ADDITIONAL GEOTECHNICAL INVESTIGATION

Wateridge Village - Phase 4, Block 5
Ottawa, Ontario

REPORT

January 24, 2024

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TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

Terrapex Environmental Ltd. (Terrapex) has been retained by Rohit Communities to carry out an additional geotechnical investigation for the proposed development located at 1076 Hemlock Private, Wateridge Community Phase 4 (the Site), in the City of Ottawa, Ontario. Authorization to proceed with this study was given by Mr. John Hebert of Rohit Communities.

We understand that Rohit Communities is seeking approval to develop the land at Wateridge Village referred to as Phase 4 including Block 4, Block 5 and Block 6 with middle-rise residential apartment dwelling. According to the Site Plan provided to Terrapex by Client on January 19, 2024, the Site is scheduled for a mixed-use residential development which would include the following:

- Block 4 will contain mid-rise residential apartment dwelling (Building D, six storeys with one level of underground parking garage).
- Block 5 will contain mid-rise residential apartment dwelling (Building A, four storeys with one level of underground parking garage).
- Block 6 will contain two mid-rise residential apartment dwellings (Building B and Building C, four storeys with one level of underground parking garage).

Geotechnical investigations have been conducted at the Site previously and the most recent geotechnical investigation report prepared by Terrapex dated February 5, 2019 with a Title of ***Geotechnical Investigation Report, Proposed Mixed-Use Development, Phase 2A & 2B, Wateridge Village, Ottawa, Ontario*** was reviewed. The relevant soil and groundwater information from this previous investigation are presented in this report.

The purpose of this investigation was to characterize the underlying soil and groundwater conditions and to provide recommendations for the detailed design of the proposed development. This report will provide findings from the geotechnical investigation and engineering recommendations for the design and construction of the proposed development in Block 5. The work carried out for Block 4 and Block 6 are reported under separate covers.

This report presents the results of the investigation performed in accordance with the general terms of reference outlined above and is intended for the guidance of the owner and the design architects or engineers only. It is assumed that the design will be in accordance with the applicable building codes and standards.

2. FIELD WORK AND LABORATORY WORK

2.1 FIELD WORK

The fieldwork for this study was carried out on November 8, 2023. It consisted of two (2) boreholes advanced by a drilling contractor commissioned by Terrapex utilizing track-mounted drilling

equipment. The boreholes are designated as BH/MW5-1 and BH/MW5-2, advanced to depths ranging from 4.4 to 4.6 m below ground (mbg). Monitoring wells were installed in both boreholes for long-term monitoring of the groundwater level. Data loggers were installed in the monitoring wells for real-time monitoring of the groundwater level. The location of the boreholes and monitoring wells, together with the borehole and test pit drilled in previous investigation (BH109 and TP204) are presented in Figure 1 of Appendix A.

Standard penetration tests were carried out in the course of advancing the boreholes through the overburden soils to take representative soil samples and to measure penetration index values (N-values) to characterize the condition of the various soil materials. The number of blows of the striking hammer required to drive the split spoon sampler through 300 mm depth increments was recorded and these are presented on the logs in Appendix B as penetration index values.

Bedrock was encountered at depths of 2.2 mbg and 0.7 mbg at the location of BH/MW5-1 and BH/MW5-2, respectively. Bedrock was cored in both boreholes from 2.2 mbg to 4.4 mbg on BH/MW5-1 and from 0.7 mbg to 4.6 mbg on BH/MW5-2 for monitoring well installation.

One (1) Test Pit (TP204) and one (1) borehole (BH109) were excavated/drilled during the investigation carried out in Block 5 during 2018, to depths of 1.9 mbg and 3.0 mbg, respectively.

Groundwater level observations were made during and upon completion of the borehole drilling, where applicable, as well as in the installed monitoring wells.

The location and ground surface elevation at the locations of the boreholes and monitoring wells were established utilizing a TopCon HiPer V GNSS Receiver referenced to UTM Zone 18T (NAD83) and presented in the attached Borehole Location Plan in Appendix A of this report. The information of the drilled boreholes and installed monitoring wells is summarized in Table 1.

Table 1: Summary of Borehole Information

Borehole No.	Northing (m)	Easting (m)	Ground Elevation (m)	Depth of Borehole (m)	Depth of Monitoring Well (m)
BH/MW5-1	5033509.37	450192.60	87.72	4.4	4.4
BH/MW5-2	5033464.36	450216.33	86.91	4.6	4.6
BH109	5033491	450202	87.34	3.0	N/A
TP204	5033484	450194	86.64	1.9	N/A

The fieldwork for this project was carried out under the supervision of an experienced technician from this office who laid out the positions of the boreholes in the field; arranged locates of buried services; effected the drilling, sampling and in situ testing; observed groundwater conditions; and prepared field borehole log sheets.

2.2 GEOTECHNICAL LABORATORY TESTS

The soil samples recovered from the split spoon sampler were properly sealed, labelled and brought to Terrapex's Toronto laboratory for detailed examination. Each soil sample was examined in the laboratory for visual and textural characteristics by the Project Engineer. Moisture content determinations were carried out on all recovered soil samples. The results are plotted on the borehole logs attached in Appendix B.

One (1) grain size analysis was performed on selected soil sample. The geotechnical laboratory results are provided in Appendix C of this report as well as presented on the respective borehole logs provided in Appendix B. One combined subgrade soil sample obtained from the location of Inf 5-2 was subjected to California Bearing Ratio (CBR) test and the results are presented in Appendix F of this Report.

In addition, one (1) soil sample, MW/BH5-1-SS2 & SS3 was submitted to AGAT Laboratories for determination of pH and sulphate content and its potential for sulphate attack on buried concrete. The results of these tests are enclosed in Appendix E and will be discussed in Section 4.2 of this report.

2.3 INFILTRATION TESTING

Soil infiltration rate testing was carried out in unsaturated soils at locations labeled as Inf5-1 through Inf5-4, as shown in Figure 2 of Appendix A. The field tests were carried out on November 20 and November 21 of 2023. Soils were pre-soaked and then a falling head test was conducted by adding a volume of water into a select soil horizon, and monitoring the rate that it was accepted into the soil. Depending upon the target depth, the water was introduced into the select soil horizon via the screened horizon of a drive-point piezometer, or by introducing a volume of water to the soil using a Pask Permeameter instrument. An electronic sounding tape was used to measure the steady-state flow rate of gravimetrically-fed water into the unsaturated soil horizon.

The results of the infiltration test are presented in Appendix D of this report and will be discussed in Section 4.1 of this report.

3. SITE AND SUBSURFACE CONDITONS

Full details of the subsurface soil and groundwater conditions at the site are given on the Borehole Log Sheets attached in Appendix B of this report. The following paragraphs present a description of the site and a commentary on the engineering properties of the various soil materials contacted in the boreholes.

It should be noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are

intended to reflect transition zones for the purpose of geotechnical design, and therefore, should not be construed as exact planes of geological change.

3.1 SITE DESCRIPTION

The subject site is located at the former CFB Rockcliffe property in the City of Ottawa. The former CFB Rockcliffe property is approximately 310 acres; bounded by Aviation Parkway to the west, Sir George Etienne Cartier Parkway to the North, the National Research Council of Canada campus to the east, and existing residential communities and Montfort Hospital to the south. It is bounded by two bedrock escarpments at the south and north boundaries. The Rockcliffe Airport is also located in the vicinity of the site, just north of Sir George Etienne Cartier Parkway.

Our investigation was limited to Phase 4 and the work carried out for Block 5 was bounded by Hemlock Road from the south, future Kijigong Street from the north, future private driveway from the west and future Oshedinaa Street from the east. The ground surface topography of the site is uneven. The ground surface elevations at the locations of the boreholes vary from 86.6 m to 87.7 m.

3.2 SUBSURFACE SOIL CONDITIONS

In general, the subsurface soil at the site consists of fill material overlying bedrock.

Fill: Fill material consisting of sandy silt to clayey silt was encountered at all borehole locations, extending to depths varying from 0.7 mbg to 2.9 mbg. The fill material is generally presented in a compact to very dense state, with the recorded SPT “N” values varying from 10 to over 50 blows per 300 mm penetration. The moisture content of the fill material ranges between 5% and 25%.

Grain size analysis and Atterberg Limits test of one (1) sample of the fill material was conducted and the results are presented in Appendix C of this report and summarized in Table 2:

Table 2: Grain size Analyses Results (Fill)

Borehole No.	Sample No.	Grain size Analyses Distribution (%)			
		Gravel	Sand	Silt	Clay
BH/MW5-1	SS2	9	13	67	11

3.3 BEDROCK CONDITION

Bedrock (Limestone) was encountered in MW/BH5-1, BH/MW5-2 and TP204 at depths of 0.7 mbg to 2.2 mbg, corresponding to a geodetic elevation of 84.8 m to 86.2 m. At the location of BH/MW5-1 and BH/MW5-2, the bedrock was proven by rock coring to depths varying from 4.4 of 4.6 mbg. The bedrock was also proven excavation at the location of TP204. The approximate depth and geodetic elevation of the bedrock surface at each borehole/test pit location is provided

in Table 3.

Table 3: Summary of Bedrock Information

Borehole No.	Depth of Bedrock Surface (m)	Elevation of Bedrock Surface (m)	Note
BH/MW5-1	2.2	85.6	Cored
BH/MW5-2	0.7	86.2	Cored
BH109	N/A	N/A	N/A
TP204	1.8.8	84.8	Excavated

The bedrock surface should not be considered accurate to better than ±0.5 m and some variations in the bedrock surface elevation across the site should be expected.

Review of available geological mapping and previous geotechnical investigations indicates that the bedrock is of the Ottawa Formation, consisting of limestone with some shale bedding and some sandstone in the basal part. In BH/MW5-2, the bedrock was cored from 0.7 m to 4.6 m and. Total Core Recovery (TCR) achieved with the HQ double tube size core bit is 100% and the Rock Quality Designation (RQD) varied from 32% to 79%, which indicate poor to good quality of bedrock. According to the previous investigations at the site, the rock is classified to be strong to very strong.

3.4 GROUNDWATER CONDITIONS

The groundwater table was measured in the installed monitoring wells on November 24, 2023. The groundwater table measured in the monitoring wells was at depths of 3.52 to 4.24 m, corresponding to elevation of 83.4 m to 83.5 m. The measured groundwater levels are provided in Table 5.

Table 4: Groundwater levels observed in Monitoring Wells

Borehole No.	Ground Elevation (m)	Depth of Well (m)	Date of Reading	Depth of Groundwater (mbg)	Groundwater Elevation (m)
BH/MW5-1	87.72	4.4	11/24/2023	4.24	83.48
BH/MW5-2	86.91	4.6	11/24/2023	3.52	83.39

More information of the groundwater will be provided after downloading the data from the data loggers.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

4. SOIL INFILTRATION, CORROSIVITY AND CBR TEST RESULTS

4.1 SOIL INFILTRATION TEST RESULTS

Field-saturated hydraulic conductivity, (Kfs) was calculated from the measurements using following equation (Elrick et. al., 1989):

$$K_{fs} = \frac{C_1 Q_1}{2\pi(H_1)^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha *}\right)}$$

Where:

Kfs =Field saturated hydraulic conductivity (entrapped air present) (cm/sec)

C_1 = Shape factor

Q_1 = flow rate (cm^3/s)

H_1 = Well height (cm)

a = Well radius (cm)

α* = alpha factor (0.15 cm^{-1})

The field measurement data and analysis of the infiltration rate testing are provided in Appendix D. Based on the resulting Kfs (cm/s), the corresponding infiltration rates (mm/hr) were estimated using the covariable relationship presented in the Low Impact Development Stormwater Management Planning and Design Guide (TRCA and CVCA, 2010). A summary of the infiltration rate testing results is presented below in Table 5.

Table 5: Summary of Infiltration Tests

Location Tested	Measured Kfs (cm/s)	Measured Infiltration Rate (mm/hr)	factor of safety	Design Infiltration Rate(mm/hr)
INF5-1	8.00E-05	48	2.5	19.2
INF5-2	2.00E-04	58	2.5	23.2
INF-5-3	1.00E-05	30	2.5	12
INF5-4	2.00E-03	98	2.5	39.2

4.2 TEST RESULTS OF SOIL CORROSION POTENTIAL

One (1) combined soil sample collected during the investigation were submitted for corrosion potential tests. The test results are listed in Table 6 and a detail report is presented in in Appendix E of this report.

Table 6: Summary of Soil Corrosivity Tests

SAMPLE ID	PH	SULPHATE (µg/g)
MW/BH5-1-SS2 & SS3	8.64	36

The pH of the tested sample indicates a moderate alkalinity. The concentration of water-soluble sulphate content of the tested samples is below the CSA Standard of 0.1% water- soluble sulphate (Table 3 of CSA A23.1/CSA A23.2, Additional Requirement for Concrete Subjected to Sulphate Attack). Special concrete mixes against sulphate attack are therefore not required for the sub-surface concrete. Kg/m^3.

4.3 CALIFORNIA BEARING RATIO TEST

One (1) composite sample from the top 1.5 m of the borehole (Inf 5-2) was collected at the time of drilling for CBR testing. Proctor test was also performed on the same sample. The results of the test are presented in Appendix C of this report. A summary of the test results is provided in Table 7.

Table 7: Summary of CBR Test

SAMPLE ID	PENETRATION (mm)	CORRECTED STRESS (MPa, after soaking)	BEARING RATIO (%)	MOISTURE AT PENETRATION POINT (%)	MAXIMUM DRY DENSITY (Kg/m3)
INF5-2	2.5	0.64	9.24	18.62	1773
	5.0	1.05	10.15		

5. DISCUSSION AND RECOMMENDATIONS

In this section, the subsurface conditions are interpreted as relevant to the design of the proposed four-storey building with one level of underground parking garage.

The construction methods described in this report must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all of the factual information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the generally wide spacing of the boreholes, conditions may vary significantly between boreholes.

5.1 SITE GRADING

No site grading plan was available to Terrapex at the time of preparing this report. Survey of the existing ground elevation at the borehole locations indicated that the ground surface varies from 86.6 m to 87.7 m, as such site grading may be required for the construction of the proposed development.

Prior to carrying out any area grading of the site, the existing fill material should be removed from both cut and fill area. The exposed subgrade should be inspected by a qualified geotechnical engineer prior to any fill material placement. Fill material should be placed in maximum 300 mm

thick lifts and compact to minimum 98% of the SPMDD of the material. If the fill material is used as an engineered fill then must be compact to 100% of the SPMDD.

5.2 FOUNDATION DESIGN

According to the Site plan provided to Terrapex by client (Preliminary Site Plan prepared by NORR/Rohit dated May 26, 2023), the proposed development on Block 5 will be four storeys residential apartment with one level of underground parking garage. The finished floor elevation at the P1 parking was not known to Terrapex at the time of preparing this report but can be assumed at ± 3 m below existing ground. The foundation will be about 0.5 to 1.0 m below the finished floor.

The proposed four-storeys building with one level underground parking can be supported by spread and strip footings founded on bedrock minimum 1.0 m below the bedrock surface for a factored bearing resistance at Ultimate Limit States of 1 MPa (ULS).

Foundations designed to the specified bearing capacity stated above are expected to settle less than 25 mm total and 19 mm differential.

Where it is necessary to place footings on bedrock at different levels, the upper footing must be founded below an imaginary 1 horizontal to 1 vertical line (1H:1V in bedrock) 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.

The bedrock may weather rapidly between wetting and drying cycles. In view of this, it is suggested that a lean concrete mat slab be placed immediately after the excavation is complete to keep the bedrock intact, unless the footings are cast immediately after excavating.

It should be noted that the recommended bearing resistances have been calculated by Terrapex from the 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 Terrapex to validate the information for use during the construction stage.

All footings exposed to seasonal freezing conditions should be provided with at least 1.8 m of earth cover or equivalent thermal insulation against frost.

5.3 CONCRETE SLAB-ON-GRADE

Based on the borehole information, the basement floor slab is expected to be in the bedrock. The floor slab can be cast as slab-on-grade provided a 200 mm layer of clear crushed stone (19 mm maximum size) is placed between the underside of the floor slab and the exposed bedrock surface. A perimeter and underfloor drainage system will be required around the exterior basement walls.

5.4 EXCAVATION, BACKFILL AND GROUNDWATER CONTROL

Based on the borehole findings, excavation for foundations, basements, sewer trenches and utilities will be carried out through fill material consisting of sandy silt to clayey silt and bedrock. No significant groundwater issue is anticipated for the excavation and installation of the foundation. It is expected that any seepage, which occurs during wet periods, can be removed by strategically placed sump pumps.

Excavation of the soil strata is not expected to pose any difficulty and can be carried out with heavy hydraulic excavators. Bedrock excavation is anticipated across the site. According to the rock core data from the previous investigations, the bedrock generally consists of strong to very strong limestone with interbedded shale of variable bed thicknesses and depths across the site.

Bedrock excavation is expected to be carried out using line drilling and blasting, hoe ramming or both. Provision should be made in the excavation contract to include the use of these techniques for excavation in bedrock. Any blasting should be carried out in accordance with City of Ottawa Special Provision S.P. No: F-1201 and under the supervision of a blasting specialist engineer. Vibration monitoring of the blasting operation should be carried out to ensure that the blasting meets the limiting vibration criteria at all times.

The contractor should submit a complete and detailed blasting design and monitoring proposal prepared by a blasting/vibrations specialist prior to commencing blasting. This would have to be reviewed and accepted in relation to the requirements of the blasting specifications. Vibration monitoring of the blasting should be carried out to ensure that the blasting meets the limiting vibration criteria at all times. A pre-blast condition survey should be carried out of surrounding structures and utilities located within 100 m of the excavation site. The condition survey should also include the National Research Council's Montreal Road Campus located east of the subject site.

All excavations must be carried out in accordance with Occupational Health and Safety Act (OHSA). With respect to OHSA, the near surface fill material is expected to conform to Type 3 soils. The bedrock is classified as Type 1 soil.

Temporary excavations for slopes in Type 3 soil should not exceed 1.0 horizontal to 1.0 vertical. Excavations in the bedrock may be cut with vertical side-walls. In the event very loose and/or soft soils are encountered at shallow depths or within zones of persistent seepage, it will be necessary to flatten the side slopes as necessary to achieve stable conditions.

For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation. Excavation side-slopes should not be unduly left exposed to inclement weather. Excavation slopes consisting of sandy soils will be prone to gullying in periods of wet weather, unless the slopes are properly sheeted with tarpaulins.

Where workers must enter excavations extending deeper than 1.2 m below grade, the excavation side-walls must be suitably sloped and/or braced in accordance with the Occupational Health and

Safety Act and Regulations for Construction Projects.

It should be noted that the on-site fill material may contain boulders, cobbles and remnants of former buildings in the form of buried concrete. Provisions must be made in the excavation and foundation installation contracts for the removal of possible boulders and concrete.

Based on the borehole information, the existing fill is considered unsuitable for re-use as backfill material as it contains organics and other debris. Excavated native soils free from organics can be used as general construction backfill, provided their moisture content is within 2 percent of their optimum moisture contents which will require significant aeration.

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

Based on observations made during drilling of the boreholes and excavation of the test pits, close examination of the soil samples extracted from the boreholes, and groundwater measurements made in the monitoring wells, significant groundwater problems are not anticipated within the presumed excavation depths throughout the site. It is expected that any seepage from wet sand seams and perched water, which occurs during wet periods, can be removed by pumping from sumps.

5.5 LATERAL EARTH PRESSURE

The lateral earth pressures acting on basement walls may be calculated from the following expression.

$$\mathbf{P = K (\gamma h + q)}$$

Where **P** = lateral pressure in kPa acting at a depth h (m) below ground surface

K = lateral earth pressure coefficient, K = 0.40 for vertical walls in overburden and horizontal backfill; K= 0.25 for vertical walls in bedrock.

γ = unit weight of backfill (kN/m^3), a value of 19.5 kN/m^3 may be used for fill and 26.0 kN/m^3 for bedrock

q = the complete surcharge loading (kPa)

This equation assumes that free-draining backfill and positive drainage is provided to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

5.6 EARTHQUAKE DESIGN PARAMETERS

The 2012 Ontario Building Code (OBC) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration and the site classification.

The parameters for determination of the Site Classification for Seismic Site Response are set out

in Table 4.1.8.4.A of the 2012 OBC. The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (vs) measurements have been taken. In the absence of such measurements, the classification is estimated on the basis of empirical analysis of undrained shear strength or penetration resistance. The applicable penetration resistance is that which has been corrected to a rod energy efficiency of 60% of the theoretical maximum or the (N_{60}) value.

Based on the current and previous borehole and test pit information, the subsurface stratigraphy generally comprises surficial topsoil and asphaltic concrete pavement, underlain by fill material, followed by various native soils consisting of silty sand to sand, sandy silt to silt, and clay and silt soils, underlain by limestone bedrock at shallow depths. Based on the above, the site designation for seismic analysis is estimated to be Class B according to Table 4.1.8.4.A from the quoted code.

The site specific 5% damped spectral acceleration coefficients, and the peak ground acceleration factors are provided in the 2012 Ontario Building.

5.7 PAVEMENT DESIGN

5.7.1 On-Grade Construction

Based on the existing topography of the site and the proposed grades, re-grading of the subgrade will be required. It is anticipated that the sub-grade material for the pavement will generally comprise of engineered fill.

The subgrade should be thoroughly proof-rolled and re-compacted to ensure uniformity in subgrade strength and support. Lift thicknesses should not exceed 200 mm in a loose state and the excavated site material should be compacted using heavy vibratory rollers.

The recommended pavement structures provided in Table 6 are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the city of Ottawa Engineering Standard. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Table 8: Recommended Asphaltic Concrete Pavement Structure Design

Pavement Layer	Compaction Requirements	Light Duty Pavement	Heavy Duty Pavement
Surface Course	as per OPSS 310	40 mm Superpave 12.5 Level B Asphalt (PG58-34)	40 mm Superpave 12.5 Level D Asphalt (PG64-34)
Binder Course	as per OPSS 310	50 mm Superpave 19 mm Level B Asphalt (PG58-34)	100 mm Superpave 19 mm Level D Asphalt (PG64-34)
Granular Base	100% SPMDD	150 mm Granular 'A' (OPSS 1010) Pit Run or 19 mm Crusher Run Limestone	150 mm Granular 'A' (OPSS 1010) Pit Run or 19 mm Crusher Run Limestone

Granular Sub-Base	100% SPMDD	450 mm Granular 'B' Type II (OPSS 1010)	600 mm Granular 'B' Type II (OPSS 1010)

The subgrade must be compacted to at least 98% of SPMDD for at least the upper 600 mm and 95% below this level. The granular base and sub-base materials should be compacted to a minimum of 100% SPMDD.

The long-term performance of the proposed pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible when fill is placed and that the subgrade is not disturbed and weakened after it is exposed.

Control of surface water is a significant factor in achieving good pavement life. Grading adjacent to the pavement areas must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb. In addition, the need for adequate drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum gradient of three percent) to provide effective drainage toward subgrade drains. Continuous sub-drains are recommended to intercept excess subsurface moisture at the curb lines and catch basins. The invert of sub-drains should be maintained at least 0.3 m below subgrade level.

Additional comments on the construction of pavement areas are as follows:

- As part of the subgrade preparation, the proposed pavement areas should be stripped of vegetation, topsoil, unsuitable earth fill and other obvious objectionable material. The subgrade should be properly shaped and sloped as required, and then proof-rolled. Loose/soft or spongy subgrade areas should be sub-excavated and replaced with suitable approved material compacted to at least 98% of SPMDD.
- Where new fill is needed to increase the grade or replace disturbed portions of the subgrade, excavated inorganic soils or similar clean imported fill materials may be used, provided their moisture content is maintained within 2 % of the soil's optimum moisture content. All fill must be placed and compacted to not less than 98% of SPMDD.
- For fine-grained soils, as encountered at the site, the degree of compaction specification alone cannot ensure distress free subgrade. Proof-rolling must be carried out and witnessed by Terrapex personnel for final recommendations of sub-base thicknesses.
- In the event that pavement construction takes place in the spring thaw, the late fall, or following periods of significant rainfall, it should be anticipated that an increase in thickness of the granular sub-base layer will be required to compensate for reduced subgrade strength.

5.7.2 Above Parking Garage Roof

The pavement above the parking garage roof slab may be comprised of a minimum of 75 mm thick layer of granular 'A' topped with asphaltic concrete having a minimum thickness of 80 mm

(40 mm HL8 and 40 mm HL3). The asphaltic concrete materials should be rolled and compacted in accordance with OPSS 310 requirements.

The gradation and physical properties of HL-3 and HL-8 asphaltic concrete, and Granular 'A' shall conform to the OPSS standards.

The critical section of pavement will be at the transition between the pavement on grade and the pavement above the garage roof slab. In order to alleviate the detrimental effects of dynamic loading / settlement / pavement depression in the backfill to the rigid garage roof structure, it is recommended that an approach type slab be constructed at the entrance/exit points, by extending the granular sub-base to greater depths along the exterior garage wall.

The granular courses of the pavement should be placed in lifts not exceeding 150 mm thick and be compacted to a minimum of 100% SPMDD.

6. LIMITATIONS OF REPORT

The conclusion and recommendations in this report are based on information determined at the inspection locations. Soil 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 soil investigation. 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 details of alignment and elevations stated in the report. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made as set out in this report. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

This report was prepared for Rohit Communities by Terrapex Environmental Ltd. The material in it reflects Terrapex Environmental Ltd. judgement in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions which the Third Party may make based on it, are the sole responsibility of such Third Parties.

We recommend, therefore, that Terrapex be retained during the final design stage to review the design drawings and to verify that they are consistent with Terrapex's recommendations, or the assumptions made in our analysis. We recommend also that Terrapex be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the test holes. In cases when these recommendations are not followed, the company's responsibility is limited to accurately interpreting the conditions encountered at the test holes, only.
The comments given in this report on potential construction problems and possible methods are intended for the guidance of the design engineer, only. The number of inspection locations may not be sufficient to determine all the factors that may affect construction methods and costs. 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.

Respectfully submitted,

TERRAPEX ENVIRONMENTAL LTD.

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APPENDIX A

Borehole Location Plan

LEGEND

- PROPOSED PLAN OF SUBDIVISION
- BOREHOLE (TERRAPEX, 2023)
- MONITORING WELL (TERRAPEX, 2023)
- BOREHOLE (TERRAPEX, 2018)
- TEST PIT (TERRAPEX, 2018)

0 25 50 75
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT: CLC

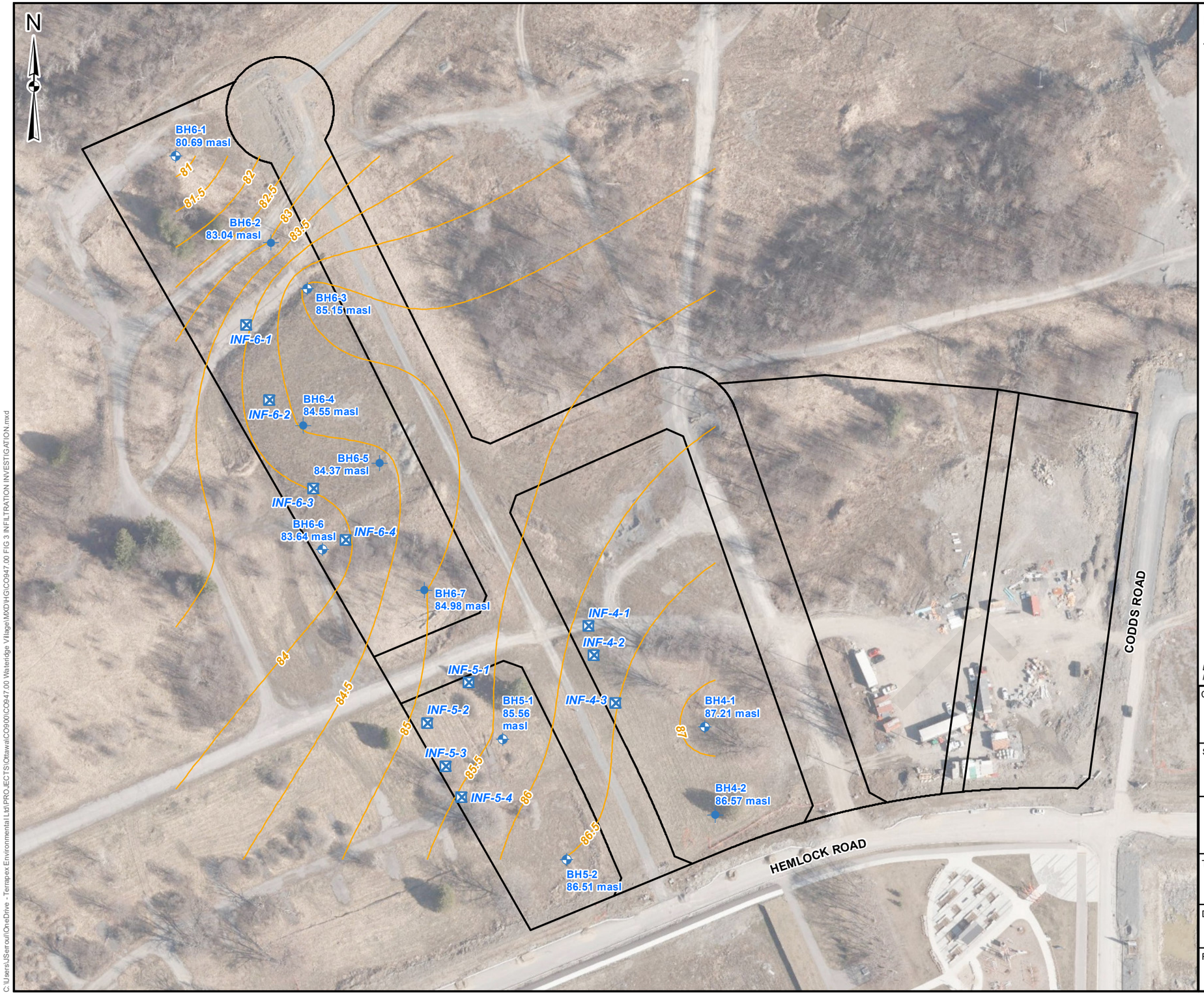
SITE LOCATION: WATERIDGE VILLAGE OTTAWA, ONTARIO

TERRAPEX

TITLE: **GENERAL SITE LAYOUT**

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS	CO947.00	TY
REVISION: 00	DATE: DECEMBER 2023	FIGURE: 1

C:\Users\JSerrou\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO947.00 Waterridge Village\MXD\GEOTECHNICAL\CO947.00 FIG 2 GENERAL SITE LAYOUT.mxd



LEGEND

- PROPOSED PLAN OF SUBDIVISION
- INFILTRATION TESTING LOCATION
- BOREHOLE (TERRAPEX, 2023)
- MONITORING WELL (TERRAPEX, 2023)
- BEDROCK SURFACE CONTOURS

0 25 50 75
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
CLC

SITE LOCATION:
WATERIDGE VILLAGE
OTTAWA, ONTARIO

TERRAPEX

TITLE:
INFILTRATION INVESTIGATION

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS	CO947.00	CB
REVISION: 00	DATE: NOVEMBER 2023	FIGURE: **2**

C:\Users\JSerrouil\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO947.00 Waterridge Village\MXD\HG\CO947.00 FIG 3 INFILTRATION INVESTIGATION.mxd

APPENDIX B

Borehole Log Sheets

CLIENT: Rohit Communities | PROJECT NO.: CO947.00 | **RECORD OF: BH/MW5-1**

ADDRESS: Wateridge Village / Hemlock Road Area

CITY/PROVINCE: Ottawa, ON | NORTHING (m): 5033509.37 | EASTING (m): 450192.60 | ELEV. (m) 87.72

CONTRACTOR: George Downing Estate Drilling Ltd | METHOD:

BOREHOLE DIAMETER (cm): 20 | WELL DIAMETER (cm): 5 | SCREEN SLOT #: 10 | SAND TYPE: 2 | SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm) 40 80 120 160 / 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL compact to very dense, brown, moist sandy silt some sand, some clay, trace gravel, trace organics ---- Gr=9.0%, Sa=13.0%, Si=66.5%, Cl=11.5% ---- crushed rock pieces	0 0.5 1 1.5 2	87.5 87 86.5 86	36 10 57	25.4 4.9 7.5	1 2 3		100 100 100				Bentonite 50 mm monitoring well was installed and the water level measured on November 24, 2023: 4.24 mbgs
		Bedrock Cored to depth of 4.39 m.	2.5 3 3.5 4	85.5 85 84.5 84 83.5			R1 R2						Sand Screen + Sand
		END OF BOREHOLE											END OF BOREHOLE: 4.39 mbgs ELEV.(m) = 83.3

TERRAPEX

LOGGED BY: UB | DRILLING DATE: 08-11-2023

INPUT BY: RR | MONITORING DATE: 24-11-2023

REVIEWED BY: TY | PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH/MW5-2**
ADDRESS: Wateridge Village / Hemlock Road Area		
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033464.36	EASTING (m): 450216.33 ELEV. (m) 86.91
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL very dense, brown, moist sandy silt trace clay, trace organics	0	86.5	50/125	17.4	1		100			Bentonite	Bentonite 50 mm monitoring well was installed and the water level measured on November 24, 2023: 3.52 mbgs
		Bedrock Cored to depth of 4.57 m.	0.5	86									
		TCR(1) = 100% RQD(1) = 32%	1	85.5			R1						
			1.5	85									
		TCR(2) = 100% RQD(2) = 79%	2	84.5			R2					Sand	Sand Screen + Sand
			2.5	84									
			3	83.5									
		TCR(3) = 100% RQD(3) = 72%	3.5	83			R3						
			4	82.5									
		END OF BOREHOLE	4.5										END OF BOREHOLE: 4.57 mbgs ELEV.(m) = 82.3

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 08-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 109**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 87.338	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033491	EASTING: 450202	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		soft, moist, dark brown, clayey silt traces of sand, gravel, and organics (FILL)	0	87.25	50/125		1		50/125		Borehole open and dy on completion.
			0.25	87							Rock in spoon tip at 0.3 m bgs
			0.5	86.75							
			0.75	86.5			2A				
			1	86.25	40				40		Difficult augering from 1.0 m bgs to refusal.
			1.25	86			2B				
			1.5	85.75							Relocated drill 1 m S to avoid rocks.
		dense to compact, damp, light brown silty sand, some clay, trace gravel (FILL)	1.75	85.5	23		3		23		
		-----	2	85.25							
		rock fragments	2.25	85							
			2.5	84.75	64		4		64		Auger refusal at 2.9 m bgs.
			2.75	84.5							
		END OF BOREHOLE									

alston associates
geotechnical division of TERRAPEX

LOGGED BY: RH | DRILLING DATE: November 19, 2018
REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 204**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.640	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033484	EASTING: 450194	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

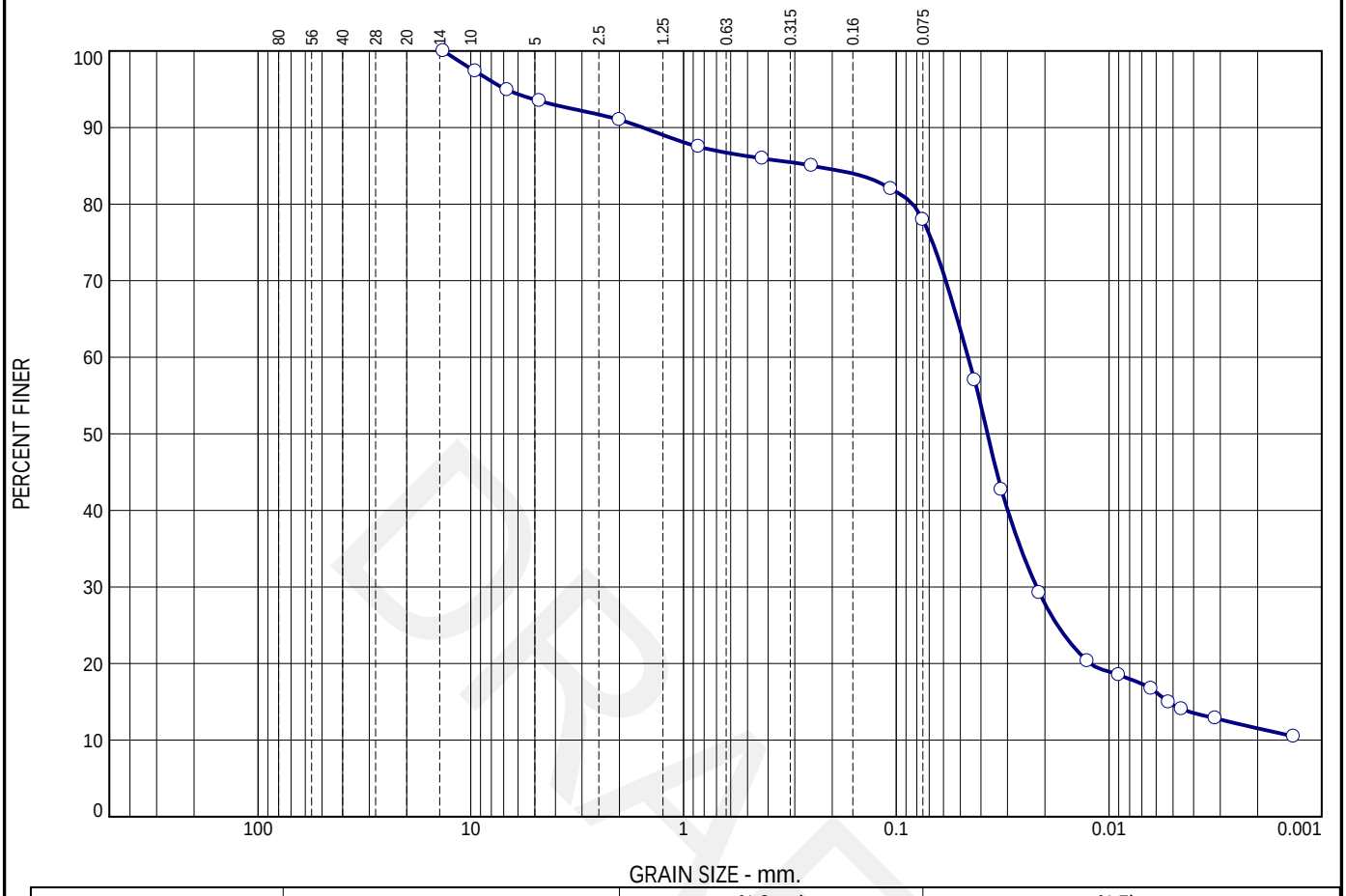
DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				damp, dark brown sand and gravel (FILL)				86.5
0.25										86.25
0.5						damp, brown sandy silt some gravel (FILL)				86
0.75										85.75
1										85.5
1.25						moist light brown mixed grey silty sand, some clay trace limestone fragments (FILL)				85.25
1.5										85
1.75		Refusal @ 1.84 m bgs on Limestone Bedrock								
						END OF TEST PIT				

APPENDIX C

Geotechnical Laboratory Test Results

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	9.0	5.0	8.0	66.5	11.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2476	0.0459	0.0372	0.0219	0.0053			

Material Description	Test Date	USCS	NM
○ SILT some sand some clay trace gravel	Dec 5/23		

Project No. CO947.00 Client: Rohit Communities

Project: Wateridge Village

○Sample Number: BH5-1 SS2

Terrapex

Toronto, Ontario

Remarks:

○Hydrometer Details: Spc. Grav. = 2.75(assumed); Vb=53cm^3; L2=13.8cm; L1=10.7cm; hs= 0.16cm/Div; A=30.2cm^2; Mass of Disp. Agent=40g/l

Figure 2

Tested By: SC

APPENDIX D

Certificate of Chemical Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED
90 SCARSDALE RD
TORONTO, ON M3B2R7
(905) 474-5265
ATTENTION TO: Reza Rafiee
PROJECT: CO947.00
AGAT WORK ORDER: 23T101726
SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead
DATE REPORTED: Dec 12, 2023
PAGES (INCLUDING COVER): 6
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23T101726

PROJECT: CO947.00

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

ATTENTION TO: Reza Rafiee

SAMPLING SITE:WATERIDGE VILLAGE

SAMPLED BY:UB/JM

(Soil) pH and Sulphate in Soil

DATE RECEIVED: 2023-12-07

DATE REPORTED: 2023-12-12

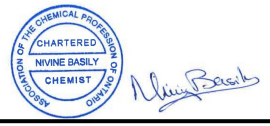
SAMPLE DESCRIPTION:				BH4-2-SS1&2	BH5-1-SS2&3	BH6-5-SS2	BH6-6-SS3
SAMPLE TYPE:				Soil	Soil	Soil	Soil
DATE SAMPLED:				2023-11-08 08:50	2023-11-08 12:50	2023-11-10 09:40	2023-11-10 10:25
Parameter	Unit	G / S	RDL	5525935	5525936	5525937	5525938
Sulphate (2:1)	µg/g		2	31	36	38	37
pH (2:1)	pH Units		NA	7.97	8.64	7.88	8.09

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

5525935-5525938 pH and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

AGAT WORK ORDER: 23T101726

PROJECT: CO947.00

ATTENTION TO: Reza Rafiee

SAMPLING SITE:WATERIDGE VILLAGE

SAMPLED BY:UB/JM

Soil Analysis

RPT Date: Dec 12, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
(Soil) pH and Sulphate in Soil															
Sulphate (2:1)	5517672		1100	1110	0.9%	< 2	94%	70%	130%	95%	80%	120%	NA	70%	130%
pH (2:1)	5525010		7.68	7.61	0.9%	NA	96%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Time Markers

AGAT WORK ORDER: 23T101726
PROJECT: CO947.00

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

ATTENTION TO: Reza Rafiee

Sample ID	Sample Description	Sample Type	Date Sampled	Date Received
5525935	BH4-2-SS1&2	Soil	08-NOV-2023	07-DEC-2023

(Soil) pH and Sulphate in Soil

Parameter	Date Prepared	Date Analyzed	Initials
Sulphate (2:1)	08-DEC-2023	08-DEC-2023	LC
pH (2:1)	08-DEC-2023	08-DEC-2023	XL

Sample ID	Sample Description	Sample Type	Date Sampled	Date Received
5525936	BH5-1-SS2&3	Soil	08-NOV-2023	07-DEC-2023

(Soil) pH and Sulphate in Soil

Parameter	Date Prepared	Date Analyzed	Initials
Sulphate (2:1)	08-DEC-2023	08-DEC-2023	LC
pH (2:1)	08-DEC-2023	08-DEC-2023	XL

Sample ID	Sample Description	Sample Type	Date Sampled	Date Received
5525937	BH6-5-SS2	Soil	10-NOV-2023	07-DEC-2023

(Soil) pH and Sulphate in Soil

Parameter	Date Prepared	Date Analyzed	Initials
Sulphate (2:1)	08-DEC-2023	08-DEC-2023	LC
pH (2:1)	08-DEC-2023	08-DEC-2023	XL

Sample ID	Sample Description	Sample Type	Date Sampled	Date Received
5525938	BH6-6-SS3	Soil	10-NOV-2023	07-DEC-2023

(Soil) pH and Sulphate in Soil

Parameter	Date Prepared	Date Analyzed	Initials
Sulphate (2:1)	08-DEC-2023	08-DEC-2023	LC
pH (2:1)	08-DEC-2023	08-DEC-2023	XL

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

AGAT WORK ORDER: 23T101726

PROJECT: CO947.00

ATTENTION TO: Reza Rafiee

SAMPLING SITE:WATERIDGE VILLAGE

SAMPLED BY:UB/JM

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER

AGAT Laboratories
5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 23T101726
Cooler Quantity: 1 large
Arrival Temperatures: 1.8 | 2.0 | 2.2
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes: Loose ice

Report Information:
Company: TERRAPEX
Contact: REZA RAFIEE
Address: 90 Scarsdale Road., Toronto, ON.
Phone: 416-991-6242 Fax:
Reports to be sent to:
1. Email: r.rafiee@terrapex.com
2. Email:

Regulatory Requirements: NA
(Please check all applicable boxes)
☐ Regulation 153/04 — Table (Indicate One) ☐Ind/Com ☐Res/Park ☐Agriculture — Soil Texture (Check One) ☐Coarse ☐Fine
☐ Excess Soils R406 — Table (Indicate One)
☐ Regulation 558
☐ CCME
☐ Sewer Use ☐Sanitary ☐Storm — Region
☐ Prov. Water Quality Objectives (PWQO)
☐ Other — Indicate One

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: CO947.00
Site Location: Waterridge Village
Sampled By: UB/JM
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No
Report Guideline on *Certificate of Analysis* ☐ Yes ☑ No

Invoice Information: Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email: accountspayable@terrapex.com

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 153: Arochlors	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ TCLP - ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: Include Moisture ☐ Sulphide ☐	pH	Water Soluble Sulphate				Potentially Hazardous or High Concentration (Y/N)
BH4-2-SS1 @ 2	8/11/23	8:50 AM PM	1	S														—	—				NA
~~BH5-1-SS2 @ 3~~	~~8/11/23~~	~~12:50 AM PM~~	~~1~~	~~S~~														~~—~~	~~—~~				~~NA~~
BH5-1-SS2 @ 3	8/11/23	12:50 AM PM	1	S														—	—				NA
~~BH5-3-SS4~~	~~8/11/23~~	~~AM PM~~	~~1~~	~~S~~														~~—~~	~~—~~				~~NA~~
BH6-5-SS2	10/11/23	9:40 AM PM	1	S														—	—				NA
BH6-6-SS3	10/11/23	10:25 AM PM	1	S														—	—				NA
		AM PM																					
		AM PM																					
		AM PM																					
		AM PM																					
		AM PM																					

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
John K	5/12/23	6:00 pm	Aniqa Tahir	07/12/23	1:20 pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page 1 of 1
N°: T-137621

Document ID: DIV-78-1511-022
Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT
Date Revised: [illegible] 2022

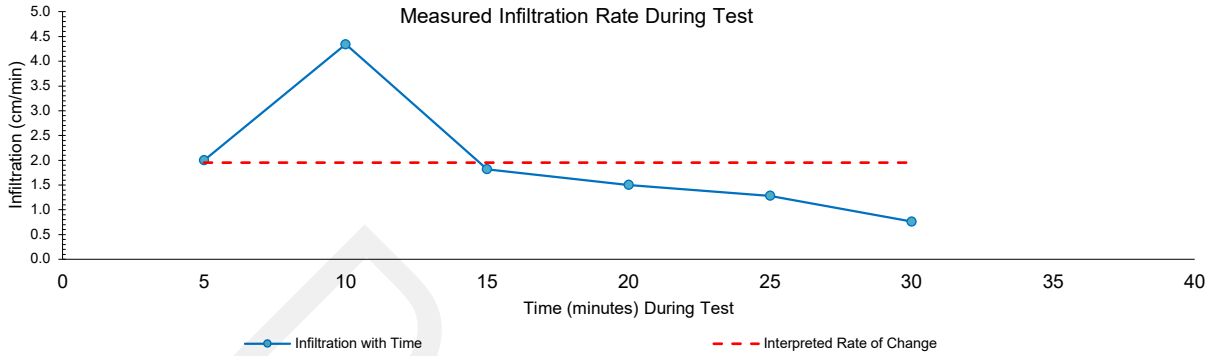
APPENDIX E

Field Infiltration Test Results

Constant Head Well Permeameter Test Report

TERRAPEX

Project:	Rohit Wateridge Village	
Project Number:	CO947	
Location Name	Inf 5-1	
Approximate Location:	450177.94	easting (metres)
	5033527.54	northing (metres)
Approximate Depth Tested:	1.5	mbg
	85.2	masl



Field Measurements:

Elapsed Time	Water Level	Water Level Change	Infiltration
(min)	(cm)	(cm)	(cm/min)
0	33	-	-
5	43	10.00	2.00
10	64.7	21.70	4.34
15	73.8	9.10	1.82
20	81.3	7.50	1.50
25	87.7	6.40	1.28
30	91.5	3.80	0.76

Date of Field Measurements: 21-Nov-23
Field Representative: EB
Reviewed: ZK
Reviewed: ZK

Soil Description

moist sandy silty clay

Test Conditions:

Instrument: 1" stainless steel Solinst Drivepoint Instrument

hole radius (a) =	2.54	cm
Water column height in hole (H_1) =	15.24	cm
Ambient Air Temperature at Testing =	4	^{o}C

Interpretations:

Soil Capillary Type =	Strong	
Soil Type Coefficient (α*) =	0.04	cm^{-1}
Average Water Level Change (R_1) =	0.03	cm/s
Steady Intake Water Rate (Q_1) =	0.16	cm^3/s
Shape factor for H_1/a = (C_1) =	1.80	-

Field Saturated Hydraulic Conductivity (K_{fs}):

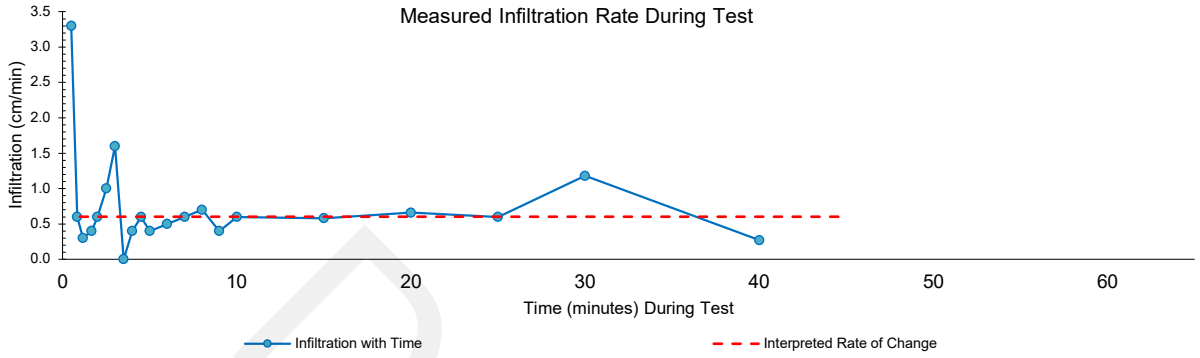
K_{fs} =	7E-05	cm/s
K_{fs} corrected to 4°C ('freshet') [1] =	7E-05	cm/s
K_{fs} corrected to 24°C ('summer') [1] =	1E-04	cm/s

[1] (Streeter and Wylie, 1975)
[1] (Reynolds, 2008 and 2015)

Constant Head Well Permeameter Test Report

TERRAPEX

Project:	Rohit Wateridge Village	
Project Number:	CO947	
Location Name	Inf 5-2	
Approximate Location:	450162.726	easting (metres)
	5033512.486	northing (metres)
Approximate Depth Tested:	0.2	mbg
	86.4	masl



Field Measurements:

Elapsed Time	Water Level	Water Level Change	Infiltration
(min)	(cm)	(cm)	(cm/min)
0.17	39	-	-
0.50	37.9	1.10	3.30
0.83	37.7	0.20	0.60
1.17	37.6	0.10	0.30
1.67	37.4	0.20	0.40
2.00	37.2	0.20	0.60
2.50	36.7	0.50	1.00
3.00	35.9	0.80	1.60
3.50	35.9	0.00	0.00
4.00	35.7	0.20	0.40
4.50	35.4	0.30	0.60
5.00	35.2	0.20	0.40
6.00	34.7	0.50	0.50
7.00	34.1	0.60	0.60
8.00	33.4	0.70	0.70
9.00	33	0.40	0.40
10.00	32.4	0.60	0.60
15.00	29.5	2.90	0.58
20.00	26.2	3.30	0.66
25.00	23.2	3.00	0.60
30.00	17.3	5.90	1.18
40.00	14.6	2.70	0.27

Soil Description

moist sandy silty clay

Test Conditions:

Instrument: 1" stainless steel Solinst Drivepoint Instrument

hole radius (a) =	6 cm
Water column height in hole (H_1) =	5 cm
Ambient Air Temperature at Testing =	4 °C

Interpretations:

Soil Capillary Type =	Strong
Soil Type Coefficient (α*) =	0.04 cm^{-1}
Average Water Level Change (R_1) =	0.01 cm/s
Steady Intake Water Rate (Q_1) =	0.35 cm^3/s
Shape factor for H_1/a = (C_1) =	0.54 -

Field Saturated Hydraulic Conductivity (K_{fs}):

K_{fs} =	2E-04 cm/s
K_{fs} corrected to 4°C ('freshet') [1] =	2E-04 cm/s
K_{fs} corrected to 24°C ('summer') [1] =	3E-04 cm/s

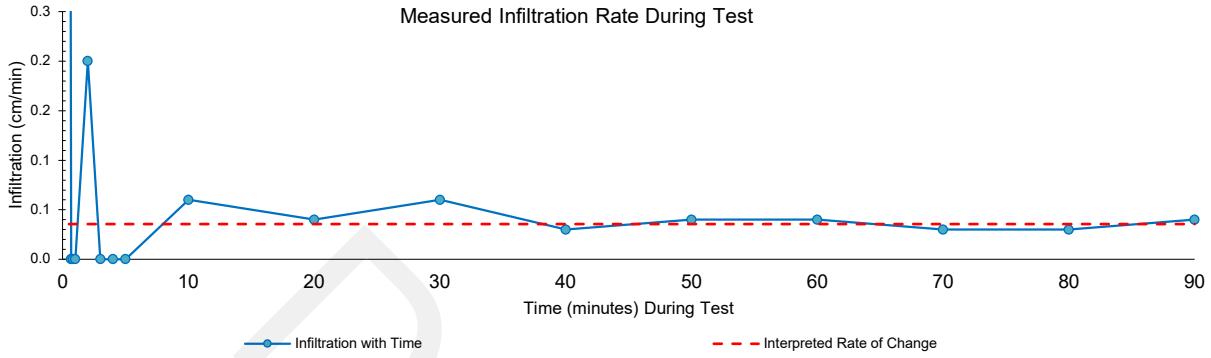
[1] (Streeter and Wylie, 1975)
[1] (Reynolds, 2008 and 2015)

Date of Field Measurements:	20-Nov-23
Field Representative:	EB
Reviewed:	ZK
Reviewed:	ZK

Constant Head Well Permeameter Test Report

TERRAPEX

Project:	Rohit Wateridge Village	
Project Number:	CO947	
Location Name	Inf 5-3	
Approximate Location:	450170.8	easting (metres)
	5033496.873	northing (metres)
Approximate Depth Tested:	0.4	mbg
	86.3	masl



Field Measurements:

Elapsed Time	Water Level	Water Level Change	Infiltration
(min)	(cm)	(cm)	(cm/min)
0.17	44	-	-
0.33	41	3.00	18.00
0.50	40.8	0.20	1.20
0.67	40.8	0.00	0.00
0.83	40.8	0.00	0.00
1.00	40.8	0.00	0.00
2.00	40.6	0.20	0.20
3.00	40.6	0.00	0.00
4.00	40.6	0.00	0.00
5.00	40.6	0.00	0.00
10.00	40.3	0.30	0.06
20.00	39.9	0.40	0.04
30.00	39.3	0.60	0.06
40.00	39	0.30	0.03
50.00	38.6	0.40	0.04
60.00	38.2	0.40	0.04
70.00	37.9	0.30	0.03
80.00	37.6	0.30	0.03
90.00	37.2	0.40	0.04

Soil Description

moist sandy silty clay

Test Conditions:

Instrument: 1" stainless steel Solinst Drivepoint Instrument

hole radius (a) =	6	cm
Water column height in hole (H_1) =	5	cm
Ambient Air Temperature at Testing =	4	^{o}C

Interpretations:

Soil Capillary Type =	Strong	
Soil Type Coefficient (α*) =	0.04	cm^{-1}
Average Water Level Change (R_1) =	0.00	cm/s
Steady Intake Water Rate (Q_1) =	0.02	cm^3/s
Shape factor for H_1/a = (C_1) =	0.54	-

Field Saturated Hydraulic Conductivity (K_{fs}):

K_{fs} =	1E-05	cm/s
K_{fs} corrected to 4^{o}C ('freshet') [1] =	1E-05	cm/s
K_{fs} corrected to 24^{o}C ('summer') [1] =	2E-05	cm/s

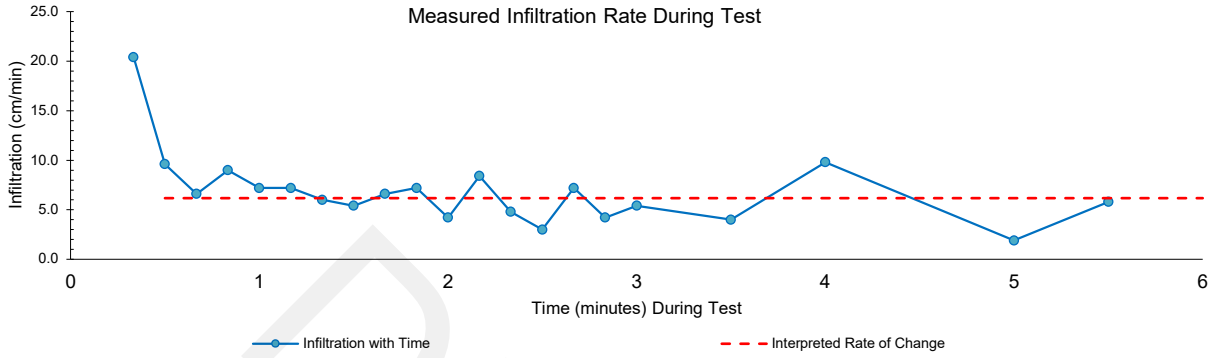
Date of Field Measurements:	20-Nov-23
Field Representative:	EB
Reviewed:	ZK
Reviewed:	ZK

[1] (Streeter and Wylie, 1975)
[1] (Reynolds, 2008 and 2015)

Constant Head Well Permeameter Test Report

TERRAPEX

Project:	Rohit Wateridge Village	
Project Number:	CO947	
Location Name	Inf 5-4	
Approximate Location:	450178.178	easting (metres)
	5033483.392	northing (metres)
Approximate Depth Tested:	0.7	mbg
	85.7	masl



Field Measurements:

Elapsed Time	Water Level	Water Level Change	Infiltration
(min)	(cm)	(cm)	(cm/min)
0.17	34	-	-
0.33	30.6	3.40	20.40
0.50	29	1.60	9.60
0.67	27.9	1.10	6.60
0.83	26.4	1.50	9.00
1.00	25.2	1.20	7.20
1.17	24	1.20	7.20
1.33	23	1.00	6.00
1.50	22.1	0.90	5.40
1.67	21	1.10	6.60
1.83	19.8	1.20	7.20
2.00	19.1	0.70	4.20
2.17	17.7	1.40	8.40
2.33	16.9	0.80	4.80
2.50	16.4	0.50	3.00
2.67	15.2	1.20	7.20
2.83	14.5	0.70	4.20
3.00	13.6	0.90	5.40
3.50	11.6	2.00	4.00
4	6.7	4.90	9.80
5	4.8	1.90	1.90
5.50	1.9	2.90	5.80

Date of Field Measurements: 20-Nov-23
Field Representative: EB
Reviewed: ZK
Reviewed: ZK

Soil Description

moist sandy silty clay

Test Conditions:

Instrument: 1" stainless steel Solinst Drivepoint Instrument

hole radius (a) =	6 cm
Water column height in hole (H_1) =	5 cm
Ambient Air Temperature at Testing =	4 °C

Interpretations:

Soil Capillary Type =	Strong
Soil Type Coefficient (α*) =	0.04 cm^{-1}
Average Water Level Change (R_1) =	0.10 cm/s
Steady Intake Water Rate (Q_1) =	3.61 cm^3/s
Shape factor for H_1/a = (C_1) =	0.54 -

Field Saturated Hydraulic Conductivity (K_{fs}):

K_{fs} =	2E-03 cm/s
K_{fs} corrected to 4°C ('freshet') [1] =	2E-03 cm/s
K_{fs} corrected to 24°C ('summer') [1] =	3E-03 cm/s

[1] (Streeter and Wylie, 1975)
[1] (Reynolds, 2008 and 2015)

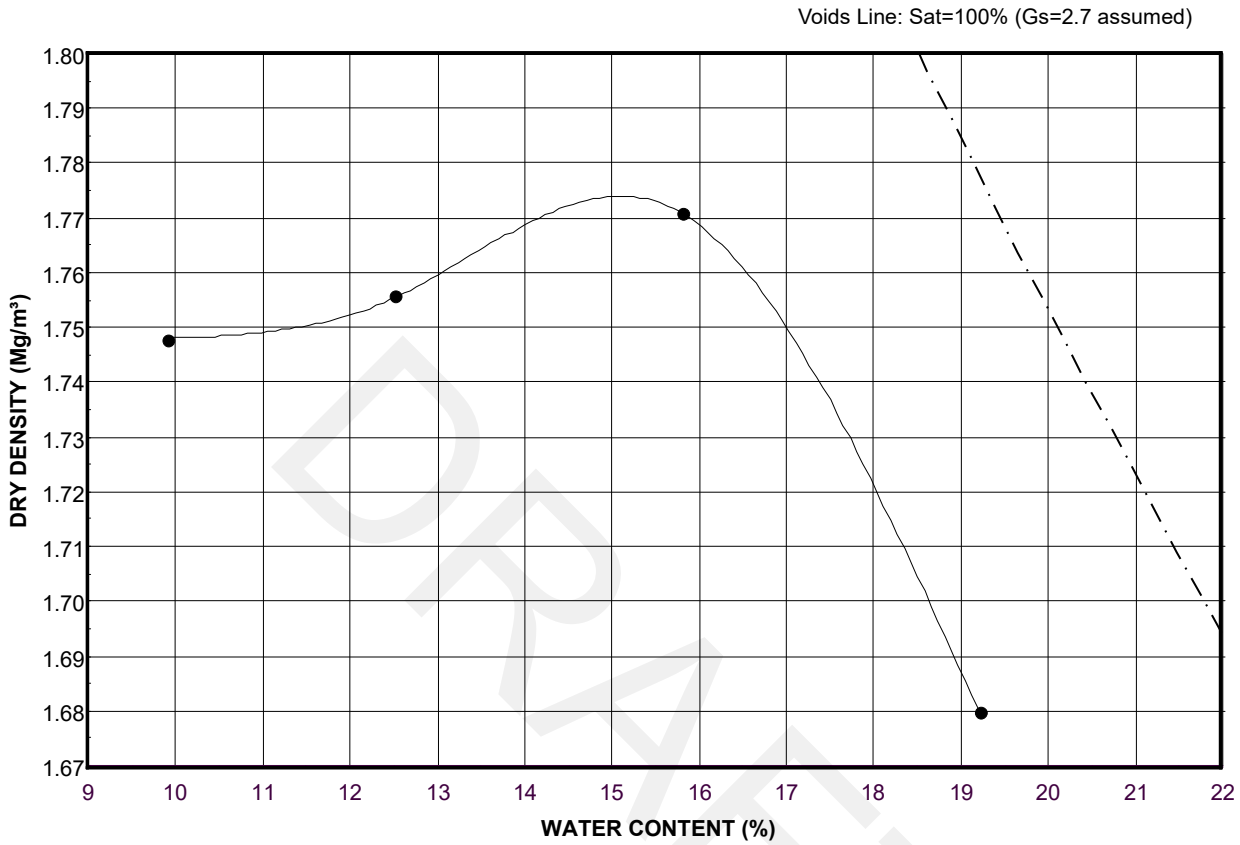
APPENDIX F

California Bearing Ratio Test Results

LABORATORY COMPACTION TEST

ASTM D698 Method C

FIGURE



Standard
Proctor Test Results

Sample:
INF 5-2

Max Dry Density:
1.773 Mg/m³

Optimum Water
Content: 14.9%

Natural Water
Content: N/A

Project Number: CA0011941.3280 (3000)
Checked By: AH

WSP Canada Inc.

LABID: 23-997
Date: 19-Dec-23

CALIFORNIA BEARING RATIO TEST (CBR) ASTM D1883

PROJECT NUMBER	CA0011941.3280(3000)	SAMPLE NUMBER	INF5-2
PROJECT NAME	Terrapex/Lab Testing/Miss.	SAMPLE DEPTH (m)	-
BOREHOLE NUMBER	-	DATE	12/15/2023

TEST INFORMATION

STRAIN RATE, mm/min	1.27	PARTICLE SIZE, mm	<19
RAM AREA, cm^2	19.44	COMPACTION	ASTM D698 Method C
LOAD CELL NUMBER	234341	NUMBER OF LAYERS	3
SURCHARGE, kg	4.54	BLOWS PER LAYER	56
SOAKING TIME, hr	92.8	RELATIVE COMPACTION, %	99

SAMPLE INFORMATION

	UNSOAKED	*SOAKED*		*UNSOAKED*	*SOAKED*
SAMPLE HEIGHT, cm	11.65	11.69	DRY WEIGHT, g	3738.49	3738.49
SAMPLE DIAMETER, cm	15.22	15.22	WATER CONTENT, %	15.33	17.90
SAMPLE AREA, cm^2	181.94	181.94	UNIT WEIGHT, kN/m^3	19.94	20.31
SAMPLE VOLUME, cc	2119.56	2127.24	DRY UNIT WT., kN/m^3	17.29	17.23
WET WEIGHT, g	4311.60	4407.70			

PENETRATION

UNSOAKED			SOAKED		
Penetration (mm)	Load (kgf)	Bearing Stress (MPa)	Penetration (mm)	Load (kgf)	Bearing Stress (MPa)
0.0	-	0.00	0.0	0.00	0.00
0.5	-	0.00	0.5	22.97	0.12
1.0	-	0.00	1.0	48.24	0.24
1.5	-	0.00	1.5	74.89	0.38
2.0	-	0.00	2.0	105.22	0.53
2.5	-	0.00	**2.5**	**126.35**	0.64
3.0	-	0.00	3.0	145.19	0.73
3.5	-	0.00	3.5	167.25	0.84
4.0	-	0.00	4.0	181.03	0.91
4.5	-	0.00	4.5	194.82	0.98
5.0	-	0.00	**5.0**	**207.22**	1.05
5.5	-	0.00	5.5	219.17	1.11
6.0	-	0.00	6.0	230.66	1.16
6.5	-	0.00	6.5	241.68	1.22
7.0	-	0.00	7.0	252.25	1.27
7.5	-	0.00	7.5	261.90	1.32
8.0	-	0.00	8.0	271.55	1.37
8.5	-	0.00	8.5	280.74	1.42
9.0	-	0.00	9.0	292.69	1.48
9.5	-	0.00	9.5	300.04	1.51
10.0	-	0.00	10.0	307.85	1.55
10.5	-	0.00	10.5	314.74	1.59
11.0	-	0.00	11.0	322.55	1.63
11.5	-	0.00	11.5	329.90	1.66
12.0	-	0.00	12.0	337.71	1.70
12.5	-	0.00	12.5	344.15	1.74
13.0	-	0.00	13.0	350.58	1.77

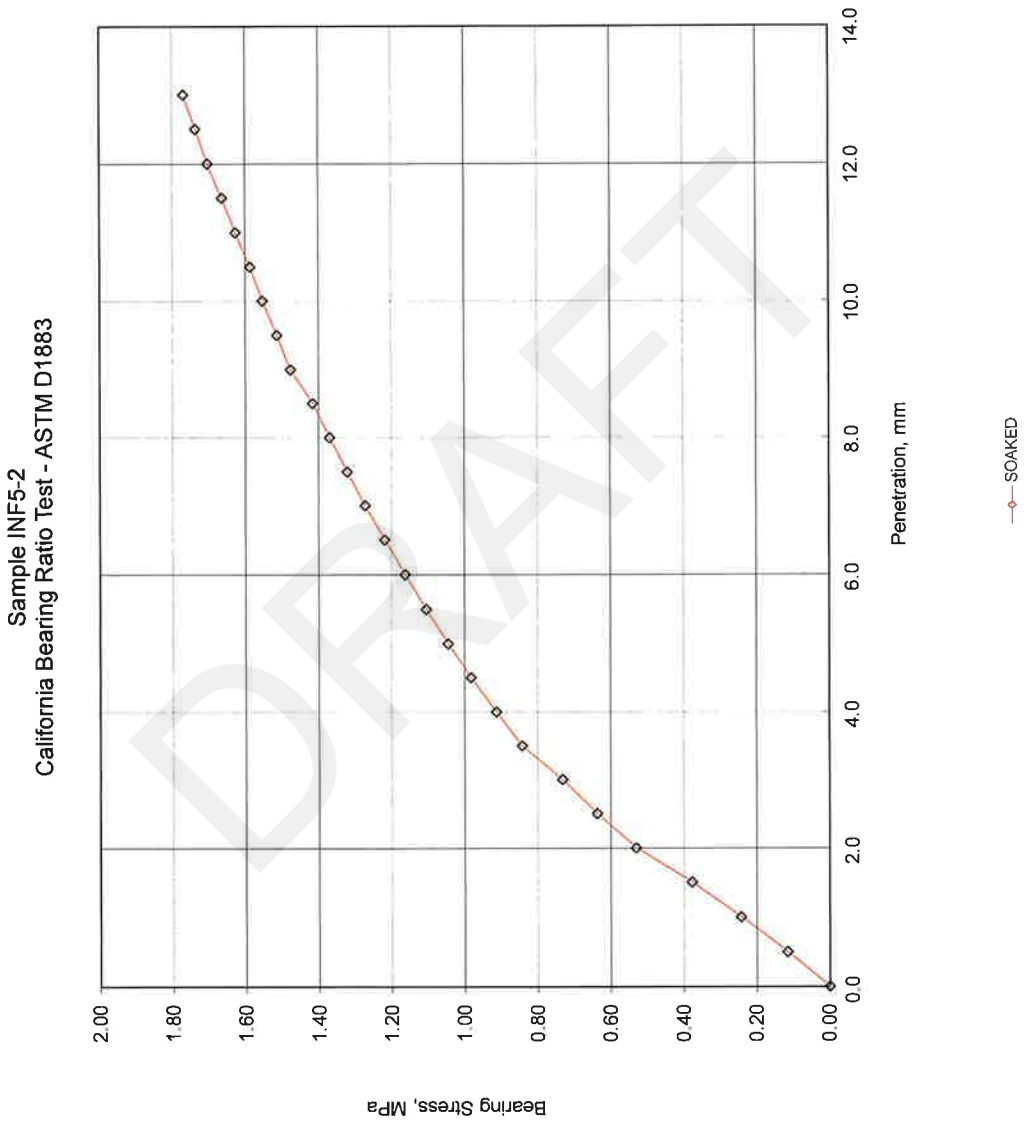
TEST RESULTS

	SOAKED
WATER CONTENT AT PENETRATION POINT, %	18.62
SWELL, %	0.36
CORRECTED STRESS VALUE (at 2.5 mm), MPa	0.64
CORRECTED STRESS VALUE (at 5.0 mm), MPa	1.05
BEARING RATIO (at 2.5 mm), %	***9.24***
BEARING RATIO (at 5.0 mm), %	***10.15***

Checked By: AH

WSP CANADA INC

CALIFORNIA BEARING RATIO TEST (CBR)



Project No.CA-0011941.3280(3000) **WSP Canada Inc.** Checked By: AH