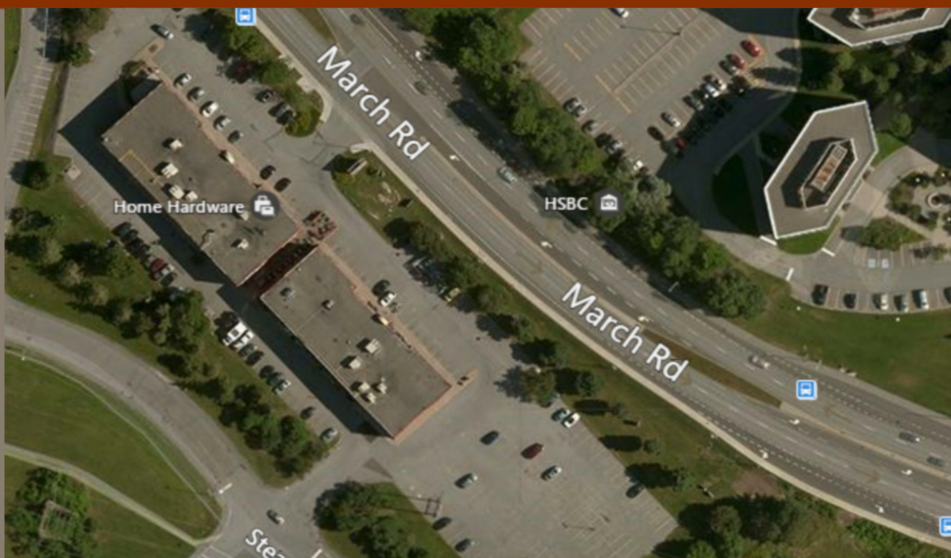

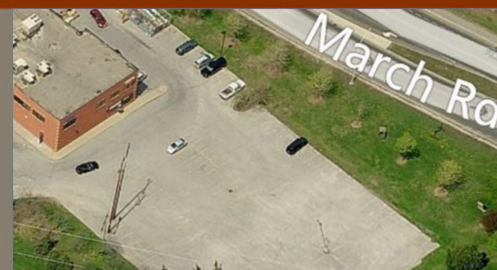

Kanata Mews, Proposed Commercial Unit Extension

329 March Road, City of Ottawa

Geotechnical Report: Site Investigation and Design Recommendations

Prepared for:

Bascorp Management
1611 Ortona Avenue
Ottawa, ON
K2C 1W4

Prepared by:
McIntosh Perry Consulting Engineers Ltd.
115 Walgreen Road
Carp, ON
K0A 1L0

February, 2016
CP-15-0465

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TABLES

APPENDICES

SITE INVESTIGATION REPORT
Kanata Mews
329 March Road, Ottawa, Ontario

1.0 INTRODUCTION

This report presents the factual findings obtained from a geotechnical investigation performed at the above mentioned site for the proposed development of a commercial property in Ottawa, Ontario. The field work was carried out on 2016 01 11 and comprised of a single borehole advanced to a maximum depth of 5.4 m.

The purpose of the investigation was to explore the subsurface conditions at this site and to provide anticipated geotechnical conditions influencing the design and construction of the proposed building.

2.0 SITE DESCRIPTION

The proposed building location is partly on a leveled parking lot and partly on a grass vegetated embankment. March Road, which provides to the complex, is at a higher elevation than the property for the proposed development. The property located to the east of March Road is also constructed at a lower elevation than the road. The area where the building is proposed is currently used as a parking lot for a mixed use of commercial and office strip mall. The existing parking lot is sloped towards a storm sewer catch basin. Cracks on asphalt surface of the parking lots were observed at several locations.

The location of the property is shown on Figure 1, included in Appendix B.

3.0 FIELD PROCEDURES

Utility clearance was carried out by USL-1 on behalf of McIntosh Perry. Public and private utility authorities were informed and all utility clearance documents were obtained before the commencement of drilling work.

The equipment used for drilling was owned and operated by CCC Geotechnical & Environmental Drilling Ltd. of Ottawa, Ontario. A truck-mounted L-45 drilling rig was used to drill the borehole.

The borehole was located within the probable building footprint. It was advanced using hollow stem augers and sampled using split spoon sampler. Samples were taken at 0.60 m to 0.75 m intervals, using a 51 mm O.D. split spoon sampler in accordance with the SPT test procedure. Borehole was backfilled with native material and restored to original ground with cold patch asphalt.

Borehole location is shown on Figure 2 included in Appendix B. Borehole log is provided in Appendix C.

4.0 LABORATORY TEST PROCEDURES

Laboratory tests on representative split spoon samples and Shelby tube recovered during this site investigation were carried out by McIntosh Perry engineers Ltd. The laboratory tests include moisture content and Atterberg limits. The laboratory tests were performed in accordance with Ministry of Transportation Ontario (MTO) test procedures, which follow American Society for Testing Materials (ASTM).

Paracel Laboratories Ltd., in Ottawa carried out chemical tests on one representative soil samples to determine the soil corrosivity characteristics.

The rest of the soil samples recovered will be stored in McIntosh Perry's storage facility for a period of one month after submission of the final report. Samples will be disposed after this period of time unless otherwise requested in writing by the owner or the representative of the owner.

5.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Site Geology

Based on published maps of the area (Ontario Geological Survey), the site is located within the Ottawa Valley Clay Plains. The Ottawa Valley between Pembroke and Hawkesbury consists of clay plains interrupted by ridges of rock or sand. It is naturally divided into two parts, above and below Ottawa. Within the valley, the bedrock is further faulted so that some of the uplifted blocks appear above the clay beds. The sediments themselves in the valley are deep silty clay. Although, the clay deposits are grey in color like the lime stones that underlies them in part, they are only mildly calcareous and likely derived from the more acidic rock of the Canadian Shield.

Surficial geology maps of the area also indicate that the property is located within fine-textured glaciomarine deposits.

5.2 Subsurface Conditions

The subsoil conditions at this site consist of a layer of asphalt, underlain by fill ranging from sandy gravel to gravelly sand with noticeable amount of silt, extends to a depth of 1.6 m below the asphalt surface. This fill is underlain by 1.4 m of clay, underlain by approximately 2 m of clay trace sand trace gravel which is followed by about 400 mm of sandy silt to the investigation depth of 5.4 m. The subsurface conditions encountered at this site mainly consisted of the following three distinct zones:

a) Sandy Gravel to Gravelly Sand and Silt (Fill)
b) Clay
c) Clay, trace Sand, trace gravel
d) Sandy Silt, trace Gravel

5.2.1 *Sandy Gravel to Gravelly Sand and Silt (Fill)*

The fill consisting of base and subbase materials was observed immediately below the asphalt surface of the parking area. This fill consisted of granular materials ranging from sandy gravel to gravelly sand with occasional cobbles. Two Standard Penetration Tests (SPT) conducted in the fill layer (N-Values 14 and 27 blows/300 mm) indicate compact state of denseness.

5.2.2 *Clay*

A layer of desiccated clay to the approximate thickness of 1.4 m encountered below the fill. The clay deposit was identified as stiff for the part above implied water level and the clay was softened as the water content increased. A sample form this layer was subject to plasticity test which indicated Liquid Limit of 55% and Plasticity Index of 36% which identifies the material as Fat Clay or clay of high plasticity (CH). Results from Atterberg limit tests conducted on a selected sample of this layer is provided on Figure 3 in Appendix B. The natural water content of this clay layer varies from 31% to 48% with an average value of 40%.

5.2.3 *Clay, trace sand, trace Gravel*

The desiccated clay layer is underlain by a clay layer containing trace sand and trace gravel. The layer transitioned from the upper layer at a depth of 3.0 m below the asphalt surface, from stiff to firm, moist to wet, and brown to grey. The in-situ vane shear strength of the clay below the desiccated crust varies from 61 kPa to 44 kPa, which indicates a stiff to firm consistency. The Standard Penetration Test value for this layer confirmed firm consistency.

The natural water content of this clay layer varies from 38% to 40% with an average value of 39%. Results from Atterberg limit tests conducted on a selected sample of this layer is provided on Figure 3 in Appendix B. Atterberg limit test results indicate liquid limit ranging between 36% and plasticity index of 21% and the material may be classified as clay of Low to Intermediate Plasticity (CL - CI) in accordance with Unified Soil Classification System (USCS).

Sample was extracted from the bottom of the thin-walled Shelby tube, recovered material was too coarse to perform an Atterberg limit test.

5.2.4 *Sandy Silt, Some Gravel*

The bottom clay layer is underlain by a sandy silt layer. The sandy silt layer was found to be wet and consisted of varying proportions of sand and gravel.

This layer extends to the depth of investigation where refusal to auguring and SPT sampler was encountered, indicating probable bedrock at 5.4 m below the surface.

5.3 Groundwater

Based on our field observations, the groundwater is expected at approximately 1.8 m to 2 m below existing parking lot pavement. However groundwater level may be expected to fluctuate due to the influence of precipitation and seasonal changes.

5.4 Chemical Analysis

The chemical test results conducted by Paracel Laboratories in Ottawa, Ontario, to determine the resistivity, pH, sulphate and chloride content of representative soil sample are shown in Table 5-1 below:

Table 5-1: Soil Chemical Analysis Results

Borehole	Sample	Depth / El. (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (Ohm-cm)
BH15-1	SS-3	1.5 – 2.1	6.97	0.0071	0.0175	1730

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

This section of the report provides recommendations for the design of the proposed building to be developed by BBS Construction (Ontario) Ltd at 329 Road in Ottawa, Ontario. The recommendations are based on interpretation of factual information obtained from the borehole advanced during the subsurface investigation. The discussions and recommendations presented are intended to provide sufficient information to the designer of the proposed building to select the suitable type(s) of foundation to support the structure.

The comments made on the construction are intended to highlight those aspects that could have impact or affect the detail design of the building, for which special provisions may be required in the Contract Documents. Those requiring information on construction aspects should make their own interpretation of the factual data presented in the report. Interpretation of the data presented may affect equipment selection, proposed construction methods, and scheduling of construction activities.

6.1.1 *Proposed Building*

The proposed building location will be partly on existing parking lot and partly on a grass vegetated embankment. March Road, which will serve as the access to the site is at a higher elevation than the property where the building is to be located. The property located to the east of March Road is also constructed at a lower elevation than the road. The area where the building is proposed is currently used as a parking lot for a mixed use of commercial and office strip mall.

The proposed building is for commercial purpose to be used by Bridgehead Coffee Shop. The proposed building is expected to have a gross footprint of approximately 372 m^2. It is understood that the proposed building will consists of single story with no basement or underground parking. The building will be constructed of prefabricated steel structure erected on a slab on grade or on shallow foundations. The finished grade of the property or elevation of the ground floor is not available on the proposed site plan provided to us.

6.2 Foundation

6.2.1 *Engineered Fill*

The proposed building will be located partly on the existing embankment. There is no information available on the finished grade of the ground floor to assess the height of engineered fill required to raise or lower the grade, especially in the area where the building is to be located on the embankment. The existing 1.6 m thick granular fill may have been placed to build the parking lots and consists of sandy gravel to gravelly sand. The variation of SPT blow counts within the fill suggest that the existing fill was not placed under controlled condition or uniformly compacted. Therefore, the behaviour of this material under applied loads cannot be predicted with a reasonable degree of accuracy. For this reason, the existing fill has to be removed from the influence zone of the proposed building and replaced with engineered fill. The influence zone of the footing is defined by a line slopes 1H:2V outward and downward form the edge of the footing to the stiff to firm desiccated clay underlying the fill. Engineered Fill should consist of clean sand and gravel such as OPSS Granular A or Granular B Type II. No recycled material other than crushed concrete shall be allowed in the Engineered Fill. This material should be tested by geotechnical engineer before being delivered to the site. Engineered Fill should be placed in lifts no thicker than 300 mm and compacted to 98% Standard Proctor Maximum Dry Density (SPMDD). The engineered fill shall be compacted to 100% SPMDD when within the influence zone of the footings (strip or pad footings).

The existing fill should be removed and the native subgrade to be proof rolled before placing the engineered fill. In addition, if any spongy, wet, or soft areas observed in the natural ground should be subexcavated and material removed. The total replacement fill height depending on the final grade is expected to be about 1.6 m. The fill should be placed in horizontal lift of uniform thickness of no more than 300 mm before compaction. It should be placed at appropriate moisture content and compacted to indicated density. The requirements for fill material and compaction may be addressed with a note on the structural drawing for foundation or grading drawing and/or with a Non Standard Special Provision (NSSP).

The subsoil at this site is not expected to undergo any significant settlement as a result of replacing the existing fill. Considering the desiccated stiff clay immediately below the fill, the settlement is not expected to be significant and any continuing settlement will be within a tolerable limit for the proposed building. If the proposed site grading requires placement of fill to higher elevation than existing, authors of this report shall be informed to provide further recommendation. In general in order to reduce the post construction settlements, the engineered fill should be placed at least three months prior to the commencement of construction of foundation.

6.2.2 *Slab-On-Grade*

A layer of OPSS Granular A should be used to support the slab on grade with a minimum thickness of 300 mm. Granular A should be compacted to 100% SPMDD. The constructed pad of Granular A might be underlain by loose to compact silt, Granular A, or Granular B Type II as detailed above.

For unheated areas, or in absence of insulated foundation walls surrounding the building, the compacted Granular A pad should be overlain by layers of structural insulation (High Load) with minimum of 250 kPa compressive strength. The R-Value of the insulation materials should be equal to the insulation provided by 1.8 m of soil cover. The specification of the manufacturer should be consulted to determine the insulation projection from the edge of the footing (slab-on-grade) considering a minimum projection of 1.8 m soil cover. The insulation layer should continuously cover the underside of slab-on-grade.

If all the conditions specified above are addressed as described, a Serviceability Limit State (SLS) of 125 kPa and Ultimate Limit State (ULS) of 150 kPa may be used for the design of the slab-on-grade and shallow footings installed at the surface.

6.2.3 *Shallow Foundation*

Considering the order of load expected at the foundation level including the load imposed by the fill and the subsoil conditions at this site, it is considered that provision of a conventional strip foundation will be adequate. A strip footing of 1.2 m wide placed at a depth of 2.0 ± 0.2 m below the proposed finished grade may be designed assuming the geotechnical resistances recommended below. The authors of this report should be consulted if excavation to a depth lower than the elevation specified is required.

The geotechnical resistance values at Ultimate Limit State (ULS) and Serviceability Limit State (SLS) provided below shall be used for the design of 1.2 m wide strip footings for the proposed building. The geotechnical resistance at ULS provided is based on a factor of 0.5 as recommended in the National Building Code of Canada (NBCC 2005). The total settlement for the geotechnical resistance at SLS recommended will be limited to 25 to 30 mm and the associated differential settlement may expected to be within about 20 mm.

Factored Bearing Pressure at ULS:	125 kPa
Bearing Pressure at SLS:	75 kPa

6.2.4 *Protection of Subgrade*

The founding level of the footing will be about 2.0 ± 0.2 m within the engineered fill or stiff clay layer encountered at the site. The fill, depending on the type of fill material or clay layer will be susceptible to disturbance from construction traffic and any ponded water. In order to limit the degradation of the founding soil, it is recommended that a concrete working slab (lean concrete) to be placed on the subgrade within four hours after preparation, inspection and approval of the footing subgrade. This requirement may be addressed with a note on the structural drawing for foundation and/or with a Non Standard Special Provision (NSSP).

6.2.5 *Lateral Earth Pressure*

Free draining material should be used as backfill material for foundation walls. If the proper drainage is provided "at rest" condition may be assumed for calculation of earth pressure on foundation walls. The following parameters are recommended for the granular backfill.

Table 6-1: Backfill Material Properties

Borehole	Granular "A"	Granular "B"
Effective Internal Friction Angle, ϕ'	35°	30°
Unit Weight, γ (kN/m^3)	22.8	22.8

6.3 Frost Protection

Based on applicable building codes, a minimum earth cover of 1.8 m, or the thermal equivalent of insulation, should be provided for all exterior footings to reduce the effects of frost action.

6.4 Site Classification for Seismic Response

6.4.1 *Site Classification for Seismic Response*

The footings are expected to be placed at about 2 ± 0.2 m below the finished grade and placed within the stiff clay layer. The in-situ vane shear test measured vary from 44 kPa to 61 kPa with an average value of 53 kPa. Therefore the average undrained shear strength value range between 50kPa and 100 kPa, and meet the requirement for Site Classification D. The soil shear wave average velocity, V_s, in Table 4.1.8.4.A of the National Building Code of Canada (NBCC 2005) range from 180 m/Sec to 360 m/Sec for the undrained shear strength ranging from 50 kPa to 100 kPa.

Based on the shear strength value, the site may be classified as a Site Class "D" for the purposes of site-specific seismic response to earthquakes based on Table 4.1.8.4.A OBC 2012, if the structure is supported on shallow foundations placed within the desiccated clay layer.

6.4.2 *Liquefaction Potential*

The shallow foundation recommended is expected to be placed over the clay layer overlying a thin layer of sandy silt followed by probable bedrock. The plasticity index (PI) of the clay range from 19 to 21 with an average value of 20. The ground water level is expected at 1.8 m to 2 m below existing grade. Therefore, the clay soil at this site may be moderately susceptible to liquefaction and there is not a major concern. However, if high ground water is expected, potential for soil liquefaction may be mitigated by lowering ground water by installing sump pump.

6.5 Construction Consideration

Any organic material and fill material of any kind should be removed from the footprint of the footing and replaced by suitable fill material to conform to specifications of OPSS Granular A. The engineered fill, if directly supporting the load of the structure, should be free from any recycled or deleterious material, it should not be placed in lifts thicker than 300 mm and compacted to 100% Standard Proctor Maximum Dry Density (SPMDD).

The founding level of the footings recommended is about 2.0 ± 0.2 m below finished grade and groundwater might be encountered at the bottom of the excavation. However, the excavated subgrade must be kept dry at all time to minimize the disturbance of the subgrade. If any groundwater or surface run-off encountered during the excavation, based on the expected hydraulic conductivity of the native material, a commonly used sump and pump method should be adequate to control the water.

A geotechnical engineer or technician should attend the site to confirm the type of the material and level of compaction.

Foundation walls should be backfilled with free-draining material such as OPSS Granular types A or B. The native clay is not a suitable material for backfilling. Sub-drains with positive drainage to the City sewer should be provided at foundation level.

The excavations for the foundation of the building would be advanced through engineered fill or desiccated clay layer. The overburden excavation should be completed in accordance with Ontario Regulation (O.Reg.) 213/91 under the Occupational Health and Safety Act (OHSA) with specific reference to acceptable size slopes and stabilization requirements. The general stratigraphy outlined herein fall into an OHSA Type 3 soil. For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation.

Authors of this report were not informed of site grading requirements. Site grading and fill placement has to be reviewed by geotechnical engineer before construction.

6.6 Site Services

The burial depth of water-bearing utility lines is typically 2.4 m below ground surface. If this depth is not achievable due to design restrictions, equivalent thermal insulation should be provided.

The contractor should retain a professional engineer to provide detailed drawings for excavation and temporary support of the excavation walls during construction.

Utilities should be supported on minimum of 150 mm bedding of Granular A compacted to minimum 95% of SPMDD. Since the native subgrade is clayey material, it is recommended to separate the subgrade from the bedding material by a layer of geotextile to prevent cross migration of materials. Utility cover can be Granular A or Granular B type II compacted to 95% SPMDD. All covers to be compacted to 100% SPMDD if intersecting structural elements.

6.7 Pavement Structure

No details are provided on the traffic loads but it is understood that the parking lot and surrounding paved area is to be used frequently by light to heavy weight vehicles, and delivery trucks on a daily basis.

Pavement structure most likely to be placed on existing fill material overlaying native clay. If the fill needs to be excavated to the required depth to accommodate the pavement structure, then the replacement engineered fill should be proof rolled under the supervision of a geotechnical engineer. Should grade raise be required, compacted Granular B Type II or Granular A should be placed as needed and compacted to 95% SPMDD prior to construction of pavement structure. The proposed pavement structure for light duty parking area and heavy duty access road for delivery trucks is included in **Error! Reference source not found.**.

Table 6-2: Proposed Pavement Structure

Material		Thickness (mm)	
		Light Duty	High Durability
Surface	Superpave 12.5 mm, PG 58-34	50	50
Binder	Superpave 19.0 mm, PG 58-34	---	60
Base	OPSS Granular A	150	150
Sub-base	OPSS Granular B Type II	350	550

Both base and sub-base should be compacted to 100% SPMDD. Existing fill is not suitable to be used for pavement structure. Asphalt layers should be compacted to comply with OPSS 310.

The above noted pavement structures are to be selected by planners based on the traffic circulation, location of access loads and vehicular loading.

6.8 Cement Type and Corrosion Potential

The chemical test was performed by Parcel laboratories on one soil sample from the native subgrade. The sulphate concentration of 0.0071% reported in Table 5-1 for fill material is less than 0.1% and the effect on buried concrete structures will be mild or relatively low. Therefor Type GU Portland cement may be adequate to protect buried concrete elements in the subsurface conditions encountered. The combination of pH. value of 6.97 and electrical resistivity of 1730 ohm-cm as reported would result in a slightly aggressively corrosive environment for steel elements in contact with soil.

7.0 CLOSURE

The field work was carried out under the supervision of Mary-Ellen Gleeson and direction of N'eem Tavakkoli. The equipment used was owned and operated by CCC Geotechnical & Environmental Drilling Ltd. of Ottawa, Ontario

This Site Investigation Report was prepared by Mary-Ellen Gleeson, EIT, Geotechnical Engineering Intern and reviewed by N'eem Tavakkoli, P. Eng., Geotechnical Engineer and Mark Vasavithasan, P.Eng., Senior Geotechnical Engineer.

The "Limitations of Report" presented in Appendix A are an integral part of this report.

McIntosh Perry Consulting Engineers Ltd.

M. Gleeson, M.Eng., EIT.
Geotechnical Engineering Intern

N. Tavakkoli, M.Eng., P.Eng.
Senior Geotechnical Engineer

REFERENCES

1) Canadian Geotechnical Society, "Canadian Foundation Engineering Manual", 4th Edition, 2006.

2) Ontario Ministry of Natural Resources (OMNR), Ontario Geological Survey, Special Volume 2, "The Physiography of Southern Ontario", 3rd Edition, 1984.

3) Google Earth, Google, 2015.

4) Government of Canada, National Building Code of Canada (NBCC), "Seismic Hazard Calculation" (online), 2010.

5) Canadian Standards Association (CSA), "Concrete Materials and Methods of Concrete Construction", A23.1, 2009

6) Government of Ontario, "Ontario Building Code (OBC)," (online), 2012.

Appendix A
Limitations of Report

LIMITATIONS OF REPORT

McIntosh Perry Consulting Engineers Ltd. (MPCE) carried out the field work and prepared the report. This document is an integral part of the Foundation Investigation and Design report presented.

The conclusions and recommendations provided in this report are based on the information obtained at the borehole locations where the tests were conducted. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the specific locations where tests were conducted and conditions may become apparent during construction, which were not detected and could not be anticipated at the time of the site investigation. The benchmark level used and borehole elevations presented in this report are primarily to establish relative differences in elevations between the borehole locations and should not be used for other purposes such as to establish elevations for grading, depth of excavations or for planning construction.

The recommendations presented in this report for design are applicable only to the intended structure and the project described in the scope of the work, and if constructed in accordance with the details outlined in the report. Unless otherwise noted, the information contained in this report does not reflect on any environmental aspects of either the site or the subsurface conditions.

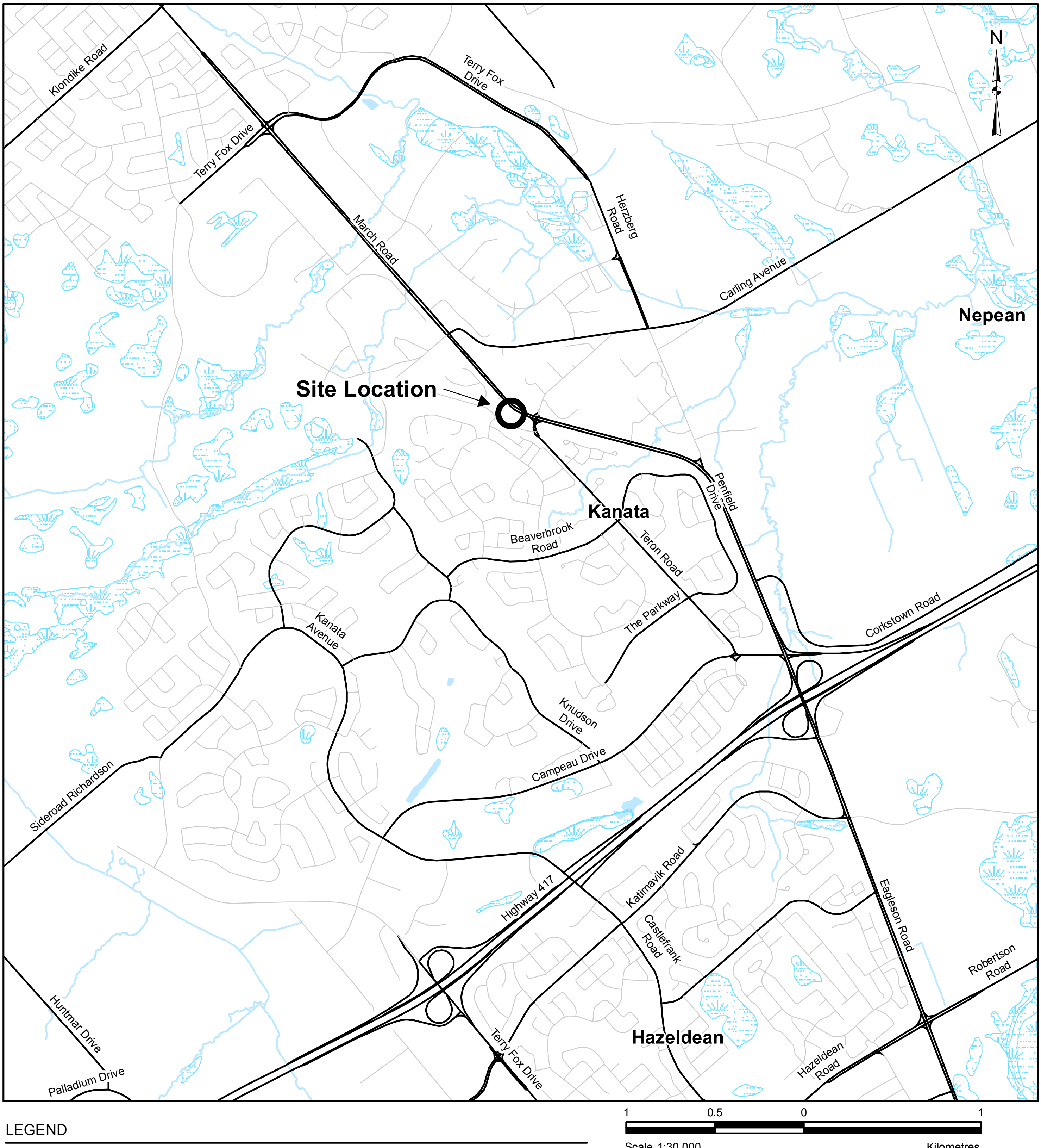
The comments or recommendation provided in this report on potential construction problems and possible construction methods are intended only to guide the designer. The number of boreholes advanced at this site may not be sufficient or adequate to reveal all the subsurface information or factors that may affect the method and cost of construction. The contractors who are undertaking the construction shall make their own interpretation of the factual data presented in this report and make their conclusions, as to how the subsurface conditions of the site may affect their construction work.

The boundaries between soil strata presented in the report are based on information obtained at the borehole locations. The boundaries of the soil strata between borehole locations are assumed from geological evidences. If differing site conditions are encountered, or if the Client becomes aware of any additional information that differs from or is relevant to the MPCE findings, the Client agrees to immediately advise MPCE so that the conclusions presented in this report may be re-evaluated.

Under no circumstances shall the liability of MPCE for any claim in contract or in tort, related to the services provided and/or the content and recommendations in this report, exceed the extent that such liability is covered by such professional liability insurance from time to time in effect including the deductible therein, and which is available to indemnify MPCE. Such errors and omissions policies are available for inspection by the Client at all times upon request, and if the Client desires to obtain further insurance to protect it against any risks beyond the coverage provided by such policies, MPCE will co-operate with the Client to obtain such insurance.

MPCE prepared this report for the exclusive use of the Client. Any use which a third party makes of this report, or any reliance on or decision to be made based on it, are the responsibility of such third parties. MPCE accepts no responsibility and will not be liable for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Appendix B
Figures



LEGEND

- Site Location
- Local Road
- Major Road
- Watercourse
- Waterbody
- Wetland

REFERENCE

Basedata provided by the Ontario Ministry of Natural Resources, 2015.

CLIENT: BASCORP MANAGEMENT

PROJECT: 329 MARCH ROAD

TITLE: KEY PLAN

McINTOSH PERRY
115 Walgreen Rd., RR#3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742

PROJECT NO: CP-15-0465		FIGURE:
Date	Jan. 20, 2016	1
GIS	JD	
Checked By	MG	

H:\01 Project - Proposals\2015 Jobs\CP\0CP-15-0465 - Bascorp - Site Plan - 329 March Road\GIS\mxd\CP150465_Geotech_01_KeyPlan_329March.mxd

LEGEND

Borehole Location
Proposed Building

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources, 2015.

CLIENT:	BASCORP MANAGEMENT
PROJECT:	329 MARCH ROAD
TITLE:	BOREHOLE LOCATIONS

McINTOSH PERRY

115 Walgreen Rd., RR#3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742

PROJECT NO: CP-15-0465		FIGURE:
Date	Jan. 20, 2016	2
GIS	JD	
Checked By	MG	

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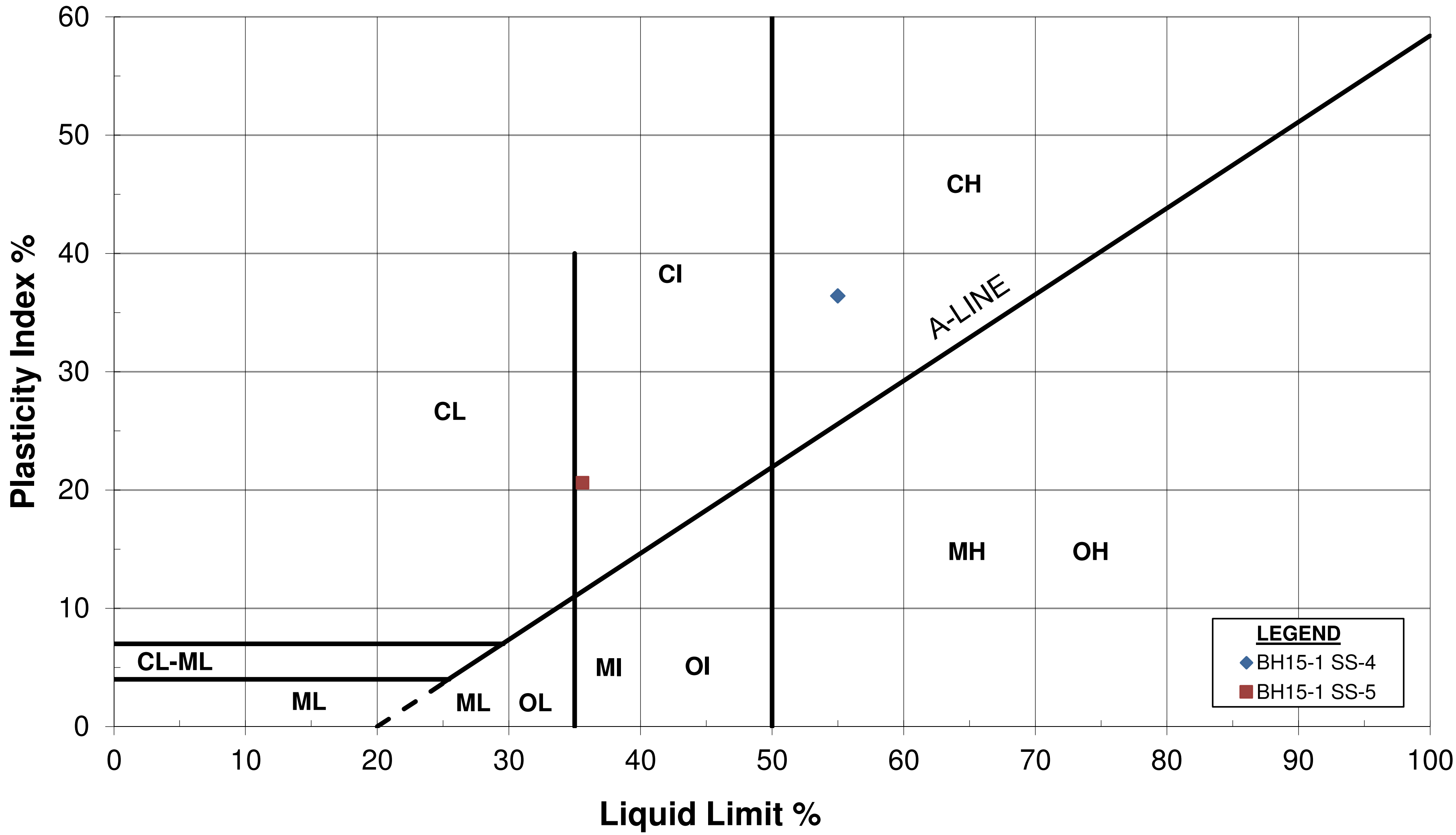

McINTOSH PERRY

PLASTICITY CHART

CLAY

329 March Road

Figure No. 3

0CP-15-0465

Appendix C
Borehole Records

McIntosh Perry Consulting Engineers Ltd
1-1329 Gardiners Rd
Kingston, Ontario K7P 0L8

RECORD OF BOREHOLE No BH15-1

METRIC

DATE 11/01/2016
ID 0CP-15-0465
CLIENT Bascorp
ELEVATION 86.6
LOCATION Co-ord; lat. 43.3349; lon. -75.9074
CONTRACTOR CCC Geotechnical and Environmental Drilling
DATUM Assumed
ORIGINATED BY MG
COMPILED BY MG
CHECKED BY MV

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES (REC)	SHEAR STRENGTH kPa	WATER CONTENT (%)
86.6 / 0.0	25 mm **ASPHALT** 450 mm base and subbase **SANDY GRAVEL to GRAVELY SILT,** compact, moist, brown (FILL)	1	SS	27		
		2	SS	14		
85.0 / 1.6	**CLAY,** stiff, desiccated, moist, brown to grey	3	SS	8		w ≈ 30
		4	SS	3		w_P ≈ 22, w ≈ 45, w_L ≈ 52
83.6 / 3.0	**CLAY,** trace sand, trace gravel, firm, moist to wet, grey	5	SS	1		w_P ≈ 20, w ≈ 30
					Field vane ≈ 60 (sensitivity 7); ≈ 43 (sensitivity 4)	
		6	TW			w ≈ 37
81.8 / 4.9	**SANDY SILT,** trace gravel, compact, wet, grey	7	SS	50/ 75mm		
81.2 / 5.4	**END OF BOREHOLE** Probable bedrock.					

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES (REC)); * GROUND WATER CONDITIONS; ELEVATION SCALE (86, 85, 84, 83, 82); DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L, WATER CONTENT (%) 25 50 75; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+3, ×3: Numbers refer to Sensitivity ○3% STRAIN AT FAILURE

Appendix D
Chemical Laboratory Test Results

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1-800-749-1947
www.paracellabs.com

Certificate of Analysis

McIntosh Perry Consulting Eng.

115 Walgreen Road
RR#3 Carp, ON K0A 1L0
Attn: Mary Ellen Gleeson

Client PO: CP-15-0465
Project: CP-15-0465 329 March Rd
Custody: 20471

Report Date: 22-Jan-2016
Order Date: 19-Jan-2016

Order #: 1604142

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1604142-01	BH15-1 SS-3

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	20-Jan-16	20-Jan-16
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	20-Jan-16	20-Jan-16
Resistivity	EPA 120.1 - probe, water extraction	20-Jan-16	20-Jan-16
Solids, %	Gravimetric, calculation	20-Jan-16	20-Jan-16

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Order #: 1604142

Certificate of Analysis

Report Date: 22-Jan-2016

Client: **McIntosh Perry Consulting Eng.**

Order Date:19-Jan-2016

Client PO: CP-15-0465

Project Description: CP-15-0465 329 March Rd

Client ID:		BH15-1 SS-3	-	-	-
Sample Date:		11-Jan-16	-	-	-
Sample ID:		1604142-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.8	-	-	-
General Inorganics					
pH	0.05 pH Units	6.97	-	-	-
Resistivity	0.10 Ohm.m	17.3	-	-	-
Anions					
Chloride	5 ug/g dry	175	-	-	-
Sulphate	5 ug/g dry	71	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Resistivity	ND	0.10	Ohm.m						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	41.8	5	ug/g dry	41.9			0.4	20	
Sulphate	50.5	5	ug/g dry	48.5			4.2	20	
General Inorganics									
pH	7.10	0.05	pH Units	6.97			1.9	10	
Physical Characteristics									
% Solids	92.0	0.1	% by Wt.	91.8			0.2	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	13.4		mg/L	4.2	92.3	78-113			
Sulphate	14.8		mg/L	4.85	99.4	78-111			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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Chain of Custody (Lab Use Only)

Nº 20471

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Client Name: McIntosh Perry

Contact Name: Mary-Ellen Gleeson

Address: 115 Walgreen Rd

Telephone: 613-836-2184 ext. 2279

Project Reference: CP-15-0465 329 March Rd

Quote #: 16-078

PO #: CP-15-0465

Email Address: m.gleeson@mcintoshperry.com

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required: ______

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [ ] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1604142

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Corrosivity										
1	BH15-1 SS-3				11-Jan-16		X			Ziplock bag							
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel.

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature] Rouse	Received at Lab: [signature]	Verified By: [signature]
Relinquished By (Print): MGleeson	Date/Time: 19/01/16 11:15AM	Date/Time: Jan 19/16 12:20	Date/Time: Jan 19/16 1:07
Date/Time: 11-Jan-16.	Temperature: / °C	Temperature: 19.7 °C	pH Verified [X] By: N/A

Appendix E

Explanation of Terms Used in Report

EXPLANATION OF TERMS USED IN REPORT

N-VALUE: THE STANDARD PENETRATION TEST (SPT) N-VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5 kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N-VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N-VALUE IS DENOTED THUS $\overline{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

C_u (kPa)	0 – 12	12 – 25	25 – 50	50 – 100	100 – 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 – 5	5 – 10	10 – 30	30 – 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSION AND STRUCUTRAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY IS:

RQD (%)	0 – 25	25 – 50	50 – 75	75 – 90	90 – 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINT AND BEDDING:

SPACING	50mm	50 – 300mm	0.3m – 1m	1m – 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	GS	GRAB SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_l, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ε	%	LINEAR STRAIN
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICALL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
c_c	1	COMPRESSION INDEX
c_s	1	SWELLING INDEX
c_a	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
Φ'	$-^o$	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
Φ_u	$-^o$	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = c_u / τ_r

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
s_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_P	%	PLASTIC LIMIT
w_s	%	SHRINKAGE LIMIT
I_P	%	PLASTICITY INDEX = ($W_L – W_L$)
I_L	1	LIQUIDITY INDEX = ($W – W_P$)/ I_P
I_C	1	CONSISTENCY INDEX = ($W_L – W$) / 1_P
$e_{,max}$	1,%	VOID RATIO IN LOOSEST STATE

e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	N PERCENT – DIAMETER
C_u	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE