		9 30 51 10
176.2					177	
6.0	**SILT TILL:** sandy, trace gravel, occasional cobble, grey, moist, very dense	7	SS	50/ 130mm	176	
175.6						
6.6	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Dec. 5, 2023 2.25					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH23-5

PROJECT: Preliminary Geotechnical Investigation
CLIENT: Homefield Communities
PROJECT LOCATION: 496857 Grey Road 2, Blue Mountain, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4932757.62 E 545486.69

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Nov-22-2023

REF. NO.: 23-301-100
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.2												
184.0 0.0	**TOPSOIL:** 130mm											
0.1	**FILL:** sand, trace rootlets, trace gravel, brown, very moist to wet, loose to compact		1	SS	4		184					
183.2												
1.0	**SAND AND GRAVEL:** trace silt, trace clay, brown, wet, compact to very dense		2	SS	21		183					
182.3			3	SS	67							
1.9	**SANDY SILT TO SILTY SAND TILL:** trace clay, trace to some gravel, occasional cobbles, grey, moist to wet, very dense		4	SS	50/ 100mm		182					
			5	SS	50/ 100mm		181					
			6	SS	50/ 130mm		180					14 45 34 7
178.2							179					
6.0	**SILT TO SANDY SILT TILL:** trace clay, trace gravel, grey, very moist, very dense		7	SS	50/ 130mm		178					
177.8												
6.4	**END OF BOREHOLE:**											

W. L. 183.8 m
Dec 05, 2023

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Dec. 5, 2023	0.42

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

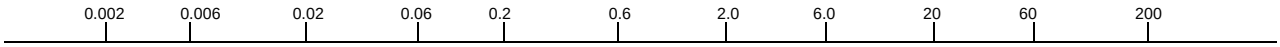
DS SOIL LOG-2021-FINAL 23-301-100GEO.GPJ DS.GDT 23-12-19

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DS also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

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



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

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

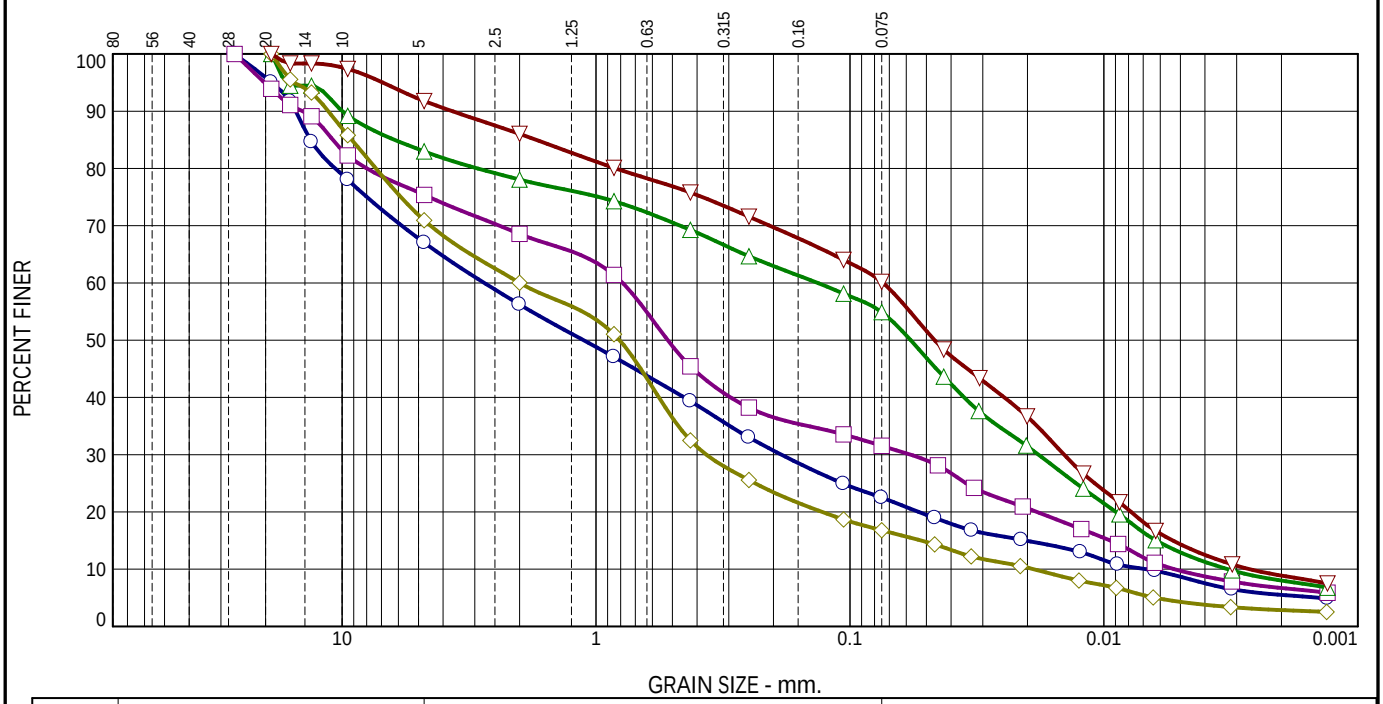
UNIFIED SOIL CLASSIFICATION

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

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

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.9	28.1	10.8	16.8	16.9	17.0	5.5
□	0.0	6.0	18.6	6.8	23.2	13.8	24.9	6.7
△	0.0	0.0	17.0	4.9	8.8	14.4	46.9	8.0
◇	0.0	0.0	29.1	10.9	27.5	15.7	13.9	2.9
▽	0.0	0.0	8.2	5.8	10.2	15.6	51.3	8.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			13.3576	2.7542	1.1202	0.1861	0.0203	0.0068	1.85	405.40
□			10.8743	0.7852	0.5219	0.0577	0.0094	0.0053	0.80	148.65
△			6.2187	0.1341	0.0576	0.0181	0.0062	0.0032	0.75	41.27
◇			9.1622	1.9952	0.8072	0.3676	0.0524	0.0189	3.57	105.32
▽			1.7217	0.0741	0.0464	0.0143	0.0054	0.0027	1.04	27.73

Material Description	USCS	AASHTO
○ Gravelly sand, some silt, trace clay		
□ Gravelly sand, some silt, trace clay		
△ Sandy silt, some gravel, trace clay		
◇ Gravelly sand, some silt, trace clay		
▽ Sandy silt till, trace clay, trace gravel		

Project No. 23-301-100 Client: Homefield Communities.

Project: Preliminary Geotechnical Investigation, 496857 Grey Road 2, Blue Mountain.

○ Location: BH23-1 SS6 Sample Number: VM-4940

□ Location: BH23-2 SS3 Sample Number: VM-4940

△ Location: BH23-2 SS6 Sample Number: VM-4940

◇ Location: BH23-3 SS3 Sample Number: VM-4940

▽ Location: BH23-3 SS6 Sample Number: VM-4940

Remarks:

○ F.M.=3.45

□ F.M.=2.84

△ F.M.=1.74

◇ F.M.=3.35

▽ F.M.=1.23

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

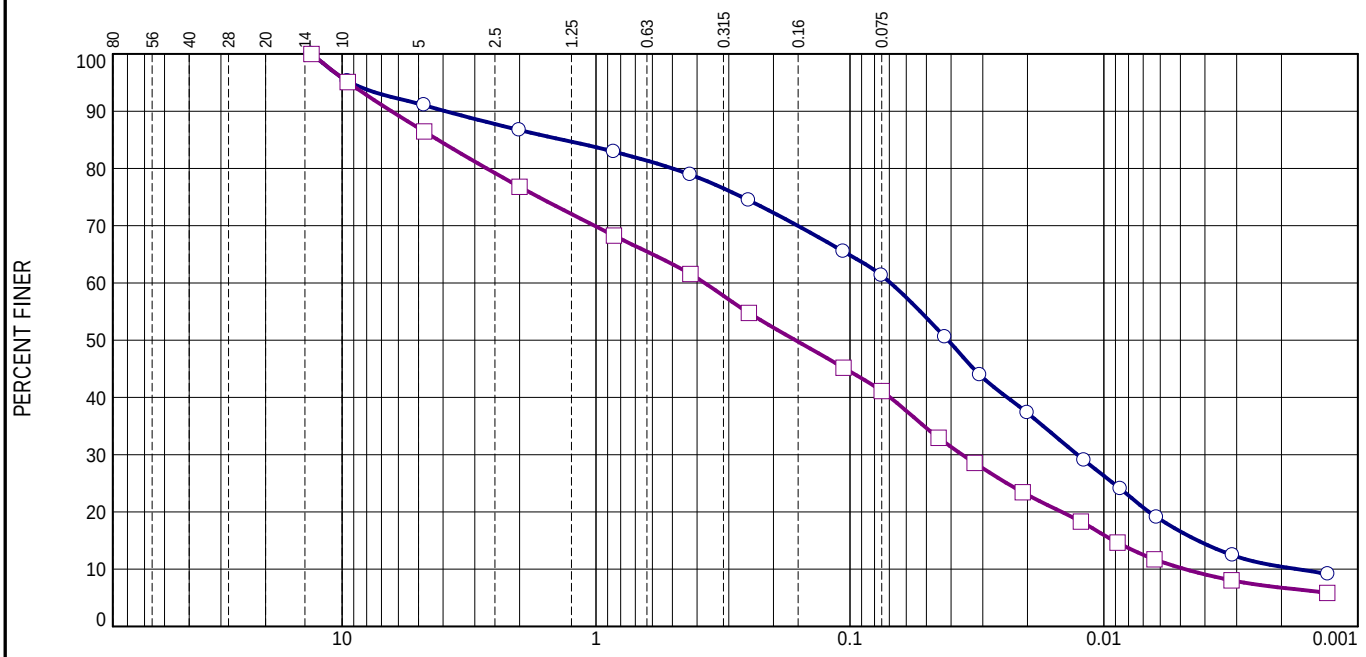
CCIL

Figure 7

Tested By: Helen/Disha Checked By: Kirupa

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.0	4.3	7.8	17.6	50.9	10.4
□	0.0	0.0	13.5	9.7	15.2	20.5	34.3	6.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3504	0.0692	0.0411	0.0127	0.0043	0.0017	1.36	40.11
□			4.1948	0.3733	0.1640	0.0361	0.0092	0.0048	0.73	77.87

Material Description	USCS	AASHTO
○ Sandy silt till, some clay, trace gravel □ Silty sand till, trace clay, some gravel		

Project No. 23-301-100 Client: Homefield Communities.

Project: Preliminary Geotechnical Investigation, 496857 Grey Road 2, Blue Mountain.

○Location: BH23-4 SS6 Sample Number: VM-4940

□Location: BH23-5 SS6 Sample Number: Vm-4940

Remarks:

○F.M.=1.15

□F.M.=1.97

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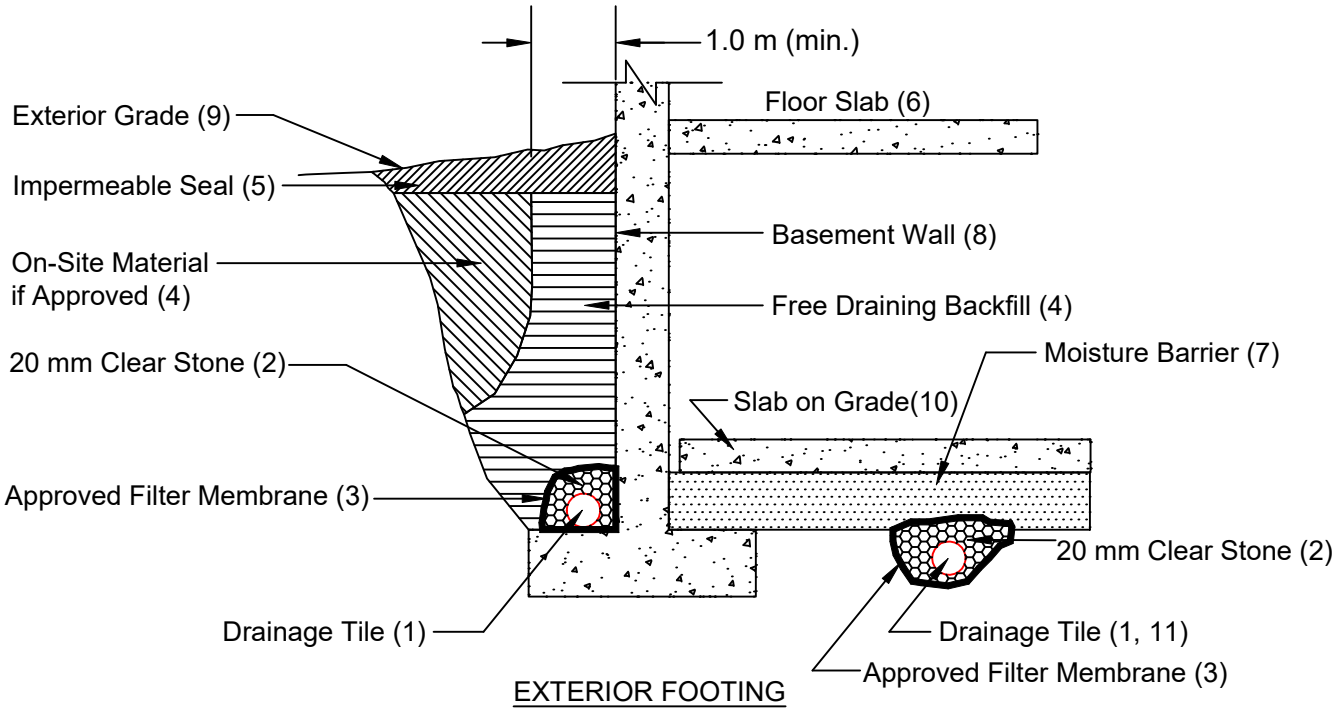
CCIL

Figure 8

Tested By: Helen/Disha Checked By: Kirupa



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

Appendix A

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DSCL). Without this confirmation no responsibility for the performance of the structure can be accepted by DSCL. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DSCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DSCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the DSCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

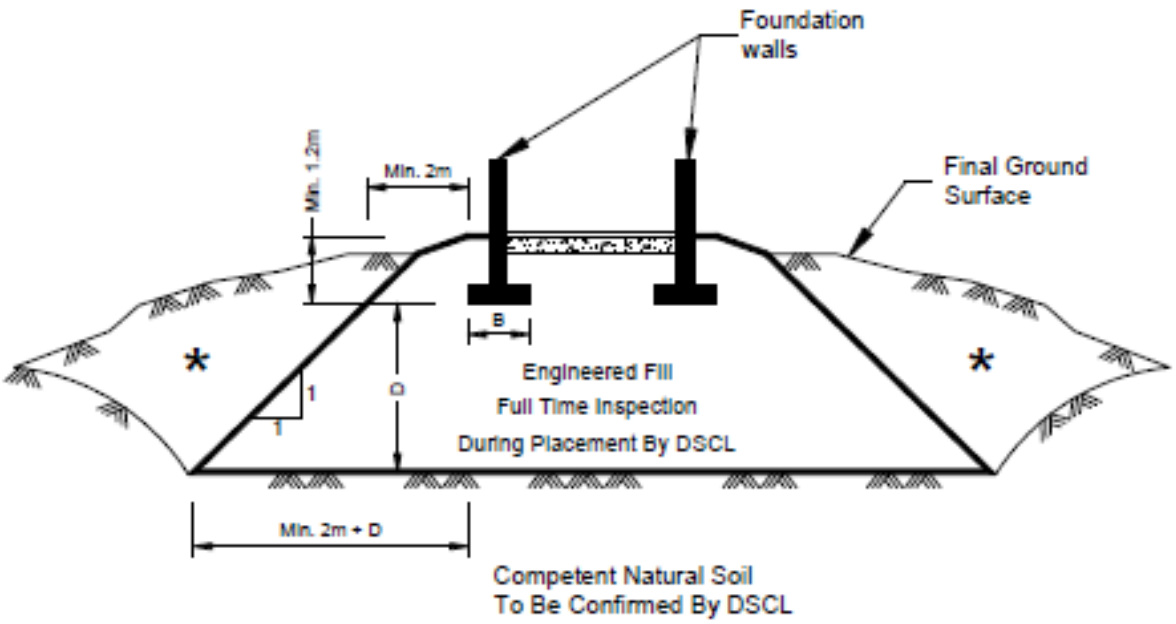
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DSCL.

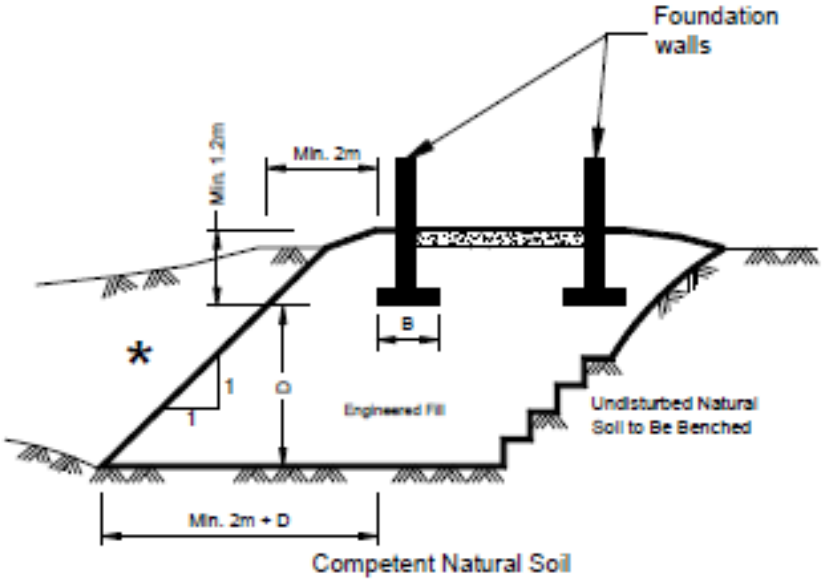
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





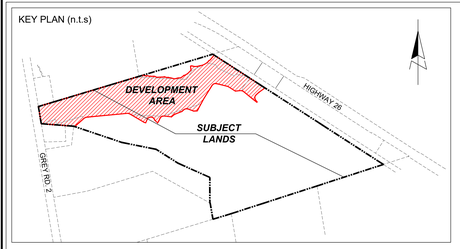
* Backfill in this area to be as per the DSCL report.

Appendix B

HINDS BROOK
SITE DEVELOPMENT PLAN

496857 GREY RD. 2
PART OF LOT 29
CONCESSION 8
TOWN OF THE BLUE MOUNTAINS
COUNTY OF GREY

KEY PLAN (n.t.s)



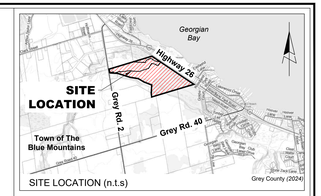
SITE DEVELOPMENT CONCEPT SUMMARY

TOTAL SITE AREA:	+/- 37.37 HA
TOTAL DEVELOPMENT AREA:	+/- 9.8 HA
TOTAL NUMBER OF DWELLINGS:	376 ROWHOUSE DWELLINGS

DENSITY PER TOTAL DEVELOPMENT AREA: APPROX. **39 DWELLINGS / HA**

RESIDENTIAL ROWHOUSE DWELLINGS

ROWHOUSE TYPE 1	- ROWHOUSE STANDARD (6.1m Frontage)	- 54 Units
ROWHOUSE TYPE 1A	- ROWHOUSE STANDARD (6.1m Frontage) (reduced rear yard setback from min. 7.5m to min. 5.5m)	- 46 Units
ROWHOUSE TYPE 2	- ROWHOUSE STANDARD (7.4m Frontage) (reduced rear yard setback from min 7.5m to min 5.5m)	- 42 Units
ROWHOUSE TYPE 3	- ROWHOUSE BACK TO BACK (6.7m Frontage)	- 156 Units
ROWHOUSE TYPE 4	- ROWHOUSE (4.95m Frontage)	- 62 Units
ROWHOUSE TYPE 4A	- ROWHOUSE (4.95m Frontage) (increased rear yard setback to min. 5.5m)	- 16 Units



SITE LOCATION (n.t.s)

LEGEND

- Property Boundary (+/-37.37 ha)
- Development Area (+/-9.8 ha) - per Natural Features Constraints
- Residential Rowhouse - Standard / Type 1 & 1A (100 Dwelling Units)
- Residential Rowhouse - Standard / Type 2 (46 Dwelling Units)
- Residential Rowhouse - Back To Back / Type 3 (156 Dwelling Units)
- Residential Rowhouse - Narrow / Type 4 & 4A (78 Dwelling Units)
- Neighbourhood Park & Parkette Areas (+/-1.24 ha or 12.6% of the Total Development Area)
- Retained Natural Heritage Areas - No Disturbance (+/-1.43 ha or 14.6% of the Total Development Area)
- SWM Pond (+/- 0.77 ha or 7.7% of the Total Development Area)
- Natural Heritage Constraint Area
- Natural Heritage Setback Area
- Temporary Snow Storage Areas
- Watercourse
- Natural Heritage Constraint Area Limit
- 15m Natural Heritage Area Setback
- Recreational Trail *(Alignment to be confirmed during construction)*
- 8m Wide Condo Road
- Condo Road Centerline *(6m Road, 12m Radius on Curb Centerline)*
- Sidewalk *(1.5m)*

Additional On-Site Parking 55 Spaces *(Min. 2.75m x 5.5m)*

GENERAL NOTES

All site measurements are in Metric.
All proposed site development features and measurements are illustrated for project review and discussions.

Plan Drawing References:

- Zubek, Emo, Patten & Thomsen Ltd. O.L.S., Plan of Survey (2024)
- Tatham Engineering. Hinds Property, Conceptual Constraint Plan (2024)
- Birks Natural Heritage Consultant Inc., Natural Heritage Constraints Study (2024)
- Town of The Blue Mountains, Zoning By-Law 2018-65

travis & associates
planning consultants
approvals facilitators
development managers
PO Box 323
Thornbury, ON
N0H 2P0
T.705-446-9917

homefield COMMUNITIES

SCALE 1:750 *(24" x 60" Page Format)*

0 10 20 40 60 80 Metres

METRIC
DISTANCES ON THIS PLAN ARE IN METRIC AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

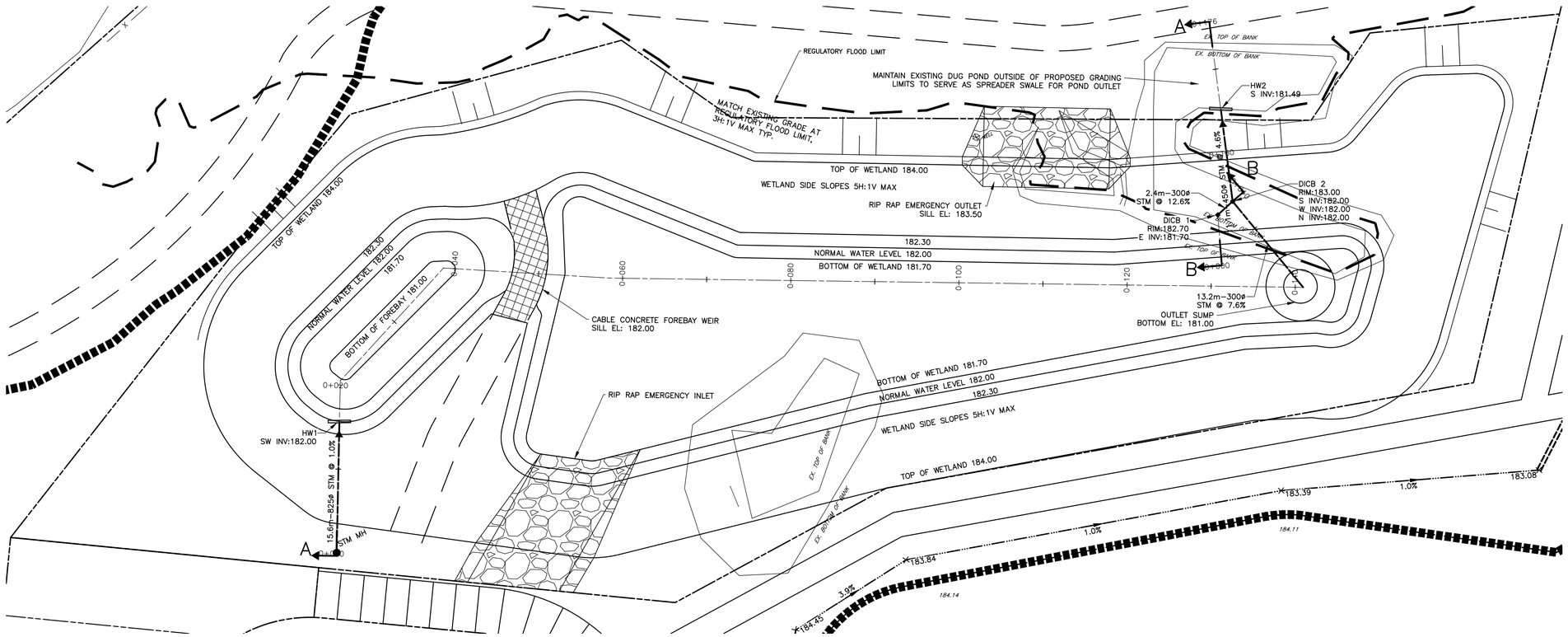
Revision #	Date D/M/Y	Description / Notes
1.	31/01/2024	PRELIMINARY DRAFT / ISSUED FOR REVIEW
2.	07/02/2024	REVISED DRAFT / ISSUED FOR REVIEW
3.	23/02/2024	REVISED DRAFT / ISSUED FOR REVIEW
4.	04/06/2024	REVISED DRAFT / ISSUED FOR REVIEW
5.	14/08/2024	REVISED DRAFT / ISSUED FOR REVIEW
6.	30/08/2024	REVISED DRAFT / ISSUED FOR REVIEW

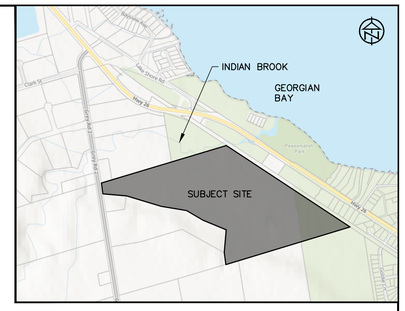
File/CAD: T&A_HindsBrook-SitePlan.dwg

Date(d/m/y): 30/08/2024 Drafted by: D.C. Checked by: A.H./R.A./C.T.

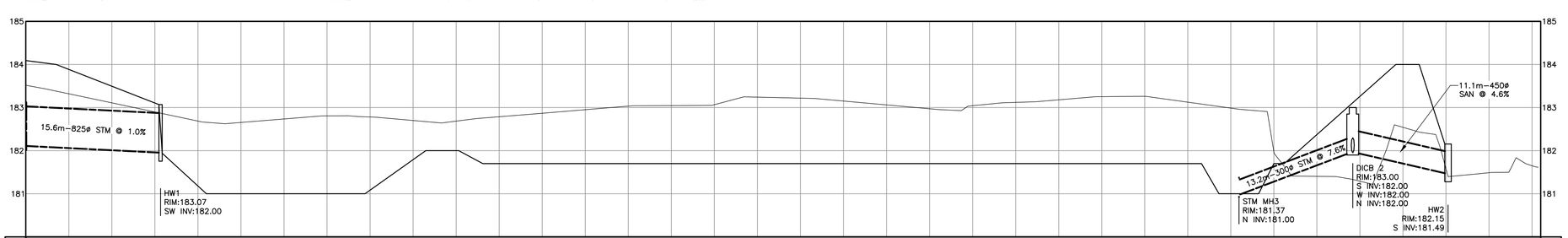
D-1

Date Plotted: August 30, 2024

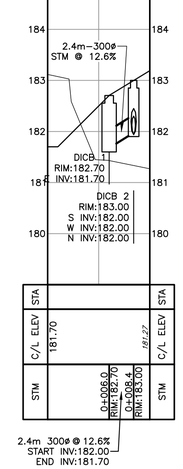




KEY PLAN



SECTION A–A



SECTION B–B

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE

ENGINEER STAMP

DRAFT FOR COORDINATION
AUGUST 28 2024

HINDS BROOK RESIDENTIAL DEVELOPMENT

TOWN OF THE BLUE MOUNTAINS

TATHAM ENGINEERING

POND PLAN AND SECTIONS

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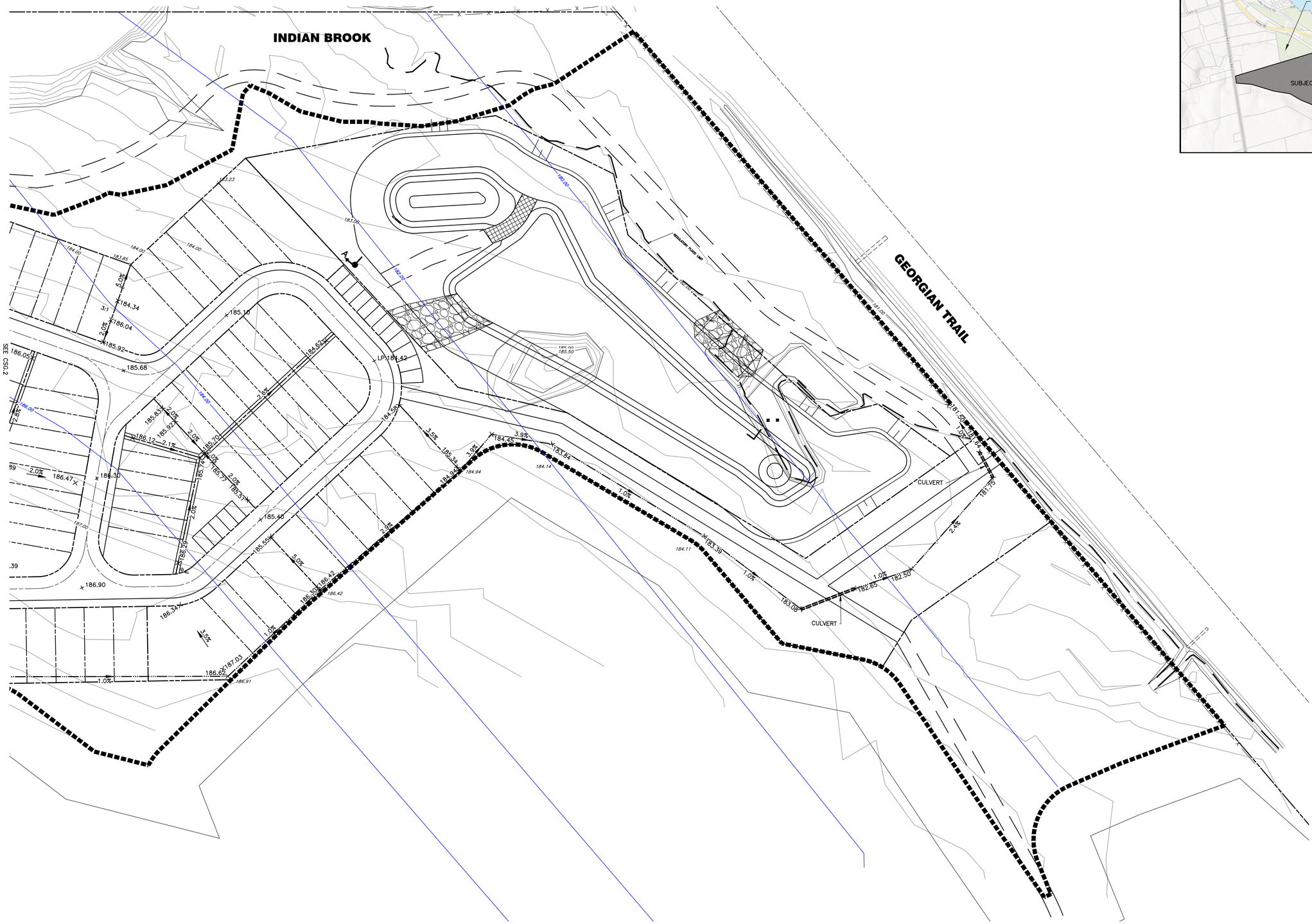
DRAWN: KRL/AO	DATE: JUL/24	
CHECK: AO	SCALE: 1:300 H, 1:60 V	

Drawing Name: 123069–LGX01_AO_Pond.dwg, Plotted: Aug 28, 2024



KEY PLAN

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BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE

ENGINEER STAMP

PRELIMINARY FOR COORDINATION
AUGUST 28 2024

HINDS BROOK RESIDENTIAL DEVELOPMENT

TOWN OF THE BLUE MOUNTAINS

CONCEPT GRADING PLAN
SHEET 3

TATHAM ENGINEERING

DESIGN: KRL	FILE: 123069	DWG: CGP.3
DRAWN: KRL	DATE: AUG 2024	
CHECK: AO	SCALE: 1:1000	

Drawing Name: 123069-CGP01.dwg, Plotted: Aug 28, 2024