January 2017

REPORT ON

Geotechnical Investigation
Proposed Residential Development
Remer and Idone Lands
Ottawa, Ontario

Submitted to:
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REPORT

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Table of Contents

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for a proposed residential development to be located on the "Remer and Idone Lands" (referred herein as the site) in Ottawa, Ontario. This report supersedes the previous geotechnical report titled "Geotechnical Investigation, Proposed Residential Development, Remer and Idone Lands, Ottawa, Ontario" (report number 13-1121-0083 (1042/2042), dated January 2016) which was issued for this project.

The purpose of this subsurface investigation was to determine the general soil, bedrock, and groundwater conditions across the site by means of 46 boreholes, 17 test pits and 1 hand augerhole. Based on an interpretation of the factual information obtained, along with the existing subsurface information available for the site from previous investigations, engineering recommendations are provided on the geotechnical design aspects of the proposed development, including construction considerations that could affect design decisions.

The reader is referred to the "Important Information and Limitations of This Report", which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to develop a residential subdivision on the Remer and Idone Lands in Ottawa, Ontario (see Key Plan, Figure 1).

The following information is known about the site and the proposed development:

- The site is located just west of Bank Street and south of Blais Road.
- The site measures approximately 600 metres by 1,500 metres in plan area.
- The site is proposed to be developed with mixed (singles, semi-detached, and town) residential houses, apartment buildings, one school, park blocks, a commercial area, and sewer installation.
- The apartment buildings will be 3-storeys in height and will have one level of underground parking. The buildings will be supported on shallow spread footings, with footing sizes of up to 1.7 metres by 1.7 metres. The underside of the footings will be on average about 1.8 metres below the finished grade, but will be as deep as about 3 metres below the finished grade.
- The sewer installation will require sewer trenches with varying depths from about 3 to 7 metres.
- This current geotechnical investigation is for the proposed residential development, servicing, and park lands only.
- Additional geotechnical investigations will be required once the details for the commercial development and school are available.

Several previous geotechnical and hydrogeological investigations have been carried out on and adjacent to the site by Golder Associates Ltd., Jacques Whitford, and Paterson Group at various times in the past 30 years. The results of those investigations are provided in the following reports:

- Report to Regional Group by Golder Associates titled “Preliminary Geotechnical Investigation, Proposed Residential Development, Ioni (note: should have read Idone) Property, 4840 Bank Street, Ottawa, Ontario”, dated May 2008 (report number 08-1121-0044).
- Report to Minto Development Inc. by Paterson Group titled “Preliminary Geotechnical Investigation, Proposed Development, Highway 31 at Blais Road, Ottawa, Ontario”, dated November 20, 2007 (report number PG0627-1).
- Report to Proctor and Redfern Limited by Jacques Whitford Environmental Limited titled “Hydrogeological Investigation, Remer Property, Leitrim, Ontario”, dated July 13, 1992 (report number 30227).
- Report to Remer Holdings by Golder Associates titled “Preliminary Geotechnical Investigation, Proposed Residential Development, Remer Holdings, Albion Road, Gloucester, Ontario”, dated November 1988 (report number 881-2175).
- Report to Tartan Homes Limited by Golder Associates titled “Preliminary Geotechnical Appraisal, Kellum Property, Leitrim Area, Gloucester, Ontario”, dated June 1988 (report number 881-2235).

The approximate locations of the relevant boreholes and test pits from the above previous investigations are shown on the Site Plan, Figure 2.

Based on the results of those previous investigations, as well as a review of the published geological mapping, the subsurface conditions across this site are expected to predominantly consist of variable deposits of sands and silts, overlying bouldery glacial till, above bedrock. The bedrock surface undulates and is expected to vary at depths of about 1 to 7 metres below the existing ground surface. Geological mapping indicates that the bedrock in the area consists of dolomite of the Oxford Formation.

A provincially significant wetland (Leitrim Wetland) is present to the west and northwest of the development site. The wetland area is known to be underlain by peat with thicknesses of up to and greater than 2.5 metres. Previous assessments in the area indicate that groundwater recharge to the Leitrim Wetland largely originates from the northwest-southeast trending sand and gravel ridge located south of the site.

In order to protect the natural function of the Leitrim Wetland and Casino Wetland, a hydrogeological assessment has been carried out in conjunction with this geotechnical investigation to evaluate the existing hydrogeological conditions at the site, and to predict the potential hydrogeological impacts to the groundwater and surface water flow systems that may be induced by the proposed development (both during construction and post-construction). The results of the hydrogeological assessment are provided under separate cover.

3.0 PROCEDURE

The fieldwork for this investigation was carried out between September 23 and October 25, 2013 (Phase I), and between September 29 and October 13, 2016 (Phase II). During those periods, the following test holes were put down at the approximate locations shown on the Site Plan, Figure 2.

- Thirty three (33) boreholes (numbered 13-1 to 13-33, inclusive) were advanced across the site (during Phase I)
- Thirteen (13) additional boreholes (numbered 16-101 to 16-113, inclusive) were advanced along the proposed sewer trenches (during Phase II)
- Seventeen (17) test pits (numbered 16-1 to 16-16, and 16-20) were advanced along the proposed sewer trenches and within the proposed park land (during Phase II)
- One (1) hand augerhole (numbered 16-18) was advanced at the western end of the site where the 3-storey apartment buildings are being proposed (during Phase II)

In 2013, the boreholes were advanced using either a track-mounted hollow stem auger drill rig or portable drilling equipment supplied and operated by Marathon Drilling Company Ltd. (Marathon) of Ottawa, Ontario. These boreholes were advanced through the overburden to depths of about 1.1 (practical refusal to augering) to 7.7 metres below the existing ground surface.

In 2016, the additional boreholes were advanced using a track mounted hollow stem auger drill rig equipment supplied and operated by CCC Geotechnical and Environmental Drilling Ltd. (CCC) of Ottawa, Ontario. These boreholes were advanced through the overburden to depths of about 3.5 to 6.3 metres below the existing ground surface.

Standard penetration tests (SPTs) were carried out in the overburden at regular intervals of depth in the boreholes and samples of the soils encountered were recovered using split spoon sampling equipment.

Upon encountering auger refusal on the bedrock surface, 15 of the boreholes (numbered 13-1, 13-3, 13-6, 13-10, 13-13, 13-17, 13-18, 13-24, 16-101 to 16-104, 16-107, 16-111 and 16-113) were advanced about 0.5 to 3.9 metres into the bedrock, using diamond drilling techniques while retrieving NQ or HQ sized bedrock core. Diamond drilling techniques were also required to advance past the cobbles and boulders within the glacial till in boreholes 13-5, 13-9, 13-10, 13-29, 13-32, 16-101, 16-102, 16-108, 16-109, and 16-111.

Monitoring wells or standpipe piezometers were installed in 18 of the boreholes, to allow for subsequent measurement of the groundwater level and/or for carrying out in situ hydraulic conductivity testing. The groundwater level measurements and in situ hydraulic conductivity testing were carried out on October 28 through November 12, 2013 and November 11, 2016.

The test pits were excavated using a track-mounted hydraulic excavator supplied and operated by R. Pomerleau Ltd. (Pomerleau) through R.W. Tomlinson Limited (Tomlinson) of Ottawa, Ontario. The test pits were extended to depths of about 2.0 to 7.0 metres below the existing ground surface prior to the test pits being terminated or encountering practical refusal to excavating.

The hand augerhole was advanced manually using a hand auger by Golder Associates personnel to a depth of about 2.2 metres below ground surface prior to the side walls sloughing.

Within the test pits and hand augehole, the depths of strata were assessed visually from the sidewalls and samples of soils were obtained from each strata.

The fieldwork was supervised by a member from our engineering staff who located the test holes, directed the drilling, excavating operations, and in situ testing, logged the test holes and samples, and took custody of the soil and bedrock samples retrieved.

Upon completion of the drilling and excavating operations, samples of the soils and bedrock encountered in the test holes were returned to our laboratory for further examination by the project engineer and for laboratory testing. The laboratory testing included natural water content determination, grain size distribution, and Atterberg Limits.

Six samples of soil (one each from boreholes 13-4, 13-6, 13-13, 13-16, 13-23, and 13-31) were submitted to EXOVA laboratories for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried steel elements.

The borehole locations were selected by Golder Associates and were located in the field by a survey crew provided by Tomlinson. The ground surface elevation at each borehole location and the elevation of the top of each monitoring well completed in 2013 was determined by Golder Associates personnel and are referenced to Geodetic datum. The ground surface elevation for the 2016 boreholes was determined by Annis O'Sullivan Vollebekk Ltd. (AOV) and also referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

The subsurface conditions encountered in the test holes put down for the current investigation are shown on the Record of Test Pit, Hand Augerhole, Borehole, and Drillhole Sheets in Appendix A. The results of the laboratory water content and Atterberg limits testing carried out on selected soil samples are also provided on the Record of Borehole Sheets. The results of grain size distribution and Atterberg limits testing carried out on selected samples of soils from the current investigation are provided on Figures 3 to 7.

The subsurface conditions encountered in the relevant boreholes and test pits from previous investigations on this site are shown on the Borehole and Test Pit Records in Appendix B.

The results of the basic chemical analysis carried out on six soil samples are provided in Appendix D.

In general, the subsurface conditions on this site consist of topsoil or peat (at the western portion of the site) overlying, sands, silts, and then overlying bouldery glacial till, above bedrock. The depth to the bedrock surface varies from about 2 to greater than 7 metres below the ground surface, generally increasing in depth from east to west.

The following sections present a more detailed overview of the subsurface conditions encountered in the test holes from the current investigation and the relevant test holes from the previous investigations.

4.2 Topsoil, Peat, and Fill

Topsoil exists at the ground surface at most of the test hole locations. Where encountered, the topsoil ranges from about 38 to 610 millimetres in thickness, but is typically less than about 350 millimetres in thickness.

Peat is present at the ground surface on the western portion of the site. The peat ranges from about 200 to 900 millimetres in thickness, but is more typically between 400 and 600 millimetres.

A layer of organic silt, about 110 millimetres thick, was encountered below the peat at test pit 16-20.

Fill was encountered at TP 08-1. At this location (at the time of the previous investigation) the fill was about 0.8 metres thick (the fill thickness may have changed since the previous investigation). The fill consists of topsoil overlain by sandy silt, some clay and a trace of gravel.

4.3 Clayey Silt and Silty Clay

Localized deposits of clayey silt and silty clay were encountered below the topsoil or peat at test pits 16-3, 16-15, TP 1, TP 4, augerhole AH 220, and boreholes 13-27, 13-30, BH 4 and PH 1 at depths of about 0.2 to 1.9 metres below the ground surface, with thicknesses varying from about 0.1 to 1.8 metres.

Three SPT “N” values measured in the clayey silt deposit ranged from 5 to 6 blows per 0.3 metres of penetration, indicating stiff consistency.

The results of Atterberg limit testing carried out on one sample of the silty clay measured a plasticity index value of about 12 percent and a liquid limit value of about 30 percent, indicating a soil of low to intermediate plasticity. The results of the Atterberg limits testing is presented on Figure 3. The measured water content on samples of the clayey silt and silty clay range from about 22 to 28 percent.

4.4 Sands and Silts

The topsoil, peat, and clayey soils are generally underlain by variable deposits of sands and silts. These deposits predominantly consist of sand, silty sand to sandy silt and silt, with varying amounts of gravel, cobbles and boulders. These deposits extend to depths ranging from about 0.6 to 6.7 metres below the ground surface, generally increasing in thickness from east to west.

SPT "N" values in the sandy and silty deposits ranged widely from 2 to 100 blows per 0.3 metres of penetration, indicating a very loose to very dense state of packing.

The measured water contents of samples from the sandy and silty soils vary from 8 to 64 percent.

The results of grain size distribution testing carried out on selected samples from these deposits are provided on Figures 4 to 6.

4.5 Glacial Till

A deposit of glacial till generally exists below the topsoil, peat, silty clay to clayey silt, and sand and silt deposits. The glacial till consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand to sandy silt.

Where fully penetrated (i.e., the bedrock was cored or the bedrock was observed in the test pits), the glacial till varies from about 0.6 to 6.9 metres in thickness and extends to depths ranging from about 2.6 to 7.0 metres below the existing ground surface. In the remaining test holes, the deposit was proven to depths of about 1.1 to 9.4 metres below the existing ground surface prior to the test holes encountering refusal to augering or being terminated.

SPT "N" values obtained in this deposit ranged widely from 6 to greater than 50 blows per 0.3 metres of penetration, indicating a loose to very dense state of packing. However, the higher "N" values likely reflect the presence of cobbles and boulders within the deposit or the bedrock surface, rather than the actual state of packing of the soil matrix. In several of the boreholes, rotary diamond drilling techniques were required to penetrate past the boulders in this deposit.

The measured water contents of samples of the glacial till ranged from 4 to 17 percent.

The results of grain size distribution testing carried out on selected samples from the glacial till deposit are provided on Figure 7.

4.6 Refusal or Bedrock

Practical refusal to augering or excavating was encountered at depths varying between about 1.1 to 9.4 metres below the existing ground surface. Refusal may indicate the bedrock surface; however, it could also represent boulders within the glacial till.

The bedrock surface was confirmed/proven to exist at depths ranging from about 2.6 to 7.0 metres below the existing ground surface. Fifteen (15) of the boreholes (numbered 13-1, 13-3, 13-6, 13-10, 13-13, 13-17, 13-18, 13-24, 16-101 to 16-104, 16-107, 16-111, and 16-113) were extended into the bedrock for depths of about 0.5 to 3.9 metres using rotary diamond drilling techniques while retrieving NQ or HQ sized core.

The following table provides a summary of the ground surface elevation, depth to the bedrock surface, and the elevation of the bedrock surface; elevations are provided in metres above sea level (masl).

Borehole/ Test Pit Number	Ground Surface Elevation (masl)	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (masl)
13-1	95.95	2.59	93.36
13-3	103.12	6.30	96.82
13-6	95.28	4.52	90.76
13-10	105.83	7.01	98.82
13-13	97.97	3.91	94.06
13-17	99.15	4.44	94.71
13-18	94.74	3.35	91.39
13-24	94.43	6.27	88.16
16-3	95.21	3.20	92.01
16-4	94.17	4.10	90.07
16-5	96.75	2.00	94.75
16-6	98.93	4.20	94.73
16-7	103.09	6.10	96.99
16-8	94.33	3.00	91.33
16-9	99.62	3.40	96.22
16-10	94.62	2.50	92.12
16-11	95.03	3.50	91.53
16-12	96.68	4.20	92.48
16-13	94.43	5.10	89.33
16-14	96.91	2.90	94.01
16-16	95.92	4.60	91.32
16-101	96.98	3.48	93.50
16-102	94.76	6.29	88.47
16-103	98.05	5.10	92.95
16-104	95.82	4.49	91.33
16-107	94.24	4.78	89.46
16-111	94.47	5.09	89.38
16-113	94.75	4.57	90.18

The bedrock encountered in the boreholes consists of sandstone, dolostone, and limestone, with black shale partings. The bedrock is generally slightly weathered to fresh, thinly to thickly bedded, and light grey to light brown in colour.

The Rock Quality Designation (RQD) values measured on the recovered bedrock core samples were quite variable and ranged between 0 and 96 percent, indicating a very poor to excellent rock quality.

4.7 Groundwater and Hydraulic Conductivity

Monitoring devices or standpipe piezometers were installed in 18 of the boreholes. The groundwater level measurement and in situ hydraulic conductivity testing were carried out on October 28 through November 12, 2013 and on November 11, 2016.

The following table summarizes the measured groundwater levels and the calculated hydraulic conductivity.

Borehole Number	Geological Unit	Date of Measurement	Ground Surface Elevation (masl)	Water Level Depth (m)	Water Level Elevation (masl)	Estimated Hydraulic Conductivity (m/s)
13-1A	Bedrock	Nov 12, 2013	95.95	3.20	92.75	1×10^{-3}
13-1B	Glacial Till	Nov 12, 2013	95.95	2.05	93.90	-
13-3A	Bedrock	Nov 12, 2013	103.12	3.48	99.64	8×10^{-5}
13-3B	Glacial Till	Nov 12, 2013	103.12	3.49	99.63	7×10^{-8}
13-9	Glacial Till	Nov 12, 2013	106.35	-0.11[1]	106.46	5×10^{-6}
13-13A	Bedrock	Nov 12, 2013	97.97	2.91	95.06	4×10^{-4}
13-13B	Glacial Till	Nov 12, 2013	97.97	2.89	95.08	9×10^{-8}
13-17A	Bedrock	Nov 8, 2013	99.15	1.79	97.36	3×10^{-5}
13-17B	Glacial Till	Nov 8, 2013	99.15	1.31	97.84	3×10^{-6}
13-18A	Bedrock	Oct 28, 2013	94.74	-0.05[1]	94.79	3×10^{-5}
13-18B	Glacial Till/ Sands and Silts	Oct 28, 2013	94.74	0.08	94.66	5×10^{-7}
13-20	Glacial Till	Nov 4, 2013	97.05	0.55	96.50	1×10^{-5}
13-24A	Bedrock	Oct 28, 2013	94.43	0.11	94.32	1×10^{-5}
13-24B	Sands and Silts	Oct 28, 2013	94.43	0.05	94.38	3×10^{-6}
13-25	Sands and Silts	Nov 7, 2013	94.91	-0.21[1]	95.12	2×10^{-6}
13-26A	Sands and Silts	Nov 7, 2013	95.44	-0.02[1]	95.42	7×10^{-6}
13-26B	Sands and Silts	Nov 7, 2013	95.44	0.00	95.46	1×10^{-6}
13-29A	Glacial Till	Nov 4, 2013	97.10	0.08	97.02	9×10^{-6}
13-29B	Sands and Silts	Nov 4, 2013	97.10	0.06	97.04	3×10^{-6}
13-32A	Glacial Till	Nov 7, 2013	96.12	0.10	96.02	6×10^{-6}
13-32B	Sands and Silts	Nov 7, 2013	96.12	0.12	96.00	6×10^{-6}
13-33A	Glacial Till	Nov 8, 2013	100.93	0.71	100.22	9×10^{-5}
13-33B	Sands and Silts	Nov 8, 2013	100.93	0.72	100.21	2×10^{-6}
16-101	Bedrock	Nov 11, 2016	96.98	2.71	94.27	-
16-104	Glacial Till/Bedrock	Nov 11, 2016	95.82	4.27	91.55	-
16-106	Glacial Till	Nov 11, 2016	103.84	4.43	99.41	-
16-107	Glacial Till	Nov 11, 2016	94.24	1.69	92.55	-
16-111	Bedrock	Nov 11, 2016	94.47	0.51	93.96	-

Note: [1] Negative value indicates the measured water level above ground surface.

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

5.0 DISCUSSION

5.1 General

This section of the report provides engineering recommendations on the geotechnical design aspects of this project based on our interpretation of the test hole information as well as the project requirements, and is subject to the limitations in the "Important Information and Limitations of This Report" attachment which follows the text of this report, but forms an integral part of this document.

5.2 Site Grading

In general, the subsurface conditions at this site consist of topsoil or peat, overlying variable thicknesses of clays, silts, and sands, followed by glacial till, which is in turn underlain by bedrock. The surface of the bedrock undulates and was encountered at depths ranging from about 2.0 to 7.0 metres below the existing ground surface.

From a foundation design perspective, no practical restrictions apply to the thickness of grade raise fill that may be placed within the proposed residential development area. However, grade raises in excess of 2.5 metres should be reviewed and approved.

With regards to the site grading, it should be noted that excavations for basement construction and installation of the site services within some parts of the site will extend below the groundwater level in the sands and silts. These deposits are somewhat permeable and therefore, in these areas, there would be some advantage to limiting the required depth of excavation (particularly for basements), since the groundwater management requirements (and costs) would increase with excavation depth below the groundwater level. It would be preferred, from a geotechnical perspective, to limit the depth of excavation for basement construction to no more than about 1 metre below the *existing* ground surface.

For predictable performance of the structures, roadways, and site services, preparation for filling of the site should include stripping the existing topsoil (which is up to about 0.6 metres thick) and peat (which is up to about 0.9 metres thick). The topsoil or peat is not suitable as general fill and should be stockpiled separately for re-use in landscaping applications only. In areas with no structures, roadways or services, the existing topsoil or peat may be left in place provided some long term settlement of the ground surface following filling above them can be tolerated.

5.3 Foundations

With the exception of the topsoil and peat, the native undisturbed soils and bedrock at this site are considered suitable for the support of conventional wood frame houses and townhouse blocks on spread footing foundations.

For design purposes, the allowable bearing pressures for spread footings (for the houses and apartment buildings) may be taken as 75 kilopascals for the silty clay to clayey silt as well as sands and silts, provided the soils have not been disturbed by groundwater inflow. For footings founded on the glacial till, an allowable pressure of 100 kilopascals may be used. For footings founded on the bedrock, an allowable bearing pressure of 250 kilopascals may be used.

The post-construction total and differential settlements of footings sized using the above maximum allowable bearing pressures should be less than about 25 and 15 millimetres, respectively, provided that the overburden soils at or below the founding level are not disturbed during construction. Suitable control of the groundwater inflow is required if such disturbance is to be avoided. Footings on bedrock should experience negligible settlements.

The glacial till at this site contains cobbles and boulders. Any boulders in footing areas that have been loosened by the excavation process should be removed and the cavity filled with lean concrete.

At some locations on the property, and depending on the amount of proposed grade raise (i.e., filling), the inorganic or native subgrade elevation may be lower than the underside of footing elevation. At these locations, the subgrade may be raised to the footing elevation using engineered fill consisting of Ontario Provincial Standard Specification (OPSS) Granular B Type II, placed in maximum 300 millimetre thick lifts, and compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The engineered fill material must be placed within the full zone of influence of the house foundations. The zone of influence is considered to extend out and down from the edge of the perimeter footings at a slope of 1 horizontal to 1 vertical (1H:1V).

Where the subgrade at footing level changes from bedrock to overburden, differential settlement could result at this transition due to the different settlement properties of these materials. To limit the magnitude of the differential settlement, transition details (such as placing additional reinforcing steel in the foundation walls) may be required. The structural engineering consultant should be contacted for input on this issue.

There may be portions of the site where the shallow sand and silt deposits will be exposed at footing/subgrade level. Prior to construction of footings or the placement of engineered fill within these areas, the surface of the native sandy and silty materials should be proof rolled to provide surficial densification of any loose or disturbed material.

Since these sandy deposits, where present, are sometimes "loose", they could be potentially liquefiable in an earthquake (i.e., potentially subject to temporary strength loss and post-earthquake settlements). That potential issue is not however considered relevant to the house design because:

- The potential post-earthquake differential settlements would be relatively small in relation to the expected collapse potential of a house (and the objective of earthquake-resistant design is only to avoid collapse and to provide for safe exit).
- The proof rolling of the sandy subgrade soils, as specified above, would densify any such soils in the immediate area of the footings and therefore the directly supporting soils would be non-liquefiable.

5.4 Seismic Design

The seismic design provisions of the 2012 Ontario Building Code (OBC) depend, in part, on the shear wave velocity of the upper 30 metres of soil and/or bedrock below founding level. Based on the 2012 OBC methodology, this site can be assigned a Site Class of D, acknowledging that this requirement does not apply to ground oriented residential structures designed per Part 9 of the OBC.

More favourable Site Class values could potentially be assigned for portions of the site if shear wave velocity testing were carried out. The founding levels versus the bedrock levels would also need to be known. However, it is considered that a Site Class of D permits conventional foundation design for this site.

5.5 Frost Protection

The soils at this site are frost susceptible. For frost protection purposes, all exterior footings or interior footings in unheated areas should be provided with a minimum of 1.5 metres of earth cover. Isolated, exterior footings adjacent to surfaces that are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

Particular attention to frost protection details will be required around the below grade entrances for the apartment buildings. Insulation could be provided as an alternative to earth cover for frost protection.

5.6 Basement Excavations

Excavations for basements will be through the topsoil or peat, and into the underlying silty clay to clayey silt, and sandy and silty deposits. Excavations into the glacial till will be required where the surface of the till is shallower, which will be the case at the eastern portion of the site. Bedrock excavation may also be required depending on the proposed site grading.

No unusual problems are anticipated in excavating the overburden materials using conventional hydraulic excavating equipment, recognizing that large boulders (which may be nested) will likely be encountered in the glacial till. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes, for worker safety.

Based on the measured groundwater levels, excavations deeper than about 1 to 2 metres, depending on the area of the site, will likely extend below the groundwater level. Where this is the case, the excavation will be subject to disturbance to the soils caused by upward flow of groundwater, resulting in possible disturbance of the excavation subgrade and potential instability of the excavation side slopes.

The groundwater levels at this site range from about the existing ground surface to about 4.5 metres below the ground surface. Provided that the basement excavations are no more than about 1 metre deep (relative to the current ground surface level), it is considered that it should generally be possible to handle the groundwater inflow by pumping from well filtered sumps in the floor of the excavations. Where the subgrade is found to be wet and sensitive to disturbance, consideration should be given to placing a mud slab of lean concrete over the subgrade (following inspection and approval by geotechnical personnel), or a 150 millimetre thick layer of OPSS Granular A underlain by a non-woven geotextile, to protect the subgrade from construction traffic.

Some pre-drainage of the site using ditching, or pumping from one or more sumps to locally lower the groundwater level to at least 0.5 metres below the floor of the excavation would assist in avoiding subgrade disturbance, where the subgrade consists of sandy soils. These measures would be particularly necessary wherever the excavation will extend more than about 1 metre below the existing ground surface.

Consideration should be given at the time of tender for the basement excavating work to carrying out a few test excavations across the site in presence of bidders so that the actual excavation conditions and rate of groundwater inflow can be assessed.

Where the groundwater level is lowered below the floor of the excavation in advance of construction, excavation side slopes should be stable in the short term at 1H:1V. In accordance with the Occupational Health and Safety Act of Ontario (OHSA), excavation side slopes below the groundwater will need to be cut back at 3H:1V vertical (i.e., Type 4 soils). If required, near vertical trench walls in the bedrock should stand unsupported for the construction period.

5.7 Basement and Garage Floor Slabs

In preparation for the construction of the basement floor slabs, all loose, wet, and disturbed material should be removed from beneath the floor slabs. Provision should be made for at least 200 millimetres of 19 millimetre crushed clear stone to form the base of the basement floor slabs. The underslab fill should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

To prevent hydrostatic pressure build up beneath the basement floor slabs, it is suggested that the granular base for the floor slabs be positively drained. This could be achieved by providing a hydraulic link between the underfloor fill material and the exterior drainage system.

The groundwater levels at this site range from near the existing ground surface to about 4.5 metres below the ground surface. The sandy and silty soils at this site are relatively permeable and therefore, if/where the groundwater level is encountered above the basement subgrade level, a geotextile could be required between the clear stone underslab fill and the subgrade soil, to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone and ultimately into the drainage system. Where a geotextile is required, it should consist of a Class II non-woven geotextile with a Filtration Opening Size (FOS) not exceeding 100 microns, in accordance with OPSS 1860.

The backfill material inside the garage should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment. The granular base for the garage floor slab should consist of at least 150 millimetres of OPSS Granular A compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.8 Basement Walls and Foundation Wall Backfill

The soils at this site are frost susceptible and should not be used as backfill directly against exterior, unheated, or well insulated foundation elements. To avoid problems with frost adhesion and heaving, these foundation elements should either be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I or, alternatively, a bond break such as the Platon system sheeting could be placed against the foundation walls.

Drainage of the wall backfill should be provided by means of a perforated pipe subdrain in a surround of 19 millimetre clear stone, fully wrapped in geotextile, which leads by gravity drainage to an adjacent storm sewer or sump pit. Conventional damp proofing of the basement walls is appropriate with the above design approach.

Should the foundations be designed in accordance with Part 4 of the OBC, further guidelines on the foundation wall design will be required.

5.9 Site Servicing

Excavations for the installation of site services will be made through the topsoil or peat, clayey soils, silty and sandy deposits, glacial till, and into the underlying bedrock. Based on the observed groundwater levels at this site, the excavations are expected to extend below the groundwater level.

No unusual problems are anticipated in excavating in the overburden using conventional hydraulic excavating equipment, recognizing that large boulders may be encountered in the glacial till. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes, for worker safety.

Excavation side slopes above the water table should be stable in short term at 1H:1V (i.e., for Type 3 soils per OSHA of Ontario). Excavation side slopes below groundwater level will need to be cut back at 3H:1V (i.e., Type 4 soils).

The stand up time for exposed side slopes will be extremely short and the subgrade will be disturbed if left exposed for any length of time. Construction of site services should be planned to be carried out in short sections, which can be fully completed in a minimal amount of time. The rate of groundwater inflow from the overburden could be significant. Based on past experience on the adjacent sites and particularly where the excavations are deeper and/or where the overburden is coarser, some pre-drainage of the overburden will be required. For example, several sumps could be constructed and pre-pumping of the overburden carried out.

Alternatively, excavations within the overburden soils could also be carried out within a fully braced steel trench box, which would minimize the width of the excavation. The use of a trench box will not, however, eliminate the potential for disturbance outside the trench box limits.

Excavation through the bedrock will likely require drill and blast procedures. Mechanical break-up of the bedrock using a hoe ram may be slow. Equipment wear (such as for drill bits) could be significant.

Near vertical trench walls in the bedrock should stand unsupported for the construction period.

Some groundwater inflow through the overburden into the excavations should be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations provided that multiple suitably sized pumps are used.

However, significant groundwater inflow should be expected where the excavation extends into/through the upper zone of bedrock. The hydraulic conductivity value for the bedrock at this site is estimated to be in the order of $1x10^{-3}$ to $1x10^{-5}$ metres per second (m/s). The contractor should therefore be made aware that the pumping requirements will be significant. Pre-pumping from sumps in the bedrock for a period of up to a few weeks might be a feasible method to lower the groundwater level.

Additional guidelines pertaining to groundwater control are provided in Section 5.10.

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer consisting of compacted OPSS Granular B Type II beneath the Granular A or to thicken the Granular A bedding. The bedding material should, in all cases, extend to the spring line of the pipe and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project, since fine particles from the sandy backfill materials or sandy soils on the trench walls could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the overburden soils and bedrock as trench backfill, provided the bedrock is well broken and broadly graded (maximum size of 300 millimetres). The rock fill, however, should only be placed from at least 300 millimetres above the pipes to avoid damage due to impact or point load. Material from below the water table may be re-used provided that it can be adequately placed and compacted.

Some of the overburden materials below the water table may be too wet to compact. Where that is the case, these materials should be wasted (and drier materials imported) or these materials should be placed only in the lower portions of the trench, recognizing that some future ground settlement over the trenches will likely occur. In that case, it would also be prudent to delay final paving for as long as practical and significant padding of the roadways may be required in these areas prior to final paving.

Boulders larger than 300 millimetres in diameter will also interfere with the backfill compaction and should be removed from the excavated material prior to re-use as backfill.

Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

Low permeability dykes or cut-offs should be constructed at 100 metre intervals in the service trenches, in particular along main service lines within the development that have continuity with off-site services, to reduce groundwater lowering at the site due to the 'french drain' effect of the granular bedding and surround for the service pipes. It is important that these barriers extend from trench wall to trench wall and that they fully penetrate the granular materials to the trench bottom. The dykes should be at least 1.5 metres wide and could be constructed using relatively dry (i.e., compactable) grey brown weathered silty clay.

5.10 Groundwater Control

5.10.1 Inflow Estimate and Radius of Influence

Significant groundwater control has typically been required during the installation of site services into the upper bedrock zone in the adjacent Findlay Creek Village development, due to the highly permeable and fractured nature of the upper bedrock. Groundwater control requirements in service trenches completed in the silty and sandy deposits and/or glacial till overburden have been typically much smaller.

For example, pumping rates used during the excavation to install the deep trunk storm sewer at Findlay Creek Village in 2005/2006 to a depth of about 5 to 6 metres into the bedrock were typically on the order of 1,000,000 litres per day (L/day) with peaks for several days up to 10,000,000 L/day and 18,000,000 L/day in July 2006. These rates were found to be sufficient to effectively facilitate temporary groundwater control in the sewer excavations. Based on the groundwater elevations recorded in the existing monitoring wells during this period, the radius of influence of this temporary pumping was estimated to be approximately 1,500 metres from the excavation.

In October and November 2013, groundwater pumping from excavations extending into the upper bedrock at Cedar Creek Drive, just south of the existing commercial development at Findlay Creek Village, resulted in a measureable decline of about 0.2 metres in groundwater levels at the groundwater monitors located more than 850 metres from the pumping location. Pumping volumes during this period ranged up to 1,200,000 L/day.

The range of hydraulic conductivity values calculated at the overburden and bedrock groundwater monitors installed on the Remer and Idone Lands is similar to the range calculated at the monitors installed at Findlay Creek Village, therefore the groundwater inflow to service trenches on the Remer and Idone Lands can reasonably be expected to be similar to analogous excavations on Findlay Creek Village lands.

The highest pumping rates are expected when pumping from trenches that extend into the bedrock (i.e., generally along the northern boundary area of the Remer Lands). Based on the measured groundwater levels, approximately 4.5 to 5.0 metres of groundwater level lowering is anticipated to be required in these service trenches.

A hydrogeological analysis was carried out to estimate the groundwater inflow. The analysis assumes that the sewer invert elevations/depths for the final sewer system layout and design will be similar to those provided by IBI Group in correspondence dated June 23, 2014.

The groundwater flow analysis assumes that up to 120 metres of the trench excavation would be open at one time, with a trench width of 5 metres. It was assumed that the groundwater elevation would need to be lowered to 5 metres below the existing groundwater elevation. The Dupuit-Forchheimer flow equation for an unconfined aquifer (Powers, 2007, eq. 6.3) was used to estimate the potential inflow to the trench excavation. Since groundwater inflow at this location will enter the trench from both the overburden and bedrock, the hydraulic conductivity used for this analysis was a depth-averaged value, using the highest (conservative) estimated hydraulic conductivities for the bedrock and the overburden in this part of the site (1×10^{-3} m/s and 1×10^{-5} m/s, respectively). The resulting depth-averaged hydraulic conductivity value was 2.6×10^{-4} m/s.

The results of the analytical modelling for groundwater inflows using the assumed trench excavation configuration are provided in Appendix C and summarized in the following table:

Assumed Hydraulic Conductivity	Initial Pumping Rate	Estimated Steady-State Pumping Rate	Estimated Steady-State Radius of Influence
2.6×10^{-4} m/s	9,100,000 L/day	2,600,000 L/day	240 metres

Based on the results of the analytical model, a pumping rate of approximately 9,100,000 L/day could be required to initially dewater the trench excavation; however, the steady state dewatering rate (i.e., water taking rate once the excavation is fully dewatered) to maintain the trench in a dewatered condition is estimated to be approximately 2,600,000 L/day. These values are similar to the groundwater pumping rates used in 2005/2006 and in 2013 at Findlay Creek Village under similar hydrogeologic conditions and trench configurations.

The radius of influence of temporary dewatering is estimated to range from approximately 240 metres (derived from the analytical model) to 1,500 metres (estimated for the 2005/2006 trunk sewer installation) from the excavation (see Appendix C).

5.10.2 Potential Effects of Dewatering on the Leitrim Wetland

For groundwater taking from trench excavations that extend into the bedrock, the estimated radius of influence ranges from 240 to 1,500 metres from the excavation. Trenches that are anticipated to extend into the bedrock are generally located along the northern boundary of the Remer Lands, as close as 120 metres from the boundary of the Leitrim Core Wetland. Drawdown of bedrock groundwater levels in the wetland is therefore anticipated during construction dewatering.

The maximum drawdown observed in the overburden and bedrock monitors at Findlay Creek Village in July 2006 and October 2013 was plotted against the distance to each monitor from the approximate geographical centre of pumping locations, to create the distance-drawdown graph as shown in Figure 8. When the x-axis (approximate distance from the centroid of the pumping locations) is logarithmic, as shown in Figure 8, the distance-drawdown relationship can be fairly accurately represented by a straight line.

Assuming that the groundwater elevation along the northern boundary area of the Remer Lands would need to be temporarily lowered to a maximum of 5.0 metres below the existing groundwater elevation, and assuming that the radius of influence would be approximately 1,500 metres from the excavation, a drawdown curve has also been plotted on Figure 8 to estimate the extent of groundwater lowering near the excavation. Figure 8 shows that the expected drawdown at 120 metres from the centroid of the pumping locations (i.e., the closest that the service trenches that extend into bedrock come to the wetland) is approximately 1.8 metres, and that at 500 metres, the expected drawdown in the bedrock is approximately 0.8 metres.

At Findlay Creek Village, groundwater pumping from bedrock excavations has been observed to induce a response in overburden groundwater levels. However, the magnitude of the response in the overburden groundwater levels has typically been smaller than the change in bedrock groundwater levels at the same location. Once pumping stopped following the previous historical groundwater control events, the overburden and bedrock groundwater levels were observed to quickly recover to pre-pumping levels (i.e., within hours to a few days).

If variations in the overburden groundwater levels are short-term in nature, impacts to vegetative communities are not expected to occur. The groundwater pumping requirements for servicing of the Remer and Idone Lands are expected to be similar to historical pumping requirements at Findlay Creek Village (i.e., continuous pumping at a rate on the order of 1,000,000 L/day for four to five months with peaks for several days at pumping rates of approximately 10,000,000 L/day to 18,000,000 L/day).

Observations made by biologists conducting photomonitoring and other surveys since 2006 as part of the ongoing vegetation monitoring program in the Leitrim Core Wetland areas to the north have not indicated adverse effects due to temporary groundwater control activities. Since the proposed groundwater taking regime at the Remer and Idone Lands is expected to be similar to the historical groundwater pumping durations and rates at the nearby Findlay Creek Village, it is anticipated that the proposed temporary pumping will not impact the function of the Leitrim Core Wetland. If water taking is required within the overburden, it is also not expected to impact the function of the Leitrim Core Wetland. In addition, no adverse long-term changes in water quantity or quality are expected due to the proposed temporary groundwater control activities required to install services in the Remer and Idone Lands.

Under the new regulations, which came into force on March 29, 2016, if the pumping volumes exceed 400,000 L/day, a Category 3 Permit-To-Take-Water (PTTW) will be required from the Ministry of the Environment and Climate Change (MOECC). A Category 3 PTTW will be required for this site due to the expected high volumes of water that will need to be pumped from the trench excavations. The time required to obtain a PTTW can be several months. Consideration should therefore be given to applying for the permit well in advance of construction.

5.11 Pavement Design

In preparation for pavement construction, all topsoil and peat should be removed from all pavement areas.

Sections requiring grade raising to the proposed subgrade level should be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material (SSM). These materials should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the materials' standard Proctor maximum dry density using suitable compaction equipment.

The surface of the subgrade or fill should be crowned to promote drainage of the pavement granular structure. Perforated pipe subdrains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres in four orthogonal directions or longitudinally where parallel to a curb.

The pavement structure for local roads, which will not experience bus or truck traffic (other than school bus and garbage collection), should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	375

The pavement structure for collector roadways which will experience bus and/or truck traffic should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with Table 10 of OPSS 310. The composition of the asphaltic concrete pavement should be as follows:

- Superpave 12.5 millimetres Surface Course – 40 millimetres
- Superpave 19 millimetres Base Course – 50 millimetres

The asphaltic cement should consist of PG 58-34 and the design of the mixes should be based on a Traffic Category B for local roads and Category D for collector roads.

The above pavement design is based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

5.12 Park Lands

Three parks are currently being proposed on this site and are to be located within Blocks 414, 446 and 464.

The subsurface conditions in the proposed park land areas generally consist of peat (only at Block 414) and/or topsoil, overlying variable deposits of sands and silts, and glacial till. Peat was not encountered within Blocks 446 and 464. However, approximately 610 to 760 millimetres of peat was encountered in three of the test holes (BH13-25, BH13-26, and AH219) put down within Block 414.

Overall, the subsurface conditions in the proposed park areas are considered to be similar to the subsurface conditions on the adjacent roadways and building lots (i.e., the thickness of peat or topsoil within the park areas is not greater than that of the topsoil within the adjacent roadways and building lots).

As is typical, prior to any filling of the park areas, any topsoil or peat should be removed from within the footprints of any grade dependent structures, concrete slabs, playing fields, and pavements for predictable performance of structures and "grades" (the same guidelines apply to the adjacent roadways and building lot areas). In areas with no proposed structures, services, or roadways, the topsoil or peat may be left in-place provided some settlement of the ground surface following filling above them can be tolerated. The native inorganic overburden soils within the park land areas are considered suitable for the support of grade dependent structures.

Provided that the topsoil and/or peat are removed (which is also a requirement for the adjacent roadways and building lots), it is considered that no unusual design or construction criteria will be required for future buildings or play structures within the park area from a geotechnical point of view.

5.13 Pools, Decks and Additions

5.13.1 Above Ground and In Ground Pools

No special geotechnical considerations are necessary for the installation of in-ground or above ground pools.

5.13.2 Decks

There are no special geotechnical considerations for decks on this site.

5.13.3 Additions

Any proposed addition to a house (regardless of size) will require a geotechnical assessment. Written approval from a geotechnical engineer should be required by the City of Ottawa prior to the building permit being issued.

5.14 Tree Planting Restrictions

Silty clay soils in the Ottawa area are highly sensitive to water depletion by trees of high water demand during periods of dry weather. When trees draw water from the silty clay, the silty clay undergoes shrinkage which can result in settlement of adjacent structures.

Based on the results of this subsurface investigation, silty clay soils exist within the extreme southwest corner of the site (in TP 1). However, this area is designated as a "No Touch Zone" (i.e., no structures will constructed in this area). This being the case, there are no tree planting restrictions for this site.

A localized layer of silty clay was also encountered near the ground surface at test pit 16-15 along the west part of the north site boundary. The silty clay is only about 350 millimetres thick and has a low to intermediate plasticity. However, the silty clay is very localized (i.e., not encountered in other test holes), has a limited thickness, and is located at the site boundary. Based on the above, it is considered that tree planting restrictions do not apply to this site, as concluded above.

5.15 Corrosion and Cement Type

Six samples of soils, one each from boreholes 13-4, 13-6, 13-13, 13-16, 13-23 and 13-31, were submitted to EXOVA laboratories for chemical analysis related to potential corrosion of exposed buried ferrous elements and potential sulphate attack on buried concrete elements. The results of the analysis are provided in Appendix D.

The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a moderate to elevated potential for corrosion of exposed ferrous metal, which should be considered in the design of the substructures.

6.0 ADDITIONAL CONSIDERATIONS

The soils on this site are sensitive to disturbance from ponded water, construction traffic, and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soils having adequate bearing capacity have been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill as well as sewer bedding and backfill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction view point.

The test pits excavated and backfilled during the current and previous investigations constitute zones of disturbance to the native soils. The presence of the backfill materials could affect the performance of surface structures or other settlement-sensitive facilities should they be constructed above the zone of influence of those locations. In such cases, the excavated soil should be removed and replaced with engineered fill.

The groundwater level monitoring devices installed at the site will require decommissioning in accordance with Ontario Regulation 128/03. However, it is expected that most of the wells will either be destroyed during construction or can be more economically abandoned as part of the construction contract. If that is not the case or is not considered feasible, abandonment of the monitoring wells can be carried out separately.

Golder Associates should be retained to review the final drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

7.0 CLOSURE

We trust that this report meets your current requirements. If you have any questions, or if we may be of further assistance, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Christine Ko, P.Eng.
Geotechnical Engineer

Troy Skinner, P.Eng.
Associate, Senior Geotechnical Engineer

KM/CK/TMS/PAS/sg/ob
\\golder.gds\gal\ottawa\active\2013\1121 - geotechnical\13-1121-0083 remer and idone lands\phase 1046 remer detailed design\05-report\13-1121-0083-1046_rpt-001_geotech_24jan2017.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client, Leitrim South Holdings Inc. and 4840 Bank St. Ltd. c/o The Regional Group. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then the client may authorize the use of this report for such purpose by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process, provided this report is not noted to be a draft or preliminary report, and is specifically relevant to the project for which the application is being made. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

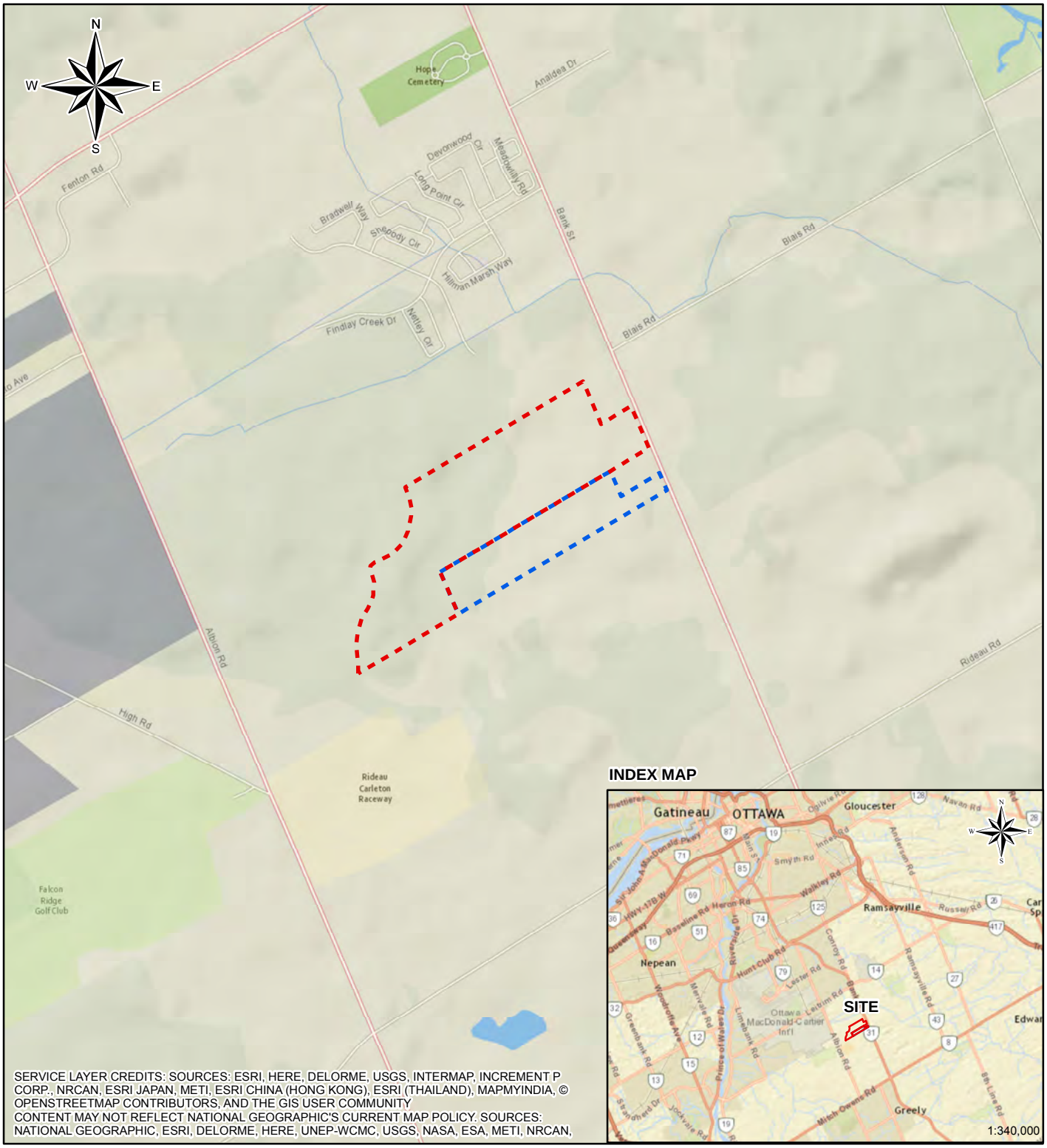
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



LEGEND

REMER LANDS STUDY AREA BOUNDARY

IDONE LANDS STUDY AREA BOUNDARY

500 250 0 500

SCALE 1:25,000 METRES

NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 13-1121-0083 (1046).

REFERENCE

DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9

PROJECT

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT, REMER AND IDONE LANDS
OTTAWA, ONTARIO

TITLE

KEY PLAN

Golder Associates

PROJECT No. 13-1121-0083			SCALE AS SHOWN	REV. 0.0
DESIGN	CK	2016-12-22	FIGURE 1	
GIS	BR	2016-12-22		
CHECK	CK	2016-12-22		
REVIEW	TMS	2016-12-22		

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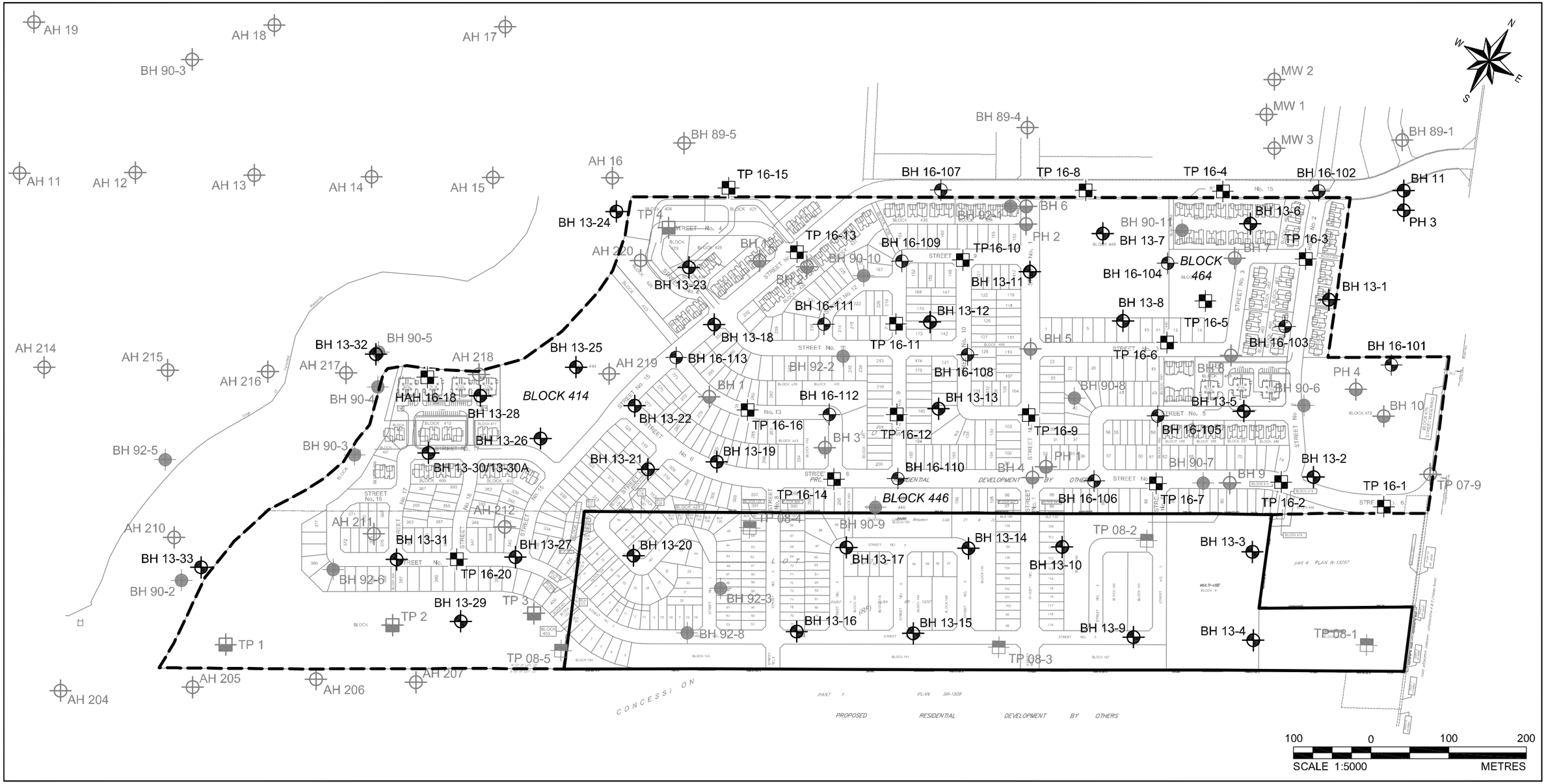


LEGEND

- APPROXIMATE BOREHOLE LOCATION IN PLAN, CURRENT INVESTIGATION
- APPROXIMATE TEST PIT/HAND AUGERHOLE, CURRENT INVESTIGATION
- APPROXIMATE TEST PIT LOCATIONS IN PLAN, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD. REPORT No. 08-1121-0044
- APPROXIMATE BOREHOLE LOCATIONS IN PLAN, PREVIOUS INVESTIGATION BY JACQUES WHITFORD, REPORT No 30227-1
- APPROXIMATE BOREHOLE LOCATIONS IN PLAN, PREVIOUS INVESTIGATION BY JDP, REPORT No PG0627
- APPROXIMATE TEST PIT LOCATIONS IN PLAN, PREVIOUS INVESTIGATION BY JDP, REPORT No PG0627
- APPROXIMATE BOREHOLE, TEST PIT AND HAND AUGERHOLE LOCATIONS IN PLAN, PREVIOUS INVESTIGATIONS BY GOLDER ASSOCIATES LTD.
- IDONE LANDS STUDY AREA BOUNDARY
- REMER LANDS STUDY AREA BOUNDARY

REFERENCE

BASE DATA PLAN PROVIDED IN ELECTRONIC FORMAT BY STANTEC, 2017-01-05.
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9

NOTE

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD.REPORT NO.13-1121-0083 (1046)
2. BOREHOLES "GREYED OUT" FOR CLARITY
3. LOCATIONS FOR BH 13-21, BH 13-30, HAH 16-18 AND TP 16-20 ARE APPROXIMATE ONLY

Golder Associates
Ottawa, Ontario

FILE No.	1311210083-1046-02.dwg
PROJECT No.	13-1121-0083
REV.	
SCALE	AS SHOWN
DATE	2016-08-17
DESIGN	
CADD	JM/BR
CHECK	CK
REVIEW	TMS

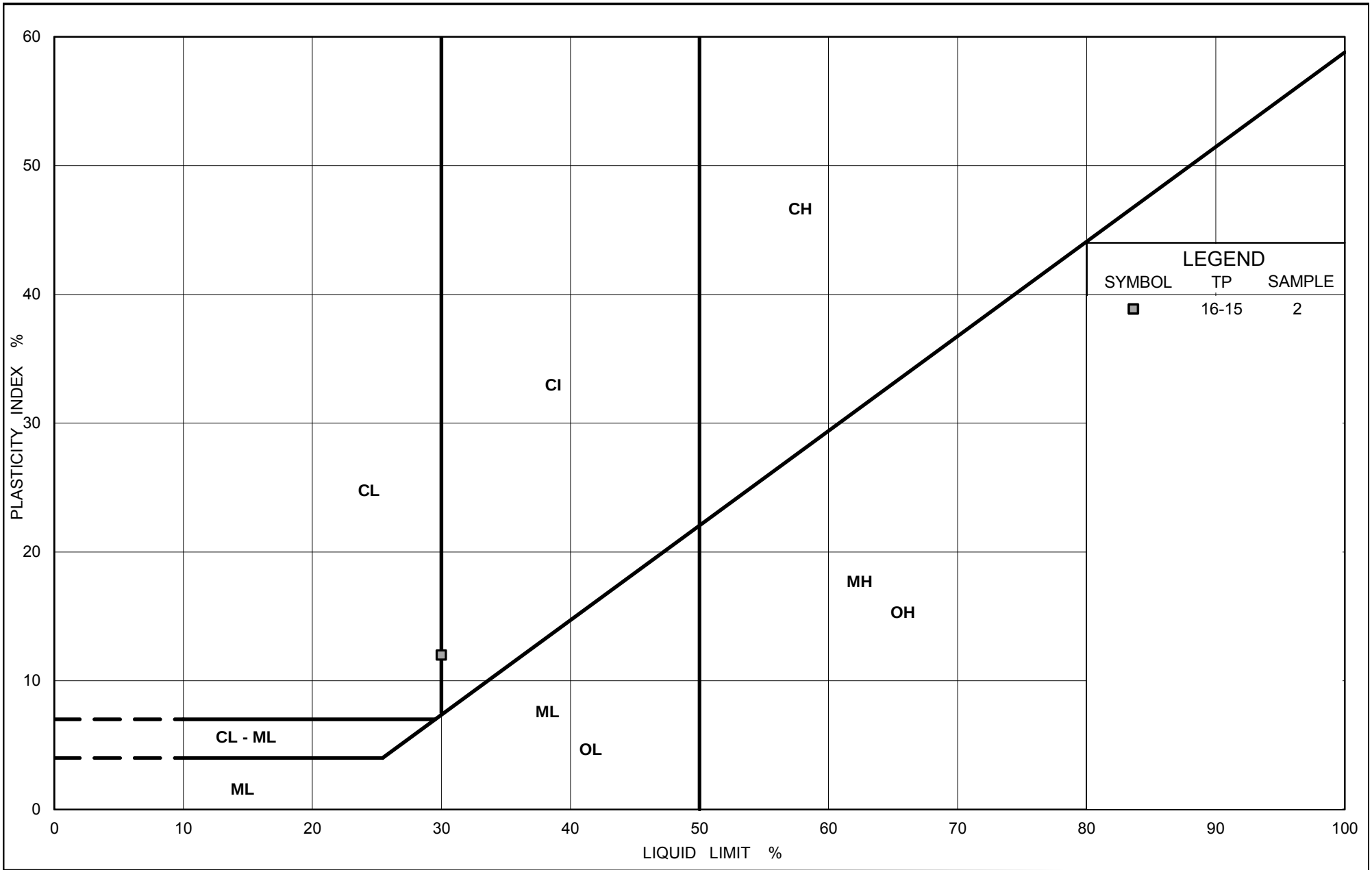
TITLE

SITE PLAN

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
REMER AND IDONE LANDS, OTTAWA, ONTARIO

FIGURE 2

FILENAME: N:\Active\2013\1121 - Geotechnical\13-1121-0083 Remer and Idone Lands\Spatial_IM\GIS\Autocad\Phase 1046\1311210083-1046-02.dwg



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PLASTICITY CHART

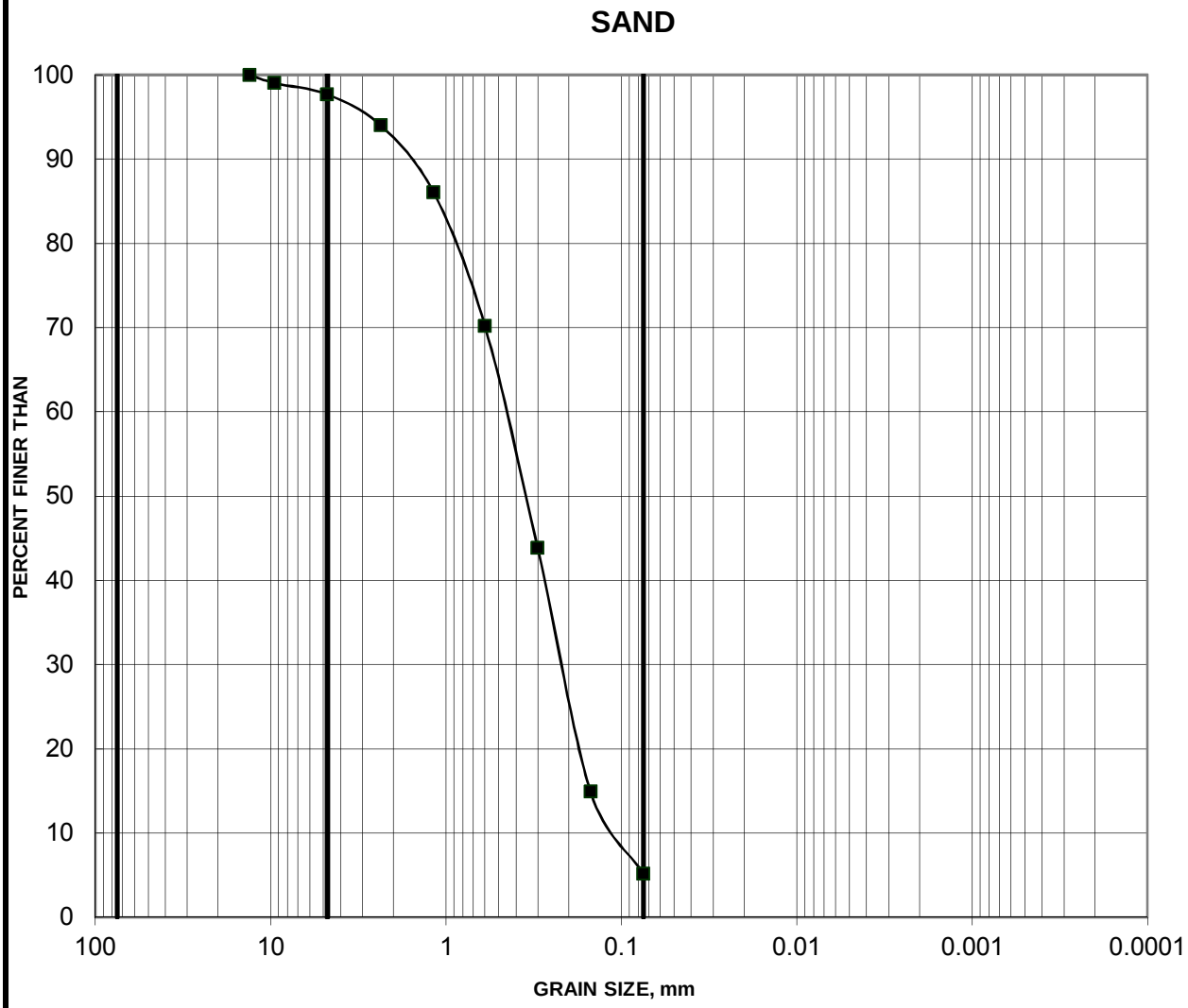
Figure : 3

Project No.: 13-1121-0083-1046

Compiled By : MI Checked By : CNM

GRAIN SIZE DISTRIBUTION

FIGURE 4



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
13-21	7A	4.57-5.03

Project: 13-1121-0083-1046

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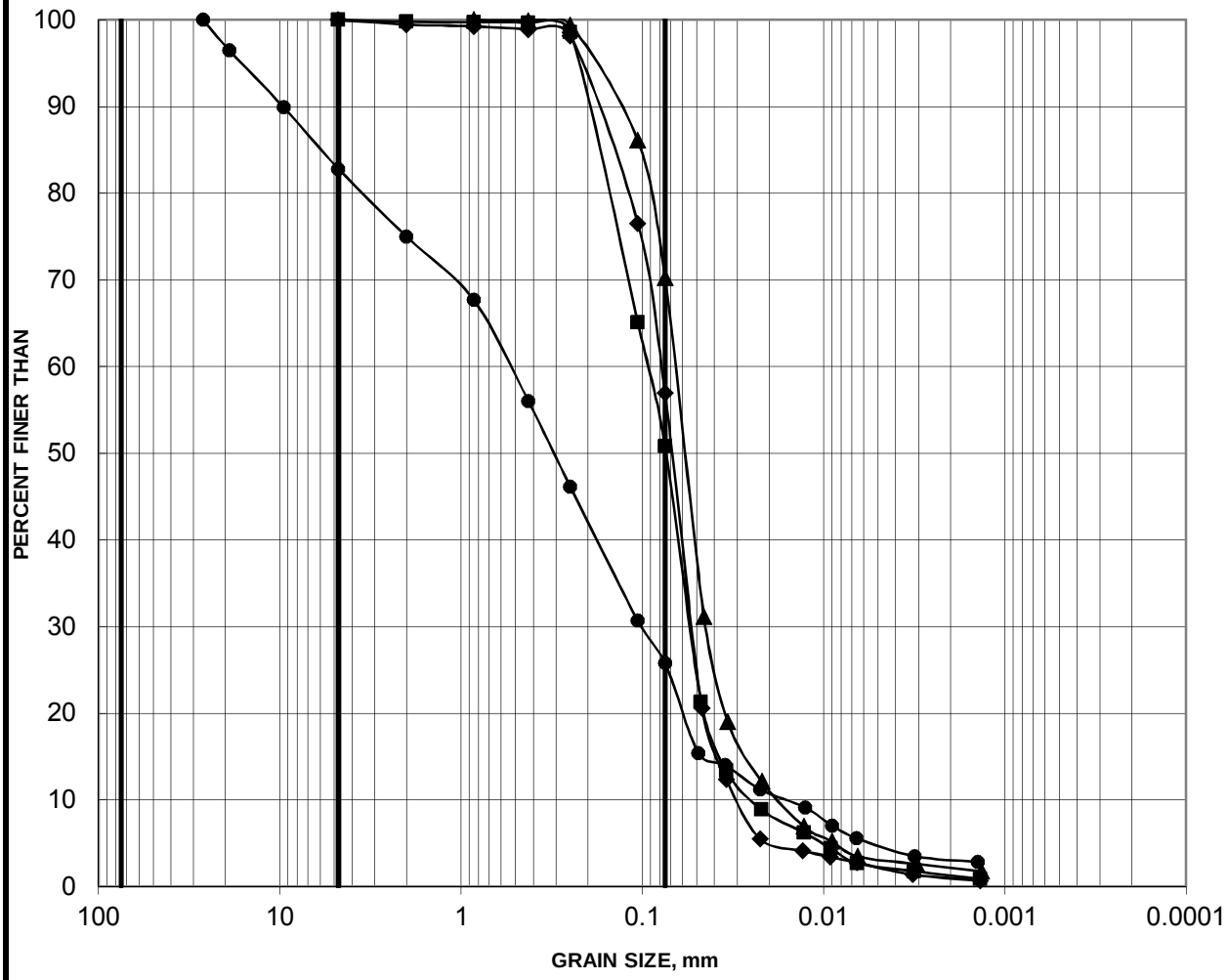
Checked by: CNM

GRAIN SIZE DISTRIBUTION

FIGURE 5

SILTY SAND TO SANDY SILT



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
13-19	4B	2.64-2.90
13-22	5	3.05-3.66
13-27	6	4.57-5.18
16-113	4	2.29-2.82

Project: 13-1121-0083-1046

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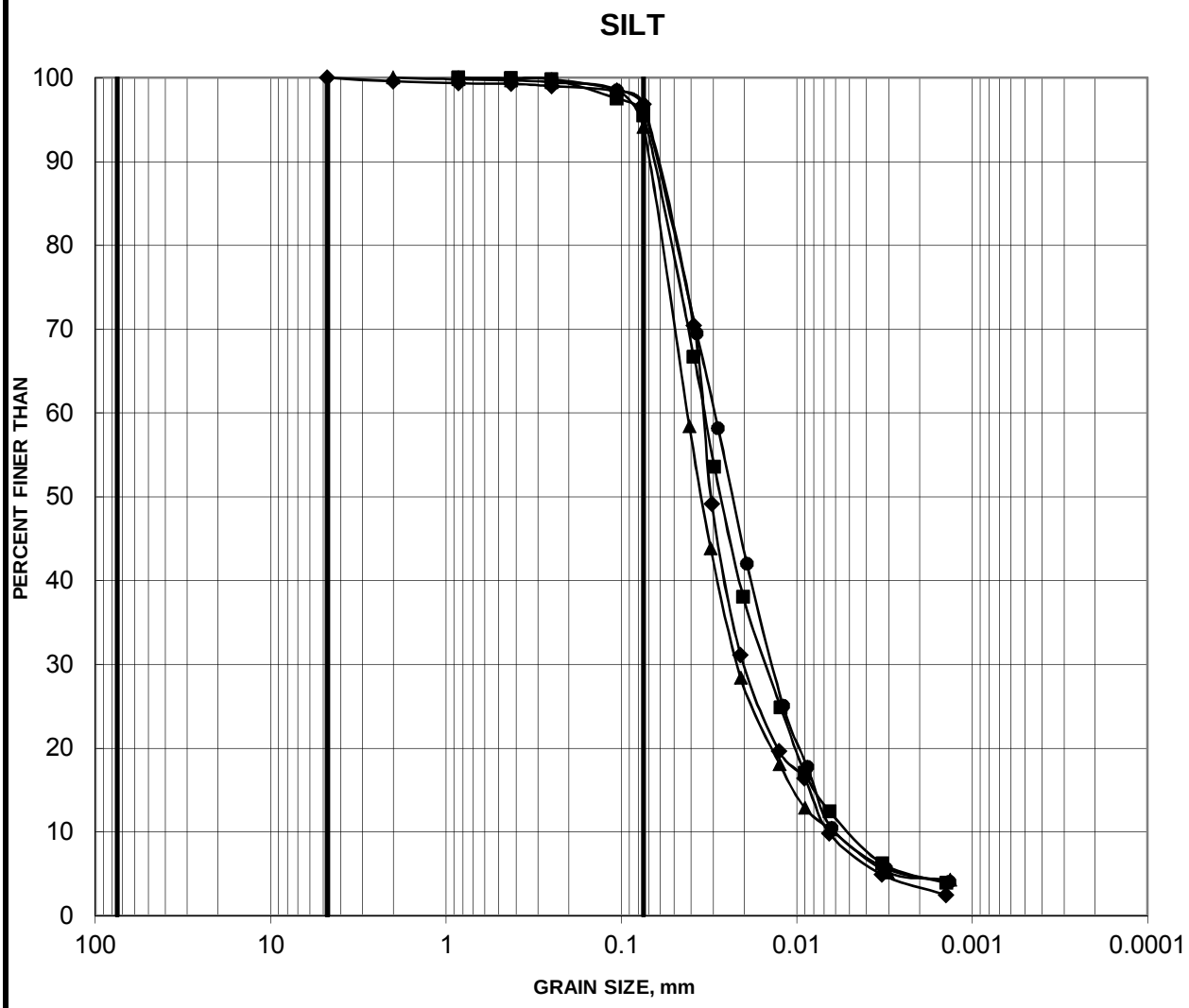
GRAIN SIZE DISTRIBUTION

FIGURE 6



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
13-21	2	0.76-1.37
13-22	2	0.76-1.37
13-23	3	1.22-1.83
13-31	5	2.44-3.05

Project: 13-1121-0083-1046

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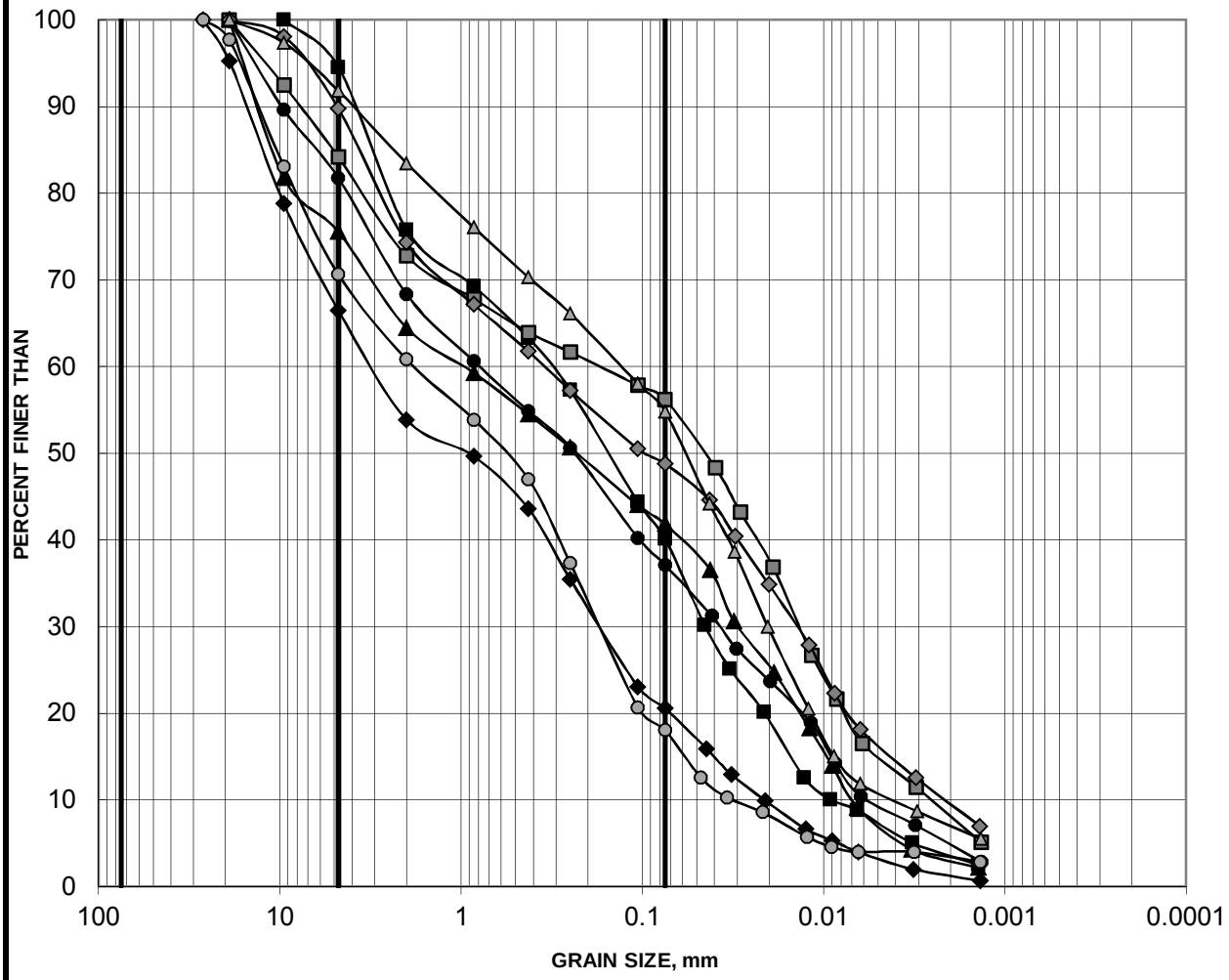
GRAIN SIZE DISTRIBUTION	FIGURE 7

GLACIAL TILL



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
13-1	3	1.52-2.13
13-6	2	0.76-1.37
13-8	3	1.52-1.93
13-9	4	3.15-3.38
13-13	4	2.29-2.90
13-15	3	1.52-1.75
16-103	5	3.05-3.47
16-109	4	2.29-2.90

Project: 13-1121-0083-1046

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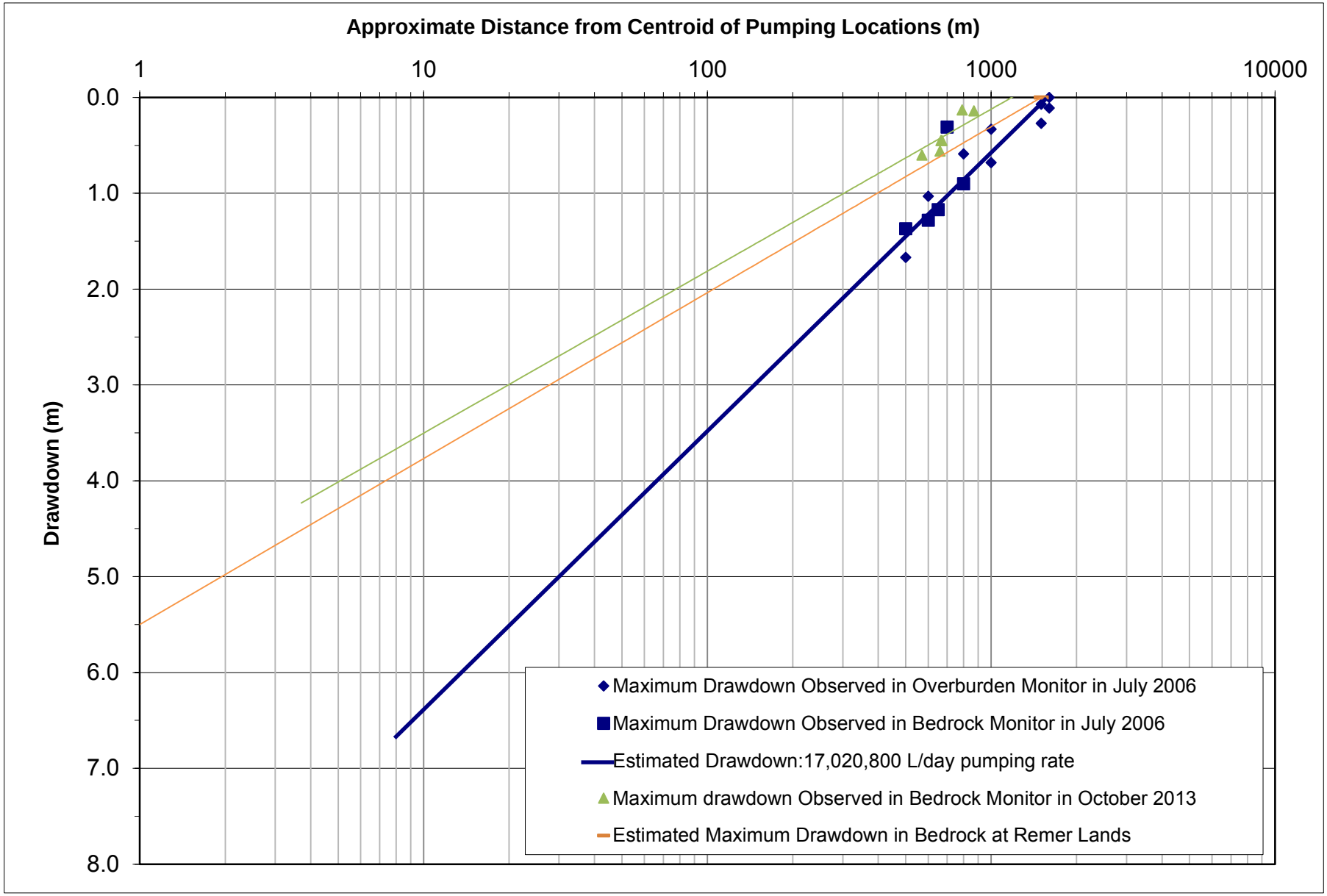
Created by: MI
Checked by: CNM



Golder Associates

Date: January 2014 Drawn: CAMC

Project: 13-1121-0083 Chkd: PAS

DISTANCE-DRAWDOWN CURVES

FIGURE 8

APPENDIX A

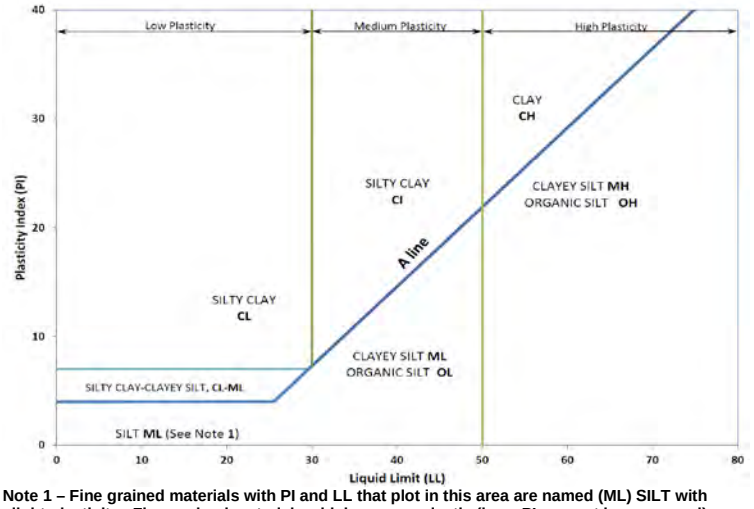
Method of Soil Classification
List of Abbreviations and Symbols
Lithological and Geotechnical Rock Description Terminology
Record of Test Pits and Hand Augerhole Sheets
Record of Borehole and Drillhole Sheets
Current Investigation

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil		Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
					Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)		Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
					Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
					Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
				Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
					None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)		Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
				Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
				Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures								30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat								75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to ~~or~~ indicate~~s~~ a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL, SAND and CLAY)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
σ_1, σ_2, σ_3	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of rock material weathering.

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)
The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid segments.

DISCONTINUITY DATA

Fracture Index
A count of the number of naturally occuring discontinuities (physical separations) in the rock core. Mechanically induced breaks caused by drilling are not included.

Dip with Respect to Core Axis
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90^{o} angle is horizontal.

Description and Notes
An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN	Joint	PL	Planar
FLT	Fault	CU	Curved
SH	Shear	UN	Undulating
VN	Vein	IR	Irregular
FR	Fracture	K	Slickensided
SY	Stylolite	PO	Polished
BD	Bedding	SM	Smooth
FO	Foliation	SR	Slightly Rough
CO	Contact	RO	Rough
AXJ	Axial Joint	VR	Very Rough
KV	Karstic Void		
MB	Mechanical Break		

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TABLE 1

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-1	0.00 – 0.13	TOPSOIL – (ML) sandy SILT; dark brown; moist
(99.68 m)	0.13 – 0.90	(SM/ML) SILTY SAND to sandy SILT, trace gravel; brown to grey brown with oxidation staining; non-cohesive, moist
	0.90 – 2.60	(SM) SILTY SAND some gravel to gravelly; grey brown, contains cobbles and boulders up to 1.2 metres in diameter (GLACIAL TILL); non-cohesive, moist
	2.60 – 3.50	(SM) gravelly SILTY SAND; grey, contains cobbles and boulders up to 1.2 metres in diameter (GLACIAL TILL); non-cohesive, moist
	3.50	End of Test Pit – Refusal to excavating on cobbles and boulders

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.13 – 0.90
2	0.90 – 2.60
3	2.60 – 3.50

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-2 (100.95 m)	0.00 – 0.28	TOPSOIL – (ML) sandy SILT; dark brown; moist
	0.28 – 0.57	(ML) SILT, some sand to sandy; grey brown; non-cohesive, moist
	0.57 – 2.10	(SM) SILTY SAND some gravel; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist
	2.10 – 7.00	(SM) gravelly SILTY SAND; grey, contains cobbles and boulders up to 1.3 metres in diameter (GLACIAL TILL); non-cohesive, moist
	7.00	End of Test Pit – Refusal to excavating on cobbles and boulders

Note: Water seepage at 6.1 metres depth upon completion.

Sample No.	Depth (m)
1	0.28 – 0.57
2	0.57 – 2.10
3	2.10 – 7.00

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-3	0.00 – 0.29	TOPSOIL – (ML) sandy SILT; dark brown; moist
(95.21 m)	0.29 – 1.20	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist
	1.20 – 1.90	(SP) SAND, some low plasticity fines and gravel; grey brown, contains cobbles and boulders; non-cohesive, moist
	1.90 – 2.40	(ML) CLAYEY SILT, some sand; grey brown with oxidation staining, contains cobbles and boulders; cohesive, w>PL
	2.40 – 3.20	(SM) SILTY SAND, some gravel to gravelly; grey brown, contains cobbles and boulders up to 1.3 metres in diameter (GLACIAL TILL); non-cohesive, moist to wet
	3.20	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.29 – 1.20
2	1.20 – 1.90
3	1.90 – 2.40
4	2.40 – 3.20

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-4	0.00 – 0.20	TOPSOIL – (ML) sandy SILT; dark brown; moist
(94.17 m)	0.20 – 0.70	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist
	0.70 – 1.40	(SP) SAND, some gravel; grey brown, contains cobbles; non-cohesive, moist
	1.40 – 4.10	(SM) gravelly SILTY SAND; grey brown, contains cobbles and boulders up to 1.1 metres in diameter (GLACIAL TILL); non-cohesive, moist
	4.10	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.20 – 0.70
2	0.70 – 1.40
3	1.40 – 3.40
4	3.40 – 4.10

TP 16-5	0.00 – 0.17	TOPSOIL – (ML) sandy SILT; dark brown; moist
(96.75 m)	0.17 – 2.00	(SM/ML) SILTY SAND to sandy SILT, some gravel to gravelly; brown, contains cobbles and boulders up to 0.7 metres in diameter; non-cohesive, moist
	2.00	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.17 – 2.00

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
16-6	0.00 – 0.19	TOPSOIL – (ML) sandy SILT; dark brown; moist
(98.93 m)	0.19 – 2.30	(SM) SILTY SAND, some gravel; brown; non-cohesive, moist
	2.30 – 4.20	(SP) SAND, some non-plastic fines and gravel; brown, contains cobbles and boulders up to 1.0 metres in diameter; non-cohesive, moist
	4.20	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.19 – 1.10
2	1.10 – 2.30
3	2.30 – 4.20

16-7	0.00 – 0.21	TOPSOIL – (ML) sandy SILT; dark brown; moist
(103.09 m)	0.21 – 2.90	(SM) SILTY SAND some gravel; grey brown, contains cobbles and boulders up to 0.5 metres in diameter (GLACIAL TILL); non-cohesive, moist
	2.90 – 6.10	(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders up to 0.5 metres in diameter (GLACIAL TILL); non-cohesive, moist to wet
	6.10	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.21 – 0.80
2	0.80 – 2.90
3	2.90 – 5.70
4	5.70 – 6.10

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-8	0.00 – 0.19	TOPSOIL – (ML) sandy SILT; dark brown; moist
(94.33 m)	0.19 – 0.60	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist
	0.60 – 1.60	(SM) SILTY SAND, some gravel; brown, contains cobbles; non-cohesive, moist
	1.60 – 2.60	(SM) gravelly SILTY SAND; dark grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist
	2.60 – 3.00	(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders up to 0.9 metres in diameter (GLACIAL TILL); non-cohesive, moist to wet
	3.00	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.19 – 0.60
2	0.60 – 1.60
3	2.60 – 3.00

TP 16-9	0.00 – 0.19	TOPSOIL – (ML) sandy SILT; dark brown; moist
(99.62 m)	0.19 – 1.10	(SM/ML) SILTY SAND to sandy SILT, trace gravel; brown; non-cohesive, moist
	1.10 – 3.40	(SM) SILTY SAND, some gravel; grey brown, contains cobbles and boulders up to 0.5 metres in diameter (GLACIAL TILL); non-cohesive, moist
	3.40	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.19 – 1.10
2	1.10 – 3.40

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-10	0.00 – 0.19	TOPSOIL – (ML) sandy SILT; dark brown; moist
(94.62 m)	0.19 – 0.57	(SP/SM) SAND, some non-plastic fines to silty; brown; non-cohesive, moist
	0.57 – 1.20	(SM) SILTY SAND; grey brown; non-cohesive, moist
	1.20 – 2.00	(SM) SILTY SAND; grey; non-cohesive, moist to wet
	2.00 – 2.20	(SP) SAND, some non-plastic fines, trace gravel; grey; non-cohesive, wet
	2.20 – 2.50	(SP) SAND; brown, contains cobbles and boulders up to 0.8 metres in diameter; non-cohesive, wet
	2.50	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 2.4 metres depth upon completion.

Sample No.	Depth (m)
1	0.19 – 0.57
2	0.57 – 1.20
3	1.20 – 2.00
4	2.00 – 2.20
5	2.20 – 2.50

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-11	0.00 – 0.16	TOPSOIL – (ML) sandy SILT; dark brown; moist
(95.03 m)	0.16 – 1.10	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist
	1.10 – 2.50	(SP) SAND, some non-plastic fines and gravel; grey brown, contains cobbles and boulders; non-cohesive, moist
	2.50 – 3.50	(SM) gravelly SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist to wet
	3.50	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 2.6 metres depth upon completion.

Sample No.	Depth (m)
1	0.16 – 1.10
2	1.10 – 2.50
3	2.50 – 3.50

TP 16-12	0.00 – 0.18	TOPSOIL – (ML) sandy SILT; dark brown; moist
(96.68 m)	0.18 – 1.30	(SM) SILTY SAND, trace gravel; brown to grey brown, contains cobbles; non-cohesive, moist
	1.30 – 3.60	(SP) SAND, some gravel; brown, contains cobbles and boulders; non-cohesive, moist
	3.60 – 4.20	(SM) gravelly SILTY SAND; dark grey, contains cobbles and boulders up to 0.9 metres in diameter (GLACIAL TILL); non-cohesive, wet
	4.20	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 4.1 metres depth upon completion.

Sample No.	Depth (m)
1	0.18 – 1.30
2	1.30 – 3.60
3	3.60 – 4.20

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-13	0.00 – 0.20	TOPSOIL – (ML) sandy SILT; dark brown; moist
(94.43 m)	0.20 – 1.20	(SP) SAND, some non-plastic fines, trace gravel; brown; non-cohesive, moist
	1.20 – 2.25	(SP/SM) SAND, some non-plastic fines to silty, some gravel; brown, contains cobbles; non-cohesive, moist
	2.25 – 3.00	(SM) gravelly SILTY SAND; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist
	3.00 – 5.10	(SM) SILTY SAND; some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet
	5.10	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 3.1 metres depth upon completion.

Sample No.	Depth (m)
1	0.20 – 1.20
2	1.20 – 2.25
3	2.25 – 3.00
4	3.00 – 3.40
5	3.40 – 5.10

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-14	0.00 – 0.23	TOPSOIL – (ML) sandy SILT; dark brown; moist
(96.91 m)	0.23 – 1.50	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist to wet
	1.50 – 2.40	(SP) SAND, some gravel to gravelly; brown, contains cobbles and boulders; non-cohesive, moist
	2.40 – 2.90	(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders up to 1.1 metres in diameter (GLACIAL TILL); non-cohesive, moist
	2.90	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 2.9 metres depth upon completion.

Sample No.	Depth (m)
1	0.23 – 0.85
2	0.85 – 1.50
3	1.50 – 2.40
4	2.40 – 2.90

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-15	0.00 – 0.40	(PT) PEAT; dark brown to black; moist
(94.01 m)	0.40 – 0.75	(CL/CI) SILTY CLAY; grey brown; cohesive, w>PL
	0.75 – 1.20	(SM) SILTY SAND; grey; non-cohesive, moist to wet
	1.20 – 2.50	(SP) SAND, some gravel; grey brown, contains cobbles; non-cohesive, wet
	2.50 – 4.50	(SM) gravelly SILTY SAND; grey, contains cobbles and boulders up to 0.5 metres in diameter (GLACIAL TILL); non-cohesive, wet
	4.50	End of Test Pit – Side walls sloughing

Note: Water seepage at 2.0 metres depth upon completion.

Sample No.	Depth (m)
1	0.00 – 0.40
2	0.40 – 0.75, Figure 3 (W_L= 30%, W_P = 18%, PI=12%)
3	0.75 – 1.20
4	1.20 – 2.50
5	2.50 – 4.50

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-16	0.00 – 0.26	TOPSOIL – (ML) sandy SILT; dark brown; moist
(95.92 m)	0.26 – 1.60	(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist
	1.60 – 2.60	(SM/SP) SILTY SAND to SAND, some gravel; grey brown, contains silt layers, cobbles and boulders; non-cohesive, moist to wet
	2.60 – 4.60	(SP) SAND, some non-plastic fines to silty, some gravel to gravelly; grey, contains cobbles and boulders up to 0.9 metres in diameter; non-cohesive, wet
	4.60	End of Test Pit – Refusal to excavating on probable bedrock

Note: Water seepage at 3.8 metres depth upon completion.

Sample No.	Depth (m)
1	0.26 – 1.60
2	1.60 – 2.60
3	2.60 – 3.50
4	3.50 – 4.60

TABLE 1 (Continued)
RECORD OF TEST PITS AND HAND AUGERHOLES

Hand Augerhole Number (Elevation m)	Depth (m)	Description
HAH 16-18	0.00 – 0.60	(PT) PEAT; dark brown, fibrous; moist to wet
	0.60 – 1.55	(SM) SILTY SAND, fine; grey; non-cohesive, wet
	1.55 – 2.20	(ML/SM) SILT and SAND; grey; non-cohesive, wet
	2.20	End of Hand Augerhole – Side walls sloughing

Note: Water level at 0.2 metres depth upon completion.

Sample No.	Depth (m)
No samples taken	

Test Pit Number (Elevation m)	Depth (m)	Description
TP 16-20	0.0 – 0.32	(PT) PEAT; dark brown to black, fibrous; moist
	0.32 – 0.43	(OL) ORGANIC SILT; white (MARL); moist to wet
	0.43 – 0.75	(SM) SILTY SAND, trace gravel; grey brown; non-cohesive, wet
	0.75 – 5.50	(SM/ML) SILTY SAND to sandy SILT; grey, contains cobbles and boulders from 4.5 to 5.5 metres depth (GLACIAL TILL); non-cohesive, wet
	5.50	End of Test Pit – Side walls sloughing

Note: Water seepage at 0.7 metres depth upon completion.

Sample No.	Depth (m)
1	0.00 – 0.32
2	0.32 – 0.43
3	0.43 – 0.75
4	0.75 – 5.50

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-1

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 23, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp ○ W WI) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.95							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 95.73							Native Backfill
		Very dense brown SILTY SAND to SANDY SILT, some gravel, trace clay (GLACIAL TILL)		0.22	1	50 DO	3				Bentonite Seal
					2	50 DO	>50				Silica Sand
1											
					3	50 DO	55		○	MH	38 mm Diam. PVC #10 Slot Screen 'B'
2											
					4	50 DO	>50				
				93.36							Silica Sand
	Rotary Drill NQ Core	Fresh, thinly to medium bedded, light grey to light brown, fine grained, crystalline, non-porous, strong DOLOMITIC SANDSTONE, with occasional thin interlaminations of black shale and thin interbeds of slightly calcareous sandstone		2.59	C1	NQ RC	DD				Bentonite Seal
3											Silica Sand
											38 mm Diam. PVC #10 Slot Screen 'A'
4				91.66							
		End of Borehole		4.29							
5											WL in Screen 'A' at Elev. 92.75 m on Nov. 12, 2013
											WL in Screen 'B' at Elev. 93.90 m on Nov. 12, 2013
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-1

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 23, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-55

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate; BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage; PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular; PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		93.36																
3	Rotary Drill / NQ Core	Fresh, thinly to medium bedded, light grey to light brown, fine grained, crystalline, non-porous, strong DOLOMITIC SANDSTONE, with occasional thin interlaminations of black shale and thin interbeds of slightly calcareous sandstone		2.59	1															Bentonite Seal / Silica Sand / 38 mm Diam. PVC #10 Slot Screen 'A'
4				91.66																
		End of Drillhole		4.29																WL in Screen 'A' at Elev. 92.75 m on Nov. 12, 2013 WL in Screen 'B' at Elev. 93.90 m on Nov. 12, 2013
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

DEPTH SCALE

1 : 50

LOGGED: ALB

CHECKED: PAS

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 26, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		101.30							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 101.05							
		Brown SILTY SAND		0.25 / 100.54	1	SS	4				
1		Very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		0.76	2	SS	>50				
					3	SS	>50		○		
2				98.84	4	SS	>50				
		End of Borehole Auger Refusal		2.46							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-3

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: September 30, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		103.12							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							Bentonite Seal
				102.87							
		Brown SANDY SILT, trace clay		0.25							
				102.15							
1		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.97	1	50 DO	63				
					2	50 DO	>50				Native Backfill
2											
				100.68	3	50 DO	>50				
		Very dense to compact grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.44							
3					4	50 DO	49				Bentonite Seal
4					5	50 DO	53				Silica Sand
5					6	50 DO	57				38 mm Diam. PVC #10 Slot Screen 'B'
6					7	50 DO	20				Silica Sand
											Bentonite Seal
				96.82	8	50 DO	>50				
	Rotary Drill NQ Core	Fresh to slightly weathered, thinly to medium bedded, light grey to white, fine to medium grained, slightly porous, slightly calcareous SANDSTONE, with thin interlaminates of shale, occasional thin (<2 mm thick) calcite veins throughout		6.30	C1	NQ RC	DD				Silica Sand
7											38 mm Diam. PVC #10 Slot Screen 'A'
8					C2	NQ RC	DD				Silica Sand
9					C3	NQ RC	DD				Bentonite Seal
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-3

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: September 30, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
				92.91	C3	NQ RC	DD				Bentonite Seal
		End of Borehole		10.21							
11											WL in Screen 'A' at Elev. 99.63 m on Nov. 12, 2013 WL in Screen 'B' at Elev. 99.64 m on Nov. 12, 2013
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-3

SHEET 3 OF 3

LOCATION: See Site Plan

DRILLING DATE: September 30, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-55

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		96.82																
7	Rotary Drill / NQ Core	Fresh to slightly weathered, thinly to medium bedded, light grey to white, fine to medium grained, slightly porous, slightly calcareous SANDSTONE, with thin interlaminates of shale, occasional thin (<2 mm thick) calcite veins throughout		6.30	1	100														Bentonite Seal Silica Sand
					1	100														38 mm Diam. PVC #10 Slot Screen 'A'
8					2	100														Silica Sand
9					3	100														Bentonite Seal
10				92.91																
		End of Drillhole		10.21																WL in Screen 'A' at Elev. 99.63 m on Nov. 12, 2013 WL in Screen 'B' at Elev. 99.64 m on Nov. 12, 2013
11																				
12																				
13																				
14																				
15																				
16																				

DEPTH SCALE
1 : 50

LOGGED: DG
CHECKED: PAS

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-4

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 1, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		104.14							
0	Power Auger 200 mm Diam. (Hollow Stem)	Loose brown SILTY fine SAND, trace gravel, with organic matter		0.00	1	50 DO	8				
				103.38							
1		Very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		0.76	2	50 DO	53				
					3	50 DO	>50				
2				101.52							
		End of Borehole Auger Refusal		2.62							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 26 & 27, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m
		GROUND SURFACE		99.74			
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00			
				99.46	1	50 DO	8
		Brown SILTY SAND		0.28			
				98.98			
1		Dense to very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		0.76	2	50 DO	49
					3	50 DO	>50
				97.89			
2	Wash Boring HQ Core	BOULDER		1.85	4	NQ RC	DD
				97.55			
		Very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		2.19	5	50 DO	>50
3					6	50 DO	>50
				95.93			
4		Very dense SANDY SILT, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		3.81	7	50 DO	>50
				95.17			
		BOULDER		4.57	8	NQ RC	DD
5				94.63			
		Very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		5.11	9	50 DO	>100
6				93.64			
		End of Borehole Auger Refusal		6.10			
7							
8							
9							
10							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○: 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-8} 10^{-6} 10^{-4} 10^{-2}

WATER CONTENT PERCENT: Wp — W — Wl: 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-6

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 23, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.28							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 95.07							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.21	1	50 DO	5				
1					2	50 DO	67		○	MH	
					3	50 DO	>50				
2	Wash Boring HQ Core			92.99							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.29	4	50 DO	65				
3					5	50 DO	>50				
				91.47							
4		Dense SILTY SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)		3.81	6	50 DO	32				
				90.76							
	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey to dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE, with occasional thin interlaminates of black shale		4.52 90.25							
5		VOID		5.03	C1	NQ RC	DD				
				89.64							
		Fresh, thinly to medium bedded, grey to dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE, with occasional thin interlaminates of black shale		5.64							
6					C2	NQ RC	DD				
				88.45							
		End of Borehole		6.83							
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: ALB

CHECKED: PAS

Golder Associates

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-6

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 23, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-55

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		90.76															
5	Rotary Drill / NQ Core	Fresh, thinly to medium bedded, grey to dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE, with occasional thin interlaminates of black shale		4.52	1														
				90.25															
		VOID		5.03															
				89.64															
6		Fresh, thinly to medium bedded, grey to dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE, with occasional thin interlaminates of black shale		5.64	2														
				88.45															
7		End of Drillhole		6.83															
8																			
9																			
10																			
11																			
12																			
13																			
14																			

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-7

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 24, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.89							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Loose to compact brown SILTY SAND		0.15	1	50 DO	5				
1					2	50 DO	10				
				93.37							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		1.52	3	50 DO	>50				
2					4	50 DO	>50		○		
				92.07							
3		End of Borehole Auger Refusal		2.82							
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-8

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 24, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		98.04							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 97.81							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.23	1	50 DO	4				
1					2	50 DO	52				
					3	50 DO	>50		○	MH	
2					4	50 DO	>50				
				95.37							
		End of Borehole Auger Refusal		2.67							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: ALB

CHECKED: PAS

Golder Associates

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-9

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 2, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		106.35							
0	Power Auger 200 mm Diam. (Hollow Stem)	Loose brown SILTY fine SAND, with organic matter		0.00	1	50 DO	4				Native Backfill
				105.59							
1		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.76	2	50 DO	>50				Bentonite Seal
					3	50 DO	>50				
2				104.22							
	Wash Boring HQ Core	COBBLES and BOULDERS		2.13	C1	NQ RC	DD				Silica Sand
3				103.20							
		Very dense grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		3.15	4	50 DO	>50		○	MH	38 mm Diam. PVC #10 Slot Screen
4				101.78							
		End of Borehole		4.57							WL in Screen at Elev. 106.46 m on Nov. 12, 2013
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-10

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 1 & 2, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		105.83							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.15							
1					1	50 DO	>50				
	Wash Bore NW Casing				2	NQ RC	DD				
2					3	NQ RC	DD				
3					4	50 DO	51				
4				101.41	5	NQ RC	DD				
		Very dense to dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		4.42	6	50 DO	>50				
5					7	NQ RC	DD				
					8	50 DO	42				
6					9	50 DO	>50				
7	RD NW			98.82							
	Rotary Drill NQ Core	Fresh, medium bedded, light grey, fine to medium grained, non-porous, strong DOLOMITIC SANDSTONE, interbedded with dark grey shaley dolomite		7.01	C1	NQ RC	DD				
8				97.75							
		End of Borehole		8.08							
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-10

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 1 & 2, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-55

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate
BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage
PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular
PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		98.82															
8	RD / NW; Rotary Drill / NQ Core	Fresh, medium bedded, light grey, fine to medium grained, non-porous, strong DOLOMITIC SANDSTONE, interbedded with dark grey shaley dolomite		7.01 – 97.75	1		80 60 40 20	80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90	0 30 60 90					10^{-8} 10^{-6} 10^{-4} 10^{-2}	2 4 6	
		End of Drillhole		8.08															
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: DG
CHECKED: PAS

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-11

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 24, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.60							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 94.42							
		Brown SILTY SAND		0.18	1	50 DO	4		W		
				93.84							
1		Very dense brown SILTY SAND		0.76	2	50 DO	>50				
				93.48							
		End of Borehole Auger Refusal		1.12							
2											
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-12

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 25, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.42							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Dense brown SILTY SAND, trace gravel		0.08	1	50 DO	5				
1					2	50 DO	48				
				94.90							
		Compact brown fine to medium SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		1.52	3	50 DO	27		○		
2				94.13							
		Very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.29	4	50 DO	>50				
3				93.04							
		End of Borehole Auger Refusal		3.38							
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-13

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 27, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		97.97							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
				97.67	1	50 DO	3				Bentonite Seal
		Loose brown SILTY SAND		0.30							Native Backfill
1					2	50 DO	5				Bentonite Seal
				96.45							Silica Sand
		Compact brown SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		1.52	3	50 DO	20				
2											
					4	50 DO	28			MH	38 mm Diam. PVC #10 Slot Screen 'B'
3											
					5	50 DO	29				Silica Sand
				94.06							Bentonite Seal
4	Rotary Drill NQ Core	Fresh to slightly weathered, medium bedded, dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE		3.91	C1	NQ RC	DD				
		- Vertical joint from 5.74 m to 6.10 m, with surface stain			C2	NQ RC	DD				Silica Sand
5					C3	NQ RC	DD				38 mm Diam. PVC #10 Slot Screen 'A'
6					C4	NQ RC	DD				
				91.75							
		End of Borehole		6.22							
7											WL in Screen 'A' at Elev. 95.08 m on Nov. 12, 2013
											WL in Screen 'B' at Elev. 95.06 m on Nov. 12, 2013
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-13

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 27, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-75

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate; BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage; PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular; PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		94.06																
4		Fresh to slightly weathered, medium bedded, dark grey, fine grained, non-porous, strong SHALEY DOLOSTONE - Vertical joint from 5.74 m to 6.10 m, with surface stain		3.91	1															Bentonite Seal
5					2															Silica Sand
					3															38 mm Diam. PVC #10 Slot Screen 'A'
6					4															
				91.75																
		End of Drillhole		6.22																
7																				WL in Screen 'A' at Elev. 95.08 m on Nov. 12, 2013 WL in Screen 'B' at Elev. 95.06 m on Nov. 12, 2013
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE

1 : 50

LOGGED: ALB

CHECKED: PAS

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-14

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 2, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		103.31							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 103.13							
		Dense to very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.18	1	50 DO	40				
1											
					2	50 DO	84				
2											
					3	50 DO	>50				
				100.54							
		End of Borehole Auger Refusal		2.77							
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: DG

CHECKED: PAS

Golder Associates

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-15

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 1, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2})	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		104.79				SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	WATER CONTENT PERCENT: Wp — W — Wl (20 40 60 80)		
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 104.59							
		Very dense brown SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.20	1	50 DO	5				
1					2	50 DO	81				
				103.04	3	50 DO	>50		○	MH	
		End of Borehole Auger Refusal		1.75							
2											
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-16

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 3, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		101.13							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 100.95							
		Brown SANDY SILT, trace clay		0.18 / 100.22							
1		Dense to very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.91	1	50 DO	31				
					2	50 DO	52				
2					3	50 DO	>50				
				98.18							
3		End of Borehole Auger Refusal		2.95							
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-17

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 4, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		99.15							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Brown SILTY fine SAND		0.15	1	50 DO	4				Bentonite Seal
				98.46							Native Backfill
1		Compact to very dense brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		0.69	2	50 DO	93				Bentonite Seal
					3	50 DO	53				Silica Sand
2					4	50 DO	22				38 mm Diam. PVC #10 Slot Screen 'B'
3	Wash Bore NW Casing				5	50 DO	>50				
					6	50 DO	54				Silica Sand
4	RD NW			94.71							Bentonite Seal
	Rotary Drill NQ Core	Fresh, medium to thickly bedded, dark grey, fine grained, non-porous, medium strong to strong SHALEY DOLOSTONE		4.44							Native Backfill and Bentonite
5		- Thin (~1-3 mm thick) calcite vein throughout interval. Some veins are open.			C1	NQ RC	DD				Silica Sand
		- Occasional sulphides disseminated throughout									38 mm Diam. PVC #10 Slot Screen 'A'
6					C2	NQ RC	DD				
				92.88							
		End of Borehole		6.27							WL in Screen 'A' at Elev. 97.36 m on Nov. 8, 2013
7											WL in Screen 'B' at Elev. 97.84 m on Nov. 8, 2013
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-17

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 4, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-55

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate; BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage; PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular; PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		94.71																
5	RD / NW; Rotary Drill / NQ Core	Fresh, medium to thickly bedded, dark grey, fine grained, non-porous, medium strong to strong SHALEY DOLOSTONE - Thin (~1-3 mm thick) calcite vein throughout interval. Some veins are open. - Occasional sulphides disseminated throughout		4.44	1															Native Backfill and Bentonite Silica Sand 38 mm Diam. PVC #10 Slot Screen 'A'
6					2															
				92.88																
		End of Drillhole		6.27																WL in Screen 'A' at Elev. 97.36 m on Nov. 8, 2013 WL in Screen 'B' at Elev. 97.84 m on Nov. 8, 2013

DEPTH SCALE

1 : 50

LOGGED: DG

CHECKED: PAS

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-18

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 25, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.74							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Compact brown SILTY SAND, trace gravel		0.10	1	50 DO	6				Bentonite Seal
1					2	50 DO	26				Silica Sand
				93.22							
		Compact grey SILTY SAND, some gravel, trace clay (GLACIAL TILL)		1.52	3	50 DO	26				38 mm Diam. PVC #10 Slot Screen 'B'
2				92.45							
		Compact to very dense grey SILTY SAND, some gravel, trace clay (GLACIAL TILL)		2.29	4	50 DO	11				Silica Sand
3					5	50 DO	>50				Bentonite Seal
				91.39							
	Rotary Drill NQ Core	Fresh to slightly weathered, thinly to medium bedded, grey, fine grained, non-porous, strong SHALEY DOLOSTONE		3.35	C1	NQ RC	DD				
4											Silica Sand
5					C2	NQ RC	DD				38 mm Diam. PVC #10 Slot Screen 'A'
				88.95							
		End of Borehole		5.79							
6											WL in Screen 'A' at Elev. 94.79 m on Oct. 28, 2013
											WL in Screen 'B' at Elev. 94.66 m on Oct. 28, 2013
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-18

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 25, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-75

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate
BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage
PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular
PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		91.39																
4	Rotary Drill NQ Core	Fresh to slightly weathered, thinly to medium bedded, grey, fine grained, non-porous, strong SHALEY DOLOSTONE		3.35	1															Bentonite Seal Silica Sand
5					2															38 mm Diam. PVC #10 Slot Screen 'A'
				88.95																
6		End of Drillhole		5.79																WL in Screen 'A' at Elev. 94.79 m on Oct. 28, 2013 WL in Screen 'B' at Elev. 94.66 m on Oct. 28, 2013
7																				
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ALB
CHECKED: PAS

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-19

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 30, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		97.42							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
				97.12	1	50 DO	3				
		Brown SILTY SAND, trace organics and gravel		0.30							
				96.81							
		Dense to very dense brown to grey brown SILTY SAND, trace gravel, with cobbles and boulders		0.61							
1					2	50 DO	>50				
					3	50 DO	39		○		
2											
					4	50 DO	36				
				94.78							
		Dense brown SILTY SAND to SANDY SILT		2.64						MH	
				94.52							
3		Dense brown fine to medium SAND, trace silt		2.90							
					5	50 DO	41		○		
				93.51							
4		Very dense grey brown SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		3.91	6	50 DO	61				
					7	50 DO	>50				
				92.80							
		End of Borehole Spoon Refusal		4.62							
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-20

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 3, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		97.05							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 96.87							
		Loose brown SILTY fine SAND		0.18	1	50 DO	4				Bentonite Seal
1					2	50 DO	7				
				95.53							
		Loose to compact grey fine SAND, trace silt		1.52	3	50 DO	10				Native Backfill
2				94.76							
		Loose grey SILTY fine SAND		2.29	4	50 DO	6				
				94.18							
3		Compact to dense grey SILTY SAND, with rock fragments, cobbles and boulders (GLACIAL TILL)		2.87	5	50 DO	16				Bentonite Seal
											Silica Sand
4					6	50 DO	48				
				92.48							
	Wash Bore HW Casing	Very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		4.57	7	50 DO	54				38 mm Diam. PVC #10 Slot Screen
5					8	50 DO	>50				Silica Sand
				91.28							
		End of Borehole		5.77							WL in Screen at Elev 96.50 m on Nov. 4, 2013
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-21

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 30, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Brown fine to medium SAND, trace silt		0.15							
		Grey brown SANDY SILT, trace organics		0.23	1	50 DO	2				
		Compact to very dense grey brown SILT, trace to some clay, with cobbles		0.61							
1					2	50 DO	11		○	MH	
					3	50 DO	>50				
2											
		Loose to compact grey SILTY SAND to SANDY SILT, trace gravel		2.29	4	50 DO	10				
3					5	50 DO	8				
4					6	50 DO	9		○		
		Dense grey fine to coarse SAND, trace gravel and silt		4.57	7	50 DO	35			M	
5		Very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		4.95	8	50 DO	>50				
		End of Borehole		5.46							
6		Note: Ground surface elevation unable to be determined due to heavy tree cover.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-22

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 1, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.29							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 95.04	1	50 DO	3				
		Compact grey brown SILT, trace clay		0.25							
1					2	50 DO	11		○	MH	
					3	50 DO	16				
2				93.00							
		Loose grey SILTY SAND to SANDY SILT, trace clay		2.29	4	50 DO	7				
3					5	50 DO	7		○	MH	
4					6	50 DO	9				
				90.57							
		Very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		4.72	7	50 DO	64				
5					8	50 DO	>50		○		
				89.50							
		End of Borehole Auger Refusal		5.79							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-23

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 4, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.50							
0	Power Auger 200 mm Diam. (Hollow Stem)	Black fibrous PEAT		0.00	1	50 DO	1				
				94.06							
		Loose to compact grey brown SILT, trace clay		0.44	2	50 DO	9				
1					3	50 DO	10			MH	
2					4	50 DO	9				
				92.06							
		Loose grey SILTY SAND		2.44	5	50 DO	6				
3				91.45							
		Loose to very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		3.05	6	50 DO	6				
					7	50 DO	>50				
				90.54							
4		End of Borehole Spoon Refusal		3.96							
		Note: Blow counts were corrected for half-weight hammer.									
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-24

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 24 & 25, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}); WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.43							
0	Portable Drill, NW Casing	Black fibrous PEAT		0.00							
				93.82							
		Probable grey SILTY fine SAND, trace gravel		0.61							
1											Native Backfill and Bentonite Mix
2											Bentonite Seal
3											Silica Sand
4											32 mm Diam. PVC #10 Slot Screen 'B'
				89.86							
		Probable grey SILTY fine SAND, some gravel		4.57							
5											Native Backfill and Bentonite Mix
				88.79							
		Inferred grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		5.64							
6											Peltonite Seal
				88.16							
	Portable Drill, NQ Core	Fresh, medium bedded, dark grey, fine grained, slightly porous, strong SHALEY DOLOMITE, with thinly to medium bedded light grey dolomite		6.27	C1	NQ RC	DD				Silica Sand
7					C2	NQ RC	DD				32 mm Diam. PVC #10 Slot Screen 'A'
8				86.35							
		End of Borehole		8.08							
		Note: Soil stratigraphy from 0 m to 6.27 m inferred from casing advancement cuttings and resistance.									WL in Screen 'A' at Elev. 94.32 m on Oct. 2013 WL in Screen 'B' at Elev. 94.38 m on Oct. 2013
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF DRILLHOLE: 13-24

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 24 & 25, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Portable

DRILLING CONTRACTOR: Marathon Drilling

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate
BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage
PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular
PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR / % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		88.16																
7	Portable Drill / NQ Core	Fresh, medium bedded, dark grey, fine grained, slightly porous, strong SHALEY DOLOMITE, with thinly to medium bedded light grey dolomite		6.27	1															Peltonite Seal Silica Sand
8				86.35	2															32 mm Diam. PVC #10 Slot Screen 'A'
		End of Drillhole		8.08																WL in Screen 'A' at Elev. 94.32 m on Oct. 2013 WL in Screen 'B' at Elev. 94.38 m on Oct. 2013
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/20/16 JM/JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: PAS

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-25

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 15, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.91							
0	Portable Drill NW Casing	Black fibrous PEAT		0.00	1	50 DO	WH				Bentonite Seal
				94.30							
1		Loose brown grey SILTY SAND to SANDY SILT		0.61	2	50 DO	5				
				93.69							
		Loose grey SILTY fine SAND		1.22	3	50 DO	5				Silica Sand
2					4	50 DO	9				
					5	50 DO	8				
3				91.86							32 mm Diam. PVC #10 Slot Screen
		Grey SILTY SAND, some gravel		3.05	6	50 DO	>50				
		Very dense to compact grey SILTY SAND, trace gravel		3.20							
					7	50 DO	>50				
4											
					8	50 DO	12				Silica Sand
				90.02							
5		Compact grey SILTY SAND and GRAVEL (GLACIAL TILL)		4.89	9	50 DO	25				
				89.42							
		End of Borehole		5.49							
		Note: Blow counts were corrected for half-weight hammer.									WL in Screen at Elev. 95.12 m on Nov. 7, 2013
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-26

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 17, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.44							
0	Portable Drill / NW Casing	TOPSOIL		0.00	1	50 DO	1				Bentonite Seal
				94.83							
		Loose to compact grey SILTY SAND to SANDY SILT		0.61	2	50 DO	6				Silica Sand
1					3	50 DO	9				
2					4	50 DO	8				38 mm Diam. PVC #10 Slot Screen 'B'
					5	50 DO	13				
3					6	50 DO	8				Bentonite Seal
											Silica Sand
4					7	50 DO	10				
					8	50 DO	11				32 mm Diam. PVC #10 Slot Screen 'A'
5					9	50 DO	25				
				89.95							Silica Sand
		End of Borehole		5.49							
6		Note: Blow counts were corrected for half-weight hammer.									WL in Screen 'A' at Elev. 95.42 m on November 7, 2013
											WL in Screen 'B' at Elev. 95.46 m on November 7, 2013
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-27

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 2, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.49							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 96.01							
		Stiff grey brown CLAYEY SILT, trace sand		0.48	1	50 DO	6				
1					2	50 DO	6				
2				94.20							
		Very loose to loose grey SANDY SILT, trace to some clay		2.29	3	50 DO	4				
3				93.44							
		Compact grey SANDY SILT		3.05	4	50 DO	17				
4					5	50 DO	10				
					6	50 DO	12			MH	
5				91.16							
		Loose grey fine SAND, trace silt		5.33	7	50 DO	5				
6				90.55							
		End of Borehole		5.94							
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/24/17 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-28

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 4, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.62							
0	Portable Drill / NW Casing	TOPSOIL		0.00	1	50 DO	2				
				95.01							
		Loose brown SILTY SAND		0.61	2	50 DO	6				
1				94.40							
		Loose to compact grey SILTY SAND		1.22	3	50 DO	10				
				93.79							
2		Very dense dark brown SANDY SILT		1.83	4	50 DO	>50				
				93.44							
		End of Borehole Spoon Refusal		2.18							
		Note: Blow counts were corrected for half-weight hammer.									
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-29

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 22, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m
		GROUND SURFACE		97.10			
0	Portable Drill NW Casing	TOPSOIL		0.00	1	50 DO	1
				96.79			
		Compact grey SILTY fine SAND, trace gravel		0.31	2	50 DO	14
1					3	50 DO	14
				95.27			
		Compact grey SILTY fine SAND, some gravel		1.83	4	50 DO	22
2				94.66			
		Compact to very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		2.44	5	NQ RC	DD
					6	50 DO	37
3					7	NQ RC	DD
					8	50 DO	14
4					9	50 DO	>34
					10	50 DO	>50
5				91.67			
		End of Borehole		5.43			
		Note: Blow counts were corrected for half-weight hammer.					
6							
7							
8							
9							
10							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

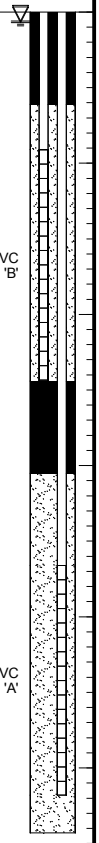
SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○: 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-8} 10^{-6} 10^{-4} 10^{-2}

WATER CONTENT PERCENT: Wp — W — Wl: 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



WL in Screen 'A' at Elev. 97.02 m on Nov. 4, 2013

WL in Screen 'B' at Elev. 97.04 m on Nov. 4, 2013

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HEC

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-30

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Portable Drill, NW Casing	TOPSOIL		0.00							
		Stiff brown CLAYEY SILT, some sand, trace gravel, with rootlets		0.15	1	50 DO	5				
		Brown SILTY SAND, some gravel		0.61	2	50 DO	>50				
1		End of Borehole Spoon Refusal		0.91							
2		Notes: 1. Ground surface elevation unable to be determined due to heavy tree cover. 2. Borehole was terminated and relocated to BH 13-30A due to shallow refusal. 3. Blow counts were corrected for half-weight hammer.									
3											
4											
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/24/17 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-30A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Portable Drill, NW Casing	TOPSOIL		0.00							
		Very loose brown SANDY SILT, some clay		0.15	1	50 DO	2				
1		Compact brown SILTY SAND, trace clay		0.61	2	50 DO	15				
		Loose to compact grey brown SILTY SAND, trace gravel		1.22	3	50 DO	10				
2		Compact to very dense grey fine to medium SAND, some silt, trace gravel, with cobbles and boulders (GLACIAL TILL)		1.83	4	50 DO	22				
					5	50 DO	42				
3					6	50 DO	>50				
		End of Borehole Spoon Refusal		3.20							
4		Notes: 1. Borehole 13-30A was relocated approximately 1.5 m from borehole 13-30 due to shallow refusal. 2. Blow counts were corrected for half-weight hammer.									
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-31

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 9, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.84							
0	Portable Drill NW Casing	TOPSOIL		0.00	1	50 DO	1				
				96.23							
1		Loose brown grey SANDY SILT, occasional silty sand seams		0.61	2	50 DO	8				
				95.62							
2		Loose to compact grey SILTY fine SAND		1.22	3	50 DO	9				
					4	50 DO	11				
				94.40							
3		Loose to compact grey SILT		2.44	5	50 DO	10			MH	
				93.79							
		Loose to compact grey SILTY fine SAND		3.05	6	50 DO	5				
4					7	50 DO	9				
					8	50 DO	4				
5					9	50 DO	14				
				91.35							
		End of Borehole		5.49							
6		Note: Blow counts were corrected for half-weight hammer.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-32

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 10 & 11, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}); WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		96.12							
	Wash Boring / NW Casing	TOPSOIL		0.00 / 95.51							Bentonite Seal
1		Inferred brown SILTY fine SAND		0.61 / 94.60							Silica Sand
2		Inferred grey SILTY fine SAND		1.52 / 92.69							38 mm Diam. PVC #10 Slot Screen 'B'
3											Silica Sand
4		Inferred grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		3.43 / 88.42							Bentonite Seal
5											Peltonite
6											Silica Sand
7					C1	NQ RC	DD				32 mm Diam. PVC #10 Slot Screen 'A'
					C2	NQ RC	DD				Silica Sand
8		End of Borehole Note: Soil stratigraphy from 0 m to 6.12 m inferred from casing advancement cuttings and resistance.		7.70							WL in Screen 'A' at Elev. 96.02 m on Nov. 7, 2013 WL in Screen 'B' at Elev. 96.00 m on Nov. 7, 2013
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM

CHECKED: PAS

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

PROJECT: 13-1121-0083

RECORD OF BOREHOLE: 13-33

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 18 & 21, 2013

DATUM: Geodetic

SAMPLER HAMMER, 32kg; DROP, 760mm

PENETRATION TEST HAMMER, 32kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp W WI) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		100.93							
0		TOPSOIL		0.00							
		Inferred grey brown SILTY fine SAND		0.15							Native Backfill and Bentonite Mix
1				99.41							Bentonite Seal
		Inferred grey SILTY fine SAND, trace fine gravel		1.52							Silica Sand
2											
3	Portable Drill / NW Casing										38 mm Diam. PVC #10 Slot Screen 'B'
4				96.71							Native Backfill and Bentonite Mix
		Inferred grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		4.22							Silica Sand
5											
6											32 mm Diam. PVC #10 Slot Screen 'A'
				93.92							Silica Sand
7		End of Borehole		7.01							
		Note: Soil stratigraphy from 0 m to 7.01 m inferred from casing advancement cuttings and resistance.									WL in Screen 'A' at Elev. 100.22 m on Nov. 8, 2013 WL in Screen 'B' at Elev. 100.21 m on Nov. 8, 2013
8											
9											
10											

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/20/16 JM/JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DWM/HEC

CHECKED: PAS

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-101

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 6, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.98							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00 / 96.77							
		(SM) SILTY SAND, trace gravel; brown; non-cohesive, dry, loose		0.21	1	SS	7				
				96.22							
		(SP) SAND; brown; non-cohesive, dry		0.76	2	SS	>50				
1		(SM) SILTY SAND, some gravel; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		0.89							Native Backfill
2					3	SS	70				
					4	SS	>50				
3	Wash Boring HW Casing				5	RC	DD				
				93.50							
	Rotary Drill NQ Core	Slightly weathered to fresh, thinly to medium bedded, grey, fine grained SANDY DOLOSTONE BEDROCK, with shale interbeds		3.48	C1	RC	DD				Bentonite Seal
4											
5					C2	RC	DD				Silica Sand
6					C3	RC	DD				Standpipe
				90.24							
		Fresh, thinly bedded, grey, fine grained SANDSTONE BEDROCK		6.74							
7				89.77							
		End of Borehole		7.21							WL in Standpipe at Elev. 94.27 m on Nov. 11, 2016
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-101

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 6, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		93.50																
4	Rotary Drill / NQ Core	Slightly weathered to fresh, thinly to medium bedded, grey, fine grained SANDY DOLOSTONE BEDROCK, with shale interbeds		3.48	1	30														
5					2	10														Bentonite Seal / Silica Sand
6					3	5														Standpipe
7		Fresh, thinly bedded, grey, fine grained SANDSTONE BEDROCK		90.24 6.74																
		End of Drillhole		89.77 7.21																WL in Standpipe at Elev. 94.27 m on Nov. 11, 2016
8																				
9																				
10																				
11																				
12																				
13																				

DEPTH SCALE
1 : 50

LOGGED: KM
CHECKED: CK

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-102

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 29, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.76							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (SM) SILTY SAND; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT; brown; non-cohesive, dry, compact to very dense		0.16	1	SS	10				
1					2	SS	26				
					3	SS	80				
2	Wash Boring HW Casing			92.70							
		(SM) SILTY SAND, some gravel; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, very dense		2.06							
3					4	SS	86				
4					5	RC	DD				
5					6	RC	DD				
6					7	RC	DD				
	Rotary Drill NQ Core	Slightly weathered to fresh, thinly bedded, grey, fine grained DOLOSTONE BEDROCK		88.47 6.29							
7		- Vertical fracture from 6.29 m to 6.45 m			C1	RC	DD				
		- Vertical fracture from 6.75 m to 6.98 m									
		End of Borehole		87.27 7.49							
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: KM

CHECKED: CK

Golder Associates

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-102

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 29, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate | BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage | PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular | PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break | BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		88.47															
7	Rotary Drill / NQ Core	Slightly weathered to fresh, thinly bedded, grey, fine grained DOLOSTONE BEDROCK - Vertical fracture from 6.29 m to 6.45 m - Vertical fracture from 6.75 m to 6.98 m		6.29	1	10													
				87.27															
		End of Drillhole		7.49															
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-103

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		98.05							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT, some gravel; brown; non-cohesive, dry, loose to very dense		0.17	1	SS	4				
1					2	SS	>50				
					3	SS	100				
2				95.76							
		(SM) SILTY SAND, some gravel; brown to grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		2.29	4	SS	>50				
3					5	SS	>50			MH	
4					6	SS	59				
					7	SS	>50				
5				92.95							
	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey, fine grained DOLOSTONE BEDROCK, with shale interbeds		5.10	C1	RC	DD				
6					C2	RC	DD				
7				91.04							
		End of Borehole		7.01							
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-103

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 5, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		92.95															
6	Rotary Drill / NQ Core	Fresh, thinly to medium bedded, grey, fine grained DOLOSTONE BEDROCK, with shale interbeds		5.10	1	30													
					2	40													
7		End of Drillhole		91.04 7.01															
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: KM
CHECKED: CK

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-104

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: September 30, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.82							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (SM) SILTY SAND; dark brown; moist		0.00							
		(SM) SILTY SAND; brown; non-cohesive, dry, loose		0.15	1	SS	6				
				95.06							
1		(SM) SILTY SAND, some gravel; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		0.76	2	SS	>50				Silica Sand
2					3	SS	68				Bentonite Seal
				93.31							
3	Wash Boring HQ Core	(SM) gravelly SILTY SAND; brown, contains dolostone fragments, cobbles and boulders (GLACIAL TILL); non-cohesive, moist, compact to very dense		2.51	4	SS	13				
					5	SS	>50				Silica Sand
4					6	SS	>50				Standpipe
				91.33							
	Rotary Drill NQ Core	Probable Limestone Bedrock		4.49	C1	RC	DD				
				90.82							
5		End of Borehole		5.00							WL in Standpipe at Elev. 91.55 m on Nov. 11, 2016
6											
7											
8											
9											
10											

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-104

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: September 30, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate; BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage; PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular; PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		91.33																
	Rotary Drill / NQ Core	Probable Limestone Bedrock		4.49	1	5														Standpipe
				90.82																
5		End of Drillhole		5.00																WL in Standpipe at Elev. 91.55 m on Nov. 11, 2016
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-105

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		101.46							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00 / 101.28							
		(SM/ML) SAND and SILT, trace gravel; grey brown; non-cohesive, moist, loose		0.18	1	SS	6				
				100.70							
1		(SM) SILTY SAND, some gravel; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		0.76	2	SS	76				
					3	SS	>50				
2					4	SS	>50				
3					5	SS	>50				
4					6	SS	>50				
					7	SS	>50				
5				96.43							
		End of Borehole		5.03							Open borehole dry upon completion of drilling
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-106

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		103.84							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; non-cohesive, moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT, trace gravel; brown, contains cobbles and boulders; non-cohesive, dry compact		0.14	1	SS	10				
				103.08							
1		(SM) SILTY SAND, some gravel; grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		0.76	2	SS	>50				Native Backfill
					3	SS	77				
2											Bentonite Seal
					4	SS	>50				
3					5	SS	68				Silica Sand
				100.03							
		(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, very dense		3.81	6	SS	63				Standpipe
4											
					7	SS	88				
5				98.71							
		End of Borehole		5.13							WL in Standpipe at Elev. 99.41 m on Nov. 11, 2016
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-107

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 7, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.24							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT, trace gravel; grey brown; non-cohesive, dry, compact		0.11	1	SS	11				Native Backfill
				93.48							
1		(SM) SILTY SAND, some gravel; grey brown to grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, dense		0.76	2	SS	50				Bentonite Seal
					3	SS	42				Silica Sand
2				92.11							
		(SM) gravelly SILTY SAND; grey, contains cobbles and boulders (GLACIAL TILL); wet, compact to very dense		2.13	4	SS	17				Standpipe
3		- Sand layers between about 2.29 m and 2.90 m			5	SS	65				
					6	SS	>50				Silica Sand
4					7	SS	>50				
				89.46							
5	Rotary Drill NQ Core	Slightly weathered to fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK, with shale interbeds		4.78	C1	RC	DD				Native Backfill
					C2	RC	DD				
				88.36							
6		End of Borehole		5.88							WL in Standpipe at Elev. 92.55 m on Nov. 11, 2016
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-107

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 7, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		89.46																
5	Rotary Drill / NQ Core	Slightly weathered to fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK, with shale interbeds		4.78	1	10														Native Backfill
					2	5														
				88.36																
6		End of Drillhole		5.88																WL in Standpipe at Elev. 92.55 m on Nov. 11, 2016
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: KM
CHECKED: CK

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-108

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 30, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		96.65							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (SM) SILTY SAND; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT, trace to some gravel; dark brown to grey brown; non-cohesive, moist, very loose to dense		0.14	1	SS	2				
1					2	SS	16				
					3	SS	43				
2				94.52							
	Wash Boring HW Casing	(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, moist, very dense		2.13	4	RC	DD				
3					5	SS	>50				
					6	RC	DD				
4					7	SS	>50				
					8	RC	DD				
5				91.67							
		End of Borehole		4.98							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: KM

CHECKED: CK

Golder Associates

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-109

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 3, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.37							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM) SILTY SAND; grey brown; non-cohesive, moist, loose		0.16	1	SS	6		○		
				93.61							
1		(SM) SILTY SAND, some gravel; grey brown, with oxidation staining; non-cohesive, moist, compact		0.76	2	SS	29		○		
				92.85							
2		(SP/SW) SAND to gravelly SAND, some non-plastic fines; grey; non-cohesive, moist to wet, compact		1.52	3	SS	19		○		
				92.08							
		(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact to very dense		2.29	4	SS	24		○	MH	
3					5	SS	>50		○		
	Wash Boring HW Casing				6	RC	DD				
4					7	SS	>50				
					8	RC	DD				
					9	RC	DD				
5				89.37							
		End of Borehole		5.00							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-110

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		98.65							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT; brown; non-cohesive, dry, loose to dense		0.14	1	SS	7				
1					2	SS	38				
				97.13							
		(SM) SILTY SAND, some gravel; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		1.52	3	SS	49				
2					4	SS	75				
3					5	SS	87				
					6	SS	>50				
4					7	SS	>50				
				93.62							
5		End of Borehole		5.03							Open borehole dry upon completion of drilling
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-111

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 3, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.47							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist, very loose to loose		0.17	1	SS	3				Silica Sand
1					2	SS	9				
				92.95							
		(SM) SILTY SAND; grey brown to grey, contains rock fragments; non-cohesive, wet, compact		1.52	3	SS	16				
2					4	SS	25				
3				91.42							
		(SP) SAND, some non-plastic fines, trace gravel; grey, contains cobbles and boulders; non-cohesive, wet, dense		3.05	5	SS	34				Bentonite Seal
4					6	SS	>50				
	Wash Boring HW Casing				7	SS	>50				
					8	RC	DD				
5				89.38							
	Rotary Drill NQ Core	Slightly weathered to fresh, thinly to medium bedded, fine grained LIMESTONE BEDROCK, with thin to medium shale interbeds		5.09	C1	RC	DD				Silica Sand
6											
					C2	RC	DD				Standpipe
		- Vertical fracture from 6.64 m to 7.16 m									
7				87.31							
		End of Borehole		7.16							WL in Standpipe at Elev. 93.96 m on Nov. 11, 2016
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-111

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 3, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.	
		BEDROCK SURFACE		89.38																
6	Rotary Drill / NQ Core	Slightly weathered to fresh, thinly to medium bedded, fine grained LIMESTONE BEDROCK, with thin to medium shale interbeds		5.09	1	10														Bentonite Seal; Silica Sand
					2	10														Standpipe
7		- Vertical fracture from 6.64 m to 7.16 m		87.31																
		End of Drillhole		7.16																WL in Standpipe at Elev. 93.96 m on Nov. 11, 2016

DEPTH SCALE

1 : 50

LOGGED: KM

CHECKED: CK

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-112

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 4, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		95.75							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(ML/SM) sandy SILT to SILTY SAND, trace gravel; grey brown; non-cohesive, moist, compact		0.14	1	SS	12				
1					2	SS	24				
					3	SS	20				
2				93.46							▽
		(SM) SILTY SAND, some gravel; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact to very dense		2.29	4	SS	16				
3					5	SS	17				
4					6	SS	>50				
					7	SS	>50				
5				90.74							
		End of Borehole		5.01							WL in open borehole at 2.29 m depth below ground surface upon completion of drilling
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-113

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: October 4, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}) / WATER CONTENT PERCENT (Wp ○ W I Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		94.75							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML/OL) sandy SILT to ORGANIC SILT; dark brown; moist		0.00 94.46	1	SS	9		○		
		(SM/ML) SILTY SAND to sandy SILT; grey brown; non-cohesive, moist to wet, loose to compact		0.29							
1					2	SS	10		○		
				93.07							
		(ML) sandy SILT; grey; non-cohesive, wet, very loose to loose		1.68	3	SS	4		○		
2				92.46							
		(SM) SILTY SAND, some gravel to gravelly; grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, compact to very dense		2.29	4	SS	23		○	MH	
3					5	SS	36		○		
4					6	SS	52		○		
				90.18							
	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK, with shale interbeds		4.57	C1	RC	DD				
5				89.59							
		End of Borehole		5.16							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

MIS-BHS 001 1311210083.GPJ GAL-MIS.GDT 01/18/17 JM/JEM

PROJECT: 13-1121-0083-1046

RECORD OF DRILLHOLE: 16-113

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 4, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate | BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage | PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular | PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break | BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA: B Angle	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		90.18															
5	Rotary Drill / NQ Core	Fresh, thinly to medium bedded, grey, fine grained LIMESTONE BEDROCK, with shale interbeds		4.57	1	10													
				89.59															
		End of Drillhole		5.16															

DEPTH SCALE

1 : 50

LOGGED: KM

CHECKED: CK

Golder Associates

MIS-RCK 004 1311210083.GPJ GAL-MISS.GDT 01/18/17 JM/JEM

APPENDIX B

Borehole and Test Pit Records
Previous Investigations

TABLE 1

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Description
TP 08-1 (Elev. 102.51m)	0.00 – 0.50 0.50 – 0.80 0.80 – 2.50 2.50 – 3.66 3.66	TOPSOIL Grey brown sandy silt, some clay, trace gravel (FILL) Brown SILTY SAND, some gravel, trace clay, with cobbles and boulders Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL) Excavator Refusal on Bedrock Note 1: Water seepage at depths of 0.5, 0.8 and 1.2 metres below existing ground surface. Note 2: Water level in test pit at 0.2 metres below ground surface upon completion of the excavation. Sample 1: Depth (m) 0.50 – 0.80 Sample 2: Depth (m) 1.00 – 1.70 Sample 3: Depth (m) 2.70 – 3.10
TP 08-2 (Elev. 104.69m)	0.00 – 0.25 0.25 – 1.55 1.55	TOPSOIL Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL) Excavator Refusal on Bedrock Note: Water seepage at a depth of 0.8 metres below existing ground surface. Sample 1: Depth (m) 0.30 – 0.60

RECORD OF TEST PITS – continued

Test Pit Number	Depth (metres)	Description
TP 08-3 (Elev. 108.49m)	0.00 – 0.20 0.20 – 1.40 1.40 – 1.70 1.10	TOPSOIL Dark brown coarse SAND and GRAVEL, trace silt, with cobbles and boulders Grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL) Excavator Refusal on Bedrock Note: Water seepage at a depth of 0.7 metres below existing ground surface. Sample 1: Depth (m) 0.30 – 0.70 Sample 2: Depth (m) 1.40 – 1.60
TP 08-4 (Elev. 98.59m)	0.00 – 0.25 0.25 – 0.70 0.70 – 2.20 2.20	TOPSOIL Brown SAND, trace silt, with gravel, cobbles and boulders Light brown SAND, some gravel, trace silt, with cobbles and boulders Excavator Refusal on Bedrock Note: Water level in test pit at 0.3 metres below ground surface upon completion of the excavation. Sample 1: Depth (m) 0.30 – 0.60 Sample 2: Depth (m) 0.80 – 1.20

RECORD OF TEST PITS – continued

Test Pit Number	Depth (metres)	Description
TP 08-5 (Elev. 105.66m)	0.00 – 0.50 0.50 – 0.95 0.95 – 1.30 1.30 – 2.20 2.20 – 2.60 2.60	TOPSOIL Light brown SANDY SILT Grey SILT Grey SILT, some sand, trace clay, with cobbles and boulders Grey fine SAND, with cobbles and boulders Excavator Refusal on Bedrock Note: Water level in test pit at 1.8 metres below ground surface upon completion of the excavation. Sample 1 – Depth (m) 0.60 – 0.90 Sample 2 – Depth (m) 1.00 – 1.20 Sample 3 – Depth (m) 1.40 – 1.80 Sample 4 – Depth (m) 2.20 – 2.50

patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

REMARKS

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

FILE NO. PG0627

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.30
TOPSOIL 0.13							
Compact, brown SILTY SAND		AU	1				
0.94		SS	2	82	50+	1	95.30
GLACIAL TILL: Very dense, brown silty sand with gravel, cobbles and boulders		SS	3	67	35	2	94.30
		SS	4	100	50+		
		SS	5	100	75+	3	93.30
3.50							
End of Borehole							
Practical refusal to augering @ 3.50m depth							
(GWL @ 1.42m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

FILE NO. PG0627

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	95.15		
TOPSOIL 0.25									
Compact, brown SILTY fine to medium SAND, trace gravel		SS	1	92	12	1	94.15		
1.50									
		SS	2	67	22	2	93.15		
Compact, brown fine to coarse SAND, occasional gravel		SS	3	83	27	3	92.15		
		SS	4	100	25				
- dense and grey by 3.6m depth						4	91.15		
		SS	5	100	40				
4.57									
End of Borehole									
(GWL @ 1.43m-Sep. 6/05)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

FILE NO. PG0627

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.19
TOPSOIL 0.20		AU	1				
		SS	2	50	10	1	96.19
Compact, brown SILTY fine SAND		SS	3	62	20	2	95.19
- occasional, gravel and cobbles by 2.5m depth 2.80		SS	4	58	19		
GLACIAL TILL: Dense to very dense, grey sandy silt to silty fine sand with gravel, cobbles and boulders		SS	5	75	45	3	94.19
		SS	6	71	70	4	93.19
4.57 End of Borehole							
(GWL @ 2.41m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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FILE NO. PG0627

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger DATE 19 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.39
TOPSOIL 0.18							
Stiff, dark brown CLAYEY SILT, trace sand and gravel 0.60		AU	1				
		SS	2	58	40	1	100.39
GLACIAL TILL: Dense to very dense, brown silty fine sand with gravel, cobbles and boulders		SS	3	92	49	2	99.39
		SS	4	83	85		
3.38		SS	5	85	85+	3	98.39
End of Borehole							
Practical refusal to augering @ 3.38m depth							
(BH dry-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

FILE NO. PG0627

HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.66
TOPSOIL 0.10							
Compact, brown SILTY fine SAND, occasional gravel		SS	1	46	16	1	95.66
1.04							
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders		SS	2	83	62	2	94.66
		SS	3	67	27		
- grey by 3.1m depth		SS	4		50+	3	93.66
3.35							
End of Borehole							
Practical refusal to augering @ 3.35m depth							
(GWL @ 2.02m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

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FILE NO. PG0627

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	93.72		
TOPSOIL 0.20									
Compact, brown SANDY SILT, some clay		AU	1						
1.00						1	92.72		
GLACIAL TILL: Compact to dense, brown silty fine to medium sand with gravel, cobbles and boulders		SS	2	50	23				
		SS	3	53	74+				
1.90									
End of Borehole									
Practical refusal to augering @ 1.90m depth									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

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FILE NO. PG0627

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger DATE 20 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.77
TOPSOIL 0.23							
Compact to dense, brown **SILTY SAND**, some gravel		SS	1	73	50+	1	93.77
		SS	2	82	96+	2	92.77
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders		SS	3	100	50+	3	91.77
		SS	4	100	50+		
3.40 End of Borehole							
Practical refusal to augering @ 3.40m depth							
(BH dry-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

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FILE NO. PG0627

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger DATE 20 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.03
TOPSOIL 0.15							
Compact, brown SILTY fine SAND		AU	1				
0.76							
		SS	2	47	79+	1	98.03
		SS	3	67	50+		
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders						2	97.03
		SS	4	78	50+		
						3	96.03
		SS	5	33	77+		
3.56							
End of Borehole							
Practical refusal to augering @ 3.56m depth							
(GWL @ 3.18m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
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FILE NO. PG0627

REMARKS

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger DATE 20 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.61
TOPSOIL 0.20							
Compact, brown SILTY fine SAND 0.60							
		SS	1	80	90+	1	100.61
GLACIAL TILL: Very dense, brown sandy silt with gravel, cobbles and boulders		SS	2	100	50+	2	99.61
		SS	3	89	50+		
		AU	4				
2.72							
End of Borehole							
Practical refusal to augering @ 2.72m depth							
(GWL @ 2.32m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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FILE NO. PG0627

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	97.80
TOPSOIL 0.28							
GLACIAL TILL: Very dense, brown sandy silt with gravel, cobbles and boulders		SS	1	73	73+	1	96.80
		SS	2	100	50+		
1.80							
End of Borehole							
Practical refusal to augering @ 1.80m depth							
(GWL @ 1.62m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

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FILE NO. PG0627

REMARKS

HOLE NO. BH11

BORINGS BY CME 55 Power Auger DATE 19 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	94.01		
38mm TOPSOIL		AU	1						
Compact to dense, brown **SILTY SAND** with gravel									
0.97		SS	2	33	45	1	93.01		
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders		SS	3	75	72				
						2	92.01		
2.54		SS	4	30	50+				
End of Borehole									
Practical refusal to augering @ 2.54m depth									
(Piezometer blocked - Sep. 6/05)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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REMARKS

BORINGS BY CME 55 Power Auger DATE 22 JUL 05

FILE NO. PG0627

HOLE NO. BH12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	94.50
TOPSOIL 0.28							
Compact, brown SILTY fine SAND - some gravel by 0.8m depth 1.22		SS	1	42	15	1	93.50
		SS	2	50	28	2	92.50
GLACIAL TILL: Compact to very dense, grey silty fine sand with gravel, cobbles and boulders		SS	3	58	26	3	91.50
		SS	4	33	63		
		SS	5	56	50+	4	90.50
4.57 End of Borehole							
(GWL @ 1.56m-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
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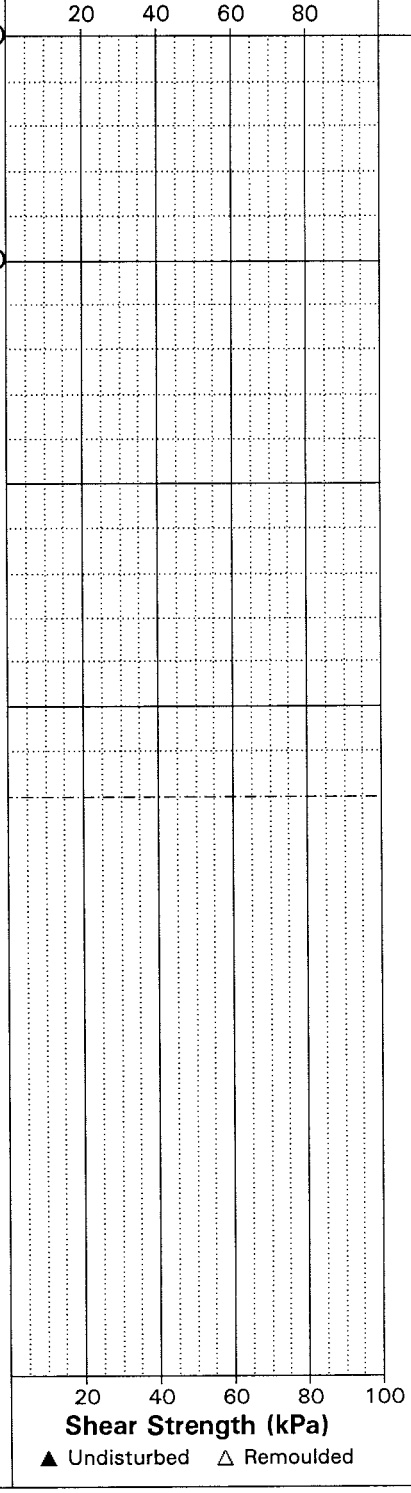
FILE NO. PG0627

REMARKS

HOLE NO. PH 1

BORINGS BY CME 55 Power Auger DATE 19 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	101.40		
TOPSOIL 0.15									
Stiff, dark brown CLAYEY SILT, trace sand and gravel 0.60									
		AU	1			1	100.40		
GLACIAL TILL: Compact to dense, brown silty fine sand with gravel, cobbles and boulders		AU	2			2	99.40		
		AU	3			3	98.40		
3.40									
End of Borehole									
Practical refusal to augering @ 3.40m depth									



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SOIL PROFILE & TEST DATA

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FILE NO. PG0627

REMARKS

HOLE NO. PH 2

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	93.97	20 40 60 80	
TOPSOIL 0.20									
OVERBURDEN						1	92.97		
1.70 End of Probehole									
Practical refusal to augering @ 1.70m depth									
(GWL @ 1.40m-Sep. 6/05)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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FILE NO. PG0627

REMARKS

HOLE NO. PH 3

BORINGS BY CME 55 Power Auger DATE 19 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	94.00	20 40 60 80	
TOPSOIL 0.10									
Very dense, brown SILTY SAND with gravel		AU	1			1	93.00		
1.22									
End of Borehole									
Practical refusal to augering @ 1.22m depth									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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REMARKS

FILE NO. PG0627

HOLE NO. PH 4

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.64
TOPSOIL 0.28							
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders						1	97.64
						2	96.64
2.37 End of Borehole		SS	1		50+		
Practical refusal to augering @ 2.37m depth							
(BH dry-Sep. 6/05)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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REMARKS

BORINGS BY 330 Excavator DATE 10 AUG 05

FILE NO. PG0627

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.09
TOPSOIL							
0.30		G	1				
Dark brown to brown CLAYEY SILT, some fine sand		G	2				
0.40							
Grey SILT, trace clay		G	3			1	99.09
1.30							
Grey SILTY CLAY with silt layers		G	4			2	98.09
2.70							
Grey SILTY fine SAND		G	5			3	97.09
4.00						4	96.09
End of Test Pit							
(Water infiltration @ 3.0m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

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FILE NO. PG0627

REMARKS

HOLE NO. TP 2

BORINGS BY 330 Excavator DATE 10 AUG 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	97.52		
PEAT		G	1						
0.50									
Compact, brown SANDY SILT with gravel and cobbles						1	96.52		
1.00		G	2						
		G	3						
Grey SILT mixed with clayey silt						2	95.52		
						3	94.52		
3.20									
End of Test Pit									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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REMARKS

BORINGS BY 330 Excavator DATE 10 AUG 05

FILE NO. PG0627

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	96.96
PEAT 0.20		G	1				
Compact, brown SILT		G	2				
- grey by 1.0m depth		G	3			1	95.96
- large boulders by 2.2m depth		G	4			2	94.96
						3	93.96
4.00 End of Test Pit						4	92.96

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE & TEST DATA

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Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

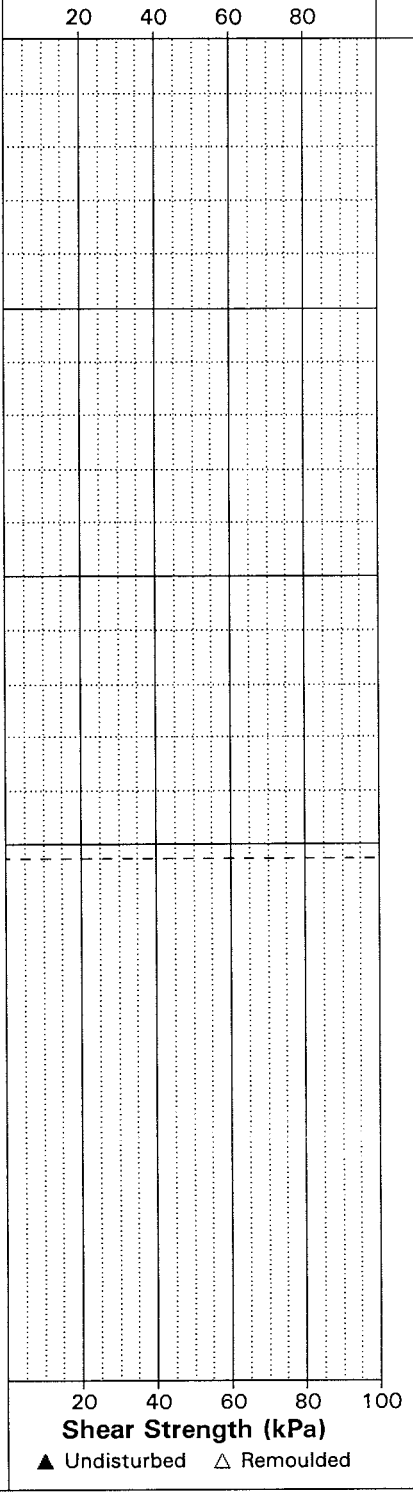
FILE NO. PG0627

REMARKS

HOLE NO. TP 4

BORINGS BY 330 Excavator DATE 9 AUG 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	94.00		
PEAT 0.28		G	1						
Stiff to very stiff, brown CLAYEY SILT 0.55		G	2						
		G	3			1	93.00		
Compact, brown SILT									
- grey by 1.8m depth						2	92.00		
		G	4						
- large boulders by 3.0m depth 3.05						3	91.00		
End of Test Pit									



JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-1

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-05-27 — WATER LEVEL 92-06-04 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	GRAIN SIZE (%) 0 20 40 60 80 100	SAMPLES TYPE	SAMPLES N-VALUE OR RQD	PIEZOMETER CONSTRUCTION DETAILS
0	93.70								
	93.4	Dark brown wet silty TOPSOIL							
	93.0	Light brown SILT, some fine sand.			2				
1		Brown silty SAND some gravel			4		SS	25	
					6		SS	66	
2	91.4				8		SS	24	
		Grey silty sand some gravel:TILL			10		SS	50	
3	90.5								
		End of Borehole (Auger Refusal)			12				
4					14				
					16				
5					18				
					20				
6					22				
					24				
7					26				
					28				
8					30				
9									
					32				
10									

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-2

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-05-27 — WATER LEVEL 92-06-05 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	GRAIN SIZE (%) 0 20 40 60 80 100	SAMPLES TYPE	SAMPLES N-VALUE OR RQD	PIEZOMETER CONSTRUCTION DETAILS
0	94.70								D S
	94.4	Dark brown silty TOPSOIL							
1		Brown silty SAND			2				
	93.2				4		SS	7	
2	92.6	Grey SILT some fine sand			6		SS	9	
		Grey silty SAND, some to trace gravel			8		SS	4	
3	91.1				10		SS	5	
4	90.2	Grey silty sand and gravel:TILL			12				
		End of Borehole (Auger Refusal)			14				
5					16				
					18				
6					20				
					22				
7					24				
					26				
8					28				
					30				
9					32				
10									

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-3

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-05-27 — WATER LEVEL 92-06-04 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	GRAIN SIZE (%) 0 20 40 60 80 100	SAMPLES TYPE	SAMPLES N-VALUE OR RQD	PIEZOMETER CONSTRUCTION DETAILS
0	100.80								D S
	100.6	Dark brown silty TOPSOIL							
1		Brown silty SAND with fine layers that have some gravel			2				
					4		SS	19	
2					6		SS	45	
	98.1				8		SS	50	
3		Grey sand silt and gravel:TILL, with increasing amounts of clay with depth			10		SS	98	
					12				
4					14				
					16		SS	25	
5					18				
					20		SS	44	
6					22				
7					24				
					26				
8					28				
9	91.4				30				
		End of Borehole (Auger Refusal)			32				
10									

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-5

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-05-29 — WATER LEVEL 92-06-04 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION
0	99.70	
	99.3	Dark brown to black peaty TOPSOIL
	99.0	Brown silty sand
1		Grey silty SAND and GRAVEL
2		
3		
4	95.1	
5		Grey silty sand and gravel:TILL
6	93.0	
7		End of Borehole (Auger Refusal)
8		
9		
10		

STRATA PLOT | WATER LEVEL | DEPTH (ft)

GRAIN SIZE (%)

0 20 40 60 80 100

SAMPLES TYPE	N-VALUE OR RQD
SS	50
SS	29
SS	47
SS	22
SS	49
SS	50

PIEZOMETER CONSTRUCTION DETAILS

D S

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-6

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-05-29 — WATER LEVEL 92-06-04 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION
0	99.10	
	98.7	Dark brown silty PEAT
1		Grey sandy SILT, some gravel
2		
3	95.3	
4	94.7	Grey silty sand and gravel:TILL
5		End of Borehole (Auger Refusal)
6		
7		
8		
9		
10		

STRATA PLOT | WATER LEVEL | DEPTH (ft)

GRAIN SIZE (%): 0 20 40 60 80 100

SAMPLES TYPE	N-VALUE OR RQD
SS	10
SS	8
SS	6
SS	7

WELL CONSTRUCTION: D S

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

BH 92-8

CLIENT Remer Group — PROJECT No. 30227

LOCATION Leitrim Road, Gloucester, Ontario — DATUM Estimated

DATES: BORING 92-06-05 — WATER LEVEL 92-06-05 — TPC ELEV.

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	GRAIN SIZE (%) 0 20 40 60 80 100	SAMPLES TYPE	SAMPLES N-VALUE OR RQD	PIEZOMETER CONSTRUCTION DETAILS
0	100.00								▽
	99.9	Dark brown silty TOPSOIL							
1		Dark brown silty SAND			2				
	98.5				4				
2		End of Borehole (Auger Refusal)			6				
					8				
3					10				
					12				
4					14				
					16				
5					18				
					20				
6					22				
					24				
7					26				
					28				
8					30				
9					32				
10									

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-2

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-25 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-2

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
0	101.10	Ground Surface						
2					SS	1	360	33
3		Dense, brown and grey, medium to coarse, SAND, trace to some silt, some gravel (increasing with depth)						
3					SS	2	500	37
5					SS	3	500	59
6	94.8				SS	4	200	*
		End of Borehole						
		* Split spoon refusal						

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 9

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-3

CLIENT Ship & Krakow Architects
LOCATION Leitrim, Ontario
DATES: BORING 90-06-26 WATER LEVEL

PROJECT No. 30067
BOREHOLE No. 90-3
DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	96.60	Ground Surface						
		Black PEAT						
	96.0							
1								
2					SS	1	320	10
		Loose to compact, grey, medium, SAND, trace to some silt, trace gravel						
3					SS	2	230	7
4								
5					SS	3	450	32
	91.0							
6		Compact, greyish brown, SILT and SAND, some gravel and pebbles			SS	4	-	*
	90.3	End of Borehole						
7		* Split spoon refusal						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
DYNAMIC PENETRATION TEST, BLOWS/0.3m ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80

△ Pocket Penetrometer Test
□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-4

CLIENT Ship & Krakow Architects — PROJECT No. 30067

LOCATION Leitrim, Ontario — BOREHOLE No. 90-4

DATES: BORING 90-06-27 — WATER LEVEL — DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
0	96.20	Ground Surface						
		Black PEAT						
	95.6							
1								
2		Compact to dense, grey, (fine becoming coarse at depth), SAND, trace silt, some gravel			SS	1	230	27
3								
4					SS	2	350	39
5								
6					SS	3	380	50
	89.5							
7		End of Borehole			SS	4	100	27
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 9

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-5

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-27 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-5

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	96.10	Ground Surface						
		Black PEAT						
	95.5							
1								
2					SS	1	240	5
3		Loose, grey, fine to medium, SAND and SILT, trace gravel and small pebbles at depth			SS	2	400	3
4								
5					SS	3	300	5
6								
	89.4				SS	4	420	9
7		End of Borehole						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-6

CLIENT Ship & Krakow Architects — PROJECT No. 30067

LOCATION Leitrim, Ontario — BOREHOLE No. 90-6

DATES: BORING 90-06-27 — WATER LEVEL — DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	99.70	Ground Surface						
	99.4	Dark brown, TOPSOIL and ROOTMAT						
1		Brown and grey, fine to medium, SAND, trace silt						
	98.1							
2		Very dense, brown, silty sand, some gravel and rock fragments at top of bedrock, TILL			SS	1	250	*
	97.4	End of Borehole (Bedrock)						
3		* Split spoon refusal						
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-7

CLIENT Ship & Krakow Architects — PROJECT No. 30067

LOCATION Leitrim, Ontario — BOREHOLE No. 90-7

DATES: BORING 90-06-27 — WATER LEVEL — DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: RECOVERY	SAMPLES: N-VALUE OR RQD
							mm	
0	102.10	Ground Surface						
		Dense, brown, silty sand: TILL						
1	100.9	End of Borehole (Bedrock)						
2								
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-8

CLIENT Ship & Krakow Architects

PROJECT No. 30067

LOCATION Leitrim, Ontario

BOREHOLE No. 90-8

DATES: BORING 90-06-27

WATER LEVEL

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	99.90	Ground Surface					mm	
0	99.6	TOPSOIL						
1		Brown, SANDY SILT, trace organics						
	98.2				SS	1	130	*
2		End of Borehole (Bedrock)						
		* Split spoon refusal						
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-9

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-28 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-9

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	98.20	Ground Surface						
	97.9	TOPSOIL						
1		Dense, brown, SILTY SAND						
	96.7							
2		Dense, brown, fine to medium, SAND, trace to some silt, trace gravel, trace iron oxidation, occasional organics			SS	1	490	50
	95.6							
3		Light brown, GRAVEL, some sand and rock fragments at bedrock surface			SS	2	270	24
	94.8							
		End of Borehole (Bedrock)						
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P · W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-10

CLIENT Ship & Krakow Architects

PROJECT No. 30067

LOCATION Leitrim, Ontario

BOREHOLE No. 90-10

DATES: BORING 90-06-28

WATER LEVEL

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	94.10	Ground Surface					mm	
0	93.8	TOPSOIL						
		Brown, fine to medium, SAND, trace silt, trace gravel						
1	92.6							
		Compact, brown, fine to medium, SAND, trace gravel			SS	1	500	21
2	91.5							
		Compact, brown, medium, SAND and GRAVEL, some rock fragments at bedrock surface			SS	2	410	30
3	90.6							
		End of Borehole (Bedrock)						
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-11

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-28 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-11

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	95.00	Ground Surface						
	94.7	TOPSOIL						
	94.4	Brown, SANDY SILT						
	94.1	COBBLES and PEBBLES						
1		Compact, brown, SAND, trace silt, trace gravel, trace organics (blocky texture)						
	93.3				SS	1	460	29
2		Compact, brown, silty sand: TILL						
	92.6	End of Borehole (Bedrock)						
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 9

△ Pocket Penetrometer Test

□ Field Vane Test

881-2175

Augerhole Number	Depth (metres)	Soil Description
AH 205	0.0 - 0.15	Brown Silty **TOPSOIL**
	0.15 - 1.52	Light Brown **SILTY** Fine **SAND**, some Clay, trace Gravel
	1.52	End of Augerhole Water at 0.30 metres depth
AH 206	0.0 - 0.76	Black **PEAT**
	0.76 - 1.22	Grey **CLAYEY SILT**, some Sand
	1.22 - 1.52	Grey **SILTY** Fine **SAND**, some Clay
	1.52	End of Augerhole Water at Ground Surface
AH 207	0.0 - 0.61	Black **PEAT**
	0.61 - 1.22	Grey **CLAYEY SILT**, some Sand
	1.22 - 1.52	Grey **SILTY** Fine **SAND**, some Clay
	1.52	End of Augerhole Water at 0.1 metres depth
AH 208	0.0 - 1.52	Black **PEAT**
	1.52 - 1.82	Grey **SILTY** Fine **SAND**, trace Gravel
	1.82	End of Augerhole Water at 0.1 metres depth
AH 209	0.0 - 2.74	Black **PEAT**
	2.74	End of Augerhole Water at Ground Surface
AH 210	0.0 - 0.20	Brown Silty **TOPSOIL**, trace Gravel
	0.20 - 1.52	Light Brown **SANDY SILT**, some Clay, trace Gravel
	1.52	End of Augerhole Augerhole Dry

881-2175

Augerhole Number	Depth (metres)	Soil Description
AH 211	0.0 - 0.15	Brown Silty **TOPSOIL**
	0.15 - 0.30	Light Brown **SANDY SILT**, some Clay
	0.30 - 0.76	Light Brown **SILTY** Fine **SAND**, some Clay
	0.76 - 1.52	Grey **SILTY** Fine **SAND**
	1.52	End of Augerhole Water at 0.20 metres depth
AH 212	0.0 - 0.10	Brown Sandy **TOPSOIL**
	0.10 - 1.12	Brown **SILTY** Fine **SAND**, trace Gravel
	1.12	End of Augerhole Augerhole Dry
AH 213	0.0 - 1.82	Black **PEAT**
	1.82 - 2.13	Grey **SILTY** Fine **SAND**, trace Gravel
	2.13	End of Augerhole Water at 0.10 metres depth
AH 214	0.0 - 2.74	Black **PEAT**
	2.74	End of Augerhole Water at Ground Surface
AH 215	0.0 - 2.74	Black **PEAT**
	2.74	End of Augerhole Water at Ground Surface
AH 216	0.0 - 1.22	Black **PEAT**
	1.22 - 2.13	Grey **SILTY** Fine **SAND**
	2.13	End of Augerhole Water at Ground Surface

Augerhole Number	Depth (metres)	Soil Description
AH 217	0.0 - 0.61	Black **PEAT**
	0.61 - 1.52	Grey **SILTY** Fine **SAND**
	1.52	End of Augerhole Water at Ground Surface
AH 218	0.0 - 0.91	Black **PEAT**
	0.91 - 1.52	Grey **SILTY** Fine **SAND**
	1.52	End of Augerhole Water at Ground Surface
AH 219	0.0 - 0.76	Black **PEAT**
	0.76 - 1.52	Grey **SILTY** Fine **SAND**
	1.52	End of Augerhole Water at Ground Surface
AH 220	0.0 - 0.30	Black **PEAT**
	0.30 - 0.76	Grey Brown **CLAYEY SILT**, some sand
	0.76 - 1.52	Grey **SILTY** Fine **SAND**, some clay
	1.52	End of Augerhole Water at 0.15 metres depth

Augerhole Number	Depth (metres)	Soil Description
AH 15	0.0 - 0.60	**PEAT**
	0.60 - 1.20	Grey Brown **CLAYEY SILT**
	1.20 - 2.0	Grey layered **SANDY SILT** to **SILTY** Fine **SAND**, occasional Silty Clay Layer
	2.0 - 2.60	Grey **SILTY** Fine **SAND**
	2.60	End of Augerhole Water at Ground Surface
AH 16	0.0 - 0.25	**PEAT**
	0.25 - 0.60	Grey brown layered **SILTY CLAY** and **CLAYEY SILT**
	0.60 - 0.75	**SILTY SAND** and **GRAVEL**
	0.75 - 1.30	Grey Brown layered **SANDY SILT**, **CLAYEY SILT** and Silty Fine **SAND**, trace Gravel
	1.30 - 2.30	Brown to Grey **SILTY** Fine **SAND**
	2.30	End of Augerhole Water at 0.15 metres depth
AH 17	0.0 - 1.10	**PEAT**
	1.10 - 2.10	Grey **SANDY SILT**, some Clayey Silt and Silty Clay Layers
	2.10 - 2.60	Grey **SILTY** Fine **SAND**
	2.60	End of Augerhole Water at 0.1 metre depth
AH 18	0.0 - 1.50	**PEAT**
	1.50 - 2.50	Grey **SILTY** Fine **SAND**, trace to some Gravel
	2.50	End of Augerhole Water at 0.30 metres depth

APPENDIX C

Results of Hydrogeological Assessment

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-1A

WELL NO. **BH13-1A**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	12/11/2013	
CASING STICK-UP	0.88	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	4.080	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	4.25	METRES (btoc)
BOTTOM OF OPEN INTERVAL	5.17	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	1.09	METRES
WATER TABLE TO BOTTOM OF SCREEN	1.09	METRES
EQUIVALENT RADIUS	0.026	METRES
OPEN INTERVAL LENGTH	0.92	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.27	METRES
MAX. HEAD IN SCREEN?	Yes	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	NA	METRES
RADIUS OF SLUG	NA	METRES
VOLUME OF SLUG ($\pi r^2 l$)	#VALUE!	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	#VALUE!	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **16/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			4.354	0	0.27	1.000
			4.153	1	0.07	0.267
			4.100	2	0.02	0.072
			4.086	3	0.01	0.023
			4.085	4	0.01	0.020
			4.085	5	0.00	0.018
			4.085	6	0.01	0.019
			4.084	7	0.00	0.016
			4.084	8	0.00	0.016
			4.084	9	0.00	0.016
			4.084	10	0.00	0.014
			4.084	11	0.00	0.015
			4.084	12	0.00	0.014
			4.083	13	0.00	0.012
			4.083	14	0.00	0.012
			4.083	15	0.00	0.012
			4.077	16	0.00	-0.012
			4.088	17	0.01	0.028
			4.083	18	0.00	0.010
			4.083	19	0.00	0.009
			4.083	20	0.00	0.009
			4.082	21	0.00	0.007
			4.082	22	0.00	0.007
			4.082	23	0.00	0.007
			4.082	24	0.00	0.008
			4.082	25	0.00	0.006
			4.082	26	0.00	0.007
			4.081	27	0.00	0.004
			4.081	28	0.00	0.005
			4.082	29	0.00	0.005
			4.082	30	0.00	0.005
			4.081	31	0.00	0.005
			4.08	32	0.00	0.004
			4.08	33	0.00	0.003
			4.08	34	0.00	0.004
			4.08	35	0.00	0.003

* Initial water level inferred from approximate volume purged during 10 seconds of waterra pur

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-1A

INTERVAL (metres below ground surface)

Top of Interval =	3.37
Bottom of Interval =	4.29

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

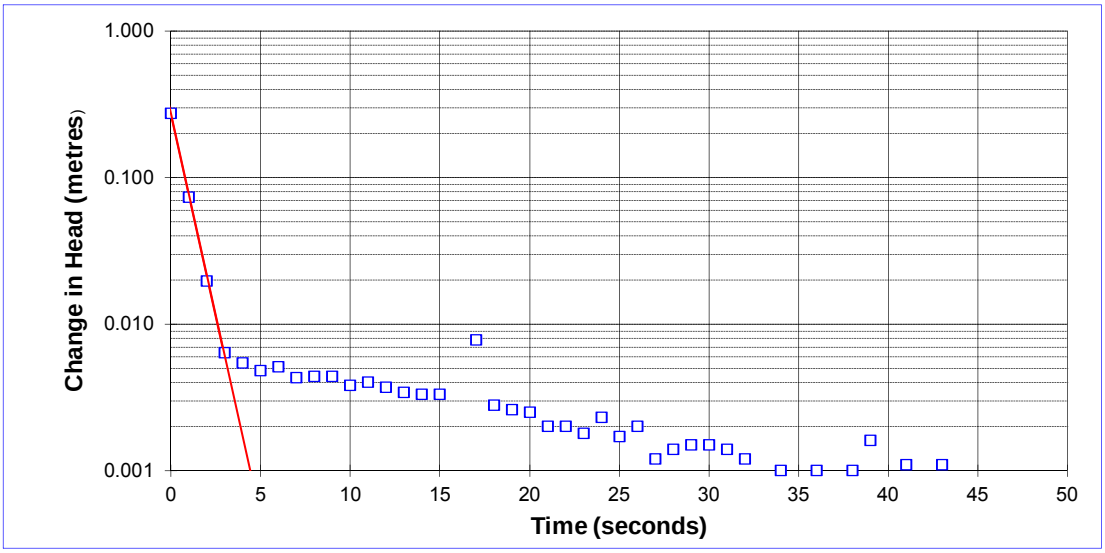
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.03
L_e =	0.92
$ln(R_e/r_w)$	5.85
y_0 =	0.27
y_t =	0.01
t =	3.0

RESULTS

K=	1E-03	m/sec
K=	1E-01	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-3A

WELL NO. BH13-3A

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	12/11/2013	
CASING STICK-UP	1.01	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	4.490	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	7.56	METRES (btoc)
BOTTOM OF OPEN INTERVAL	9.09	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	3.91	METRES
WATER TABLE TO BOTTOM OF SCREEN	1.78	METRES
EQUIVALENT RADIUS	0.026	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.49	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			5.983	0	1.49	1.000
			4.999	1	0.51	0.341
			4.869	2	0.38	0.254
			4.771	3	0.28	0.188
			4.701	4	0.21	0.142
			4.645	5	0.16	0.104
			4.608	6	0.12	0.079
			4.573	7	0.08	0.056
			4.556	8	0.07	0.044
			4.545	9	0.06	0.037
			4.537	10	0.05	0.032
			4.532	11	0.04	0.028
			4.528	12	0.04	0.025
			4.524	13	0.03	0.023
			4.521	14	0.03	0.021
			4.520	15	0.03	0.020
			4.518	16	0.03	0.019
			4.516	17	0.03	0.017
			4.515	18	0.03	0.017
			4.514	19	0.02	0.016
			4.509	20	0.02	0.013
			4.513	21	0.02	0.016
			4.512	22	0.02	0.015
			4.512	23	0.02	0.015
			4.510	24	0.02	0.013
			4.510	25	0.02	0.014
			4.509	26	0.02	0.013
			4.509	27	0.02	0.013
			4.509	28	0.02	0.013
			4.507	29	0.02	0.012
			4.508	30	0.02	0.012
			4.507	31	0.02	0.011
			4.507	32	0.02	0.011
			4.507	33	0.02	0.011
			4.506	34	0.02	0.011
			4.506	35	0.02	0.011

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-3A

INTERVAL (metres below ground surface)

Top of Interval =	6.55
Bottom of Interval =	8.08

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

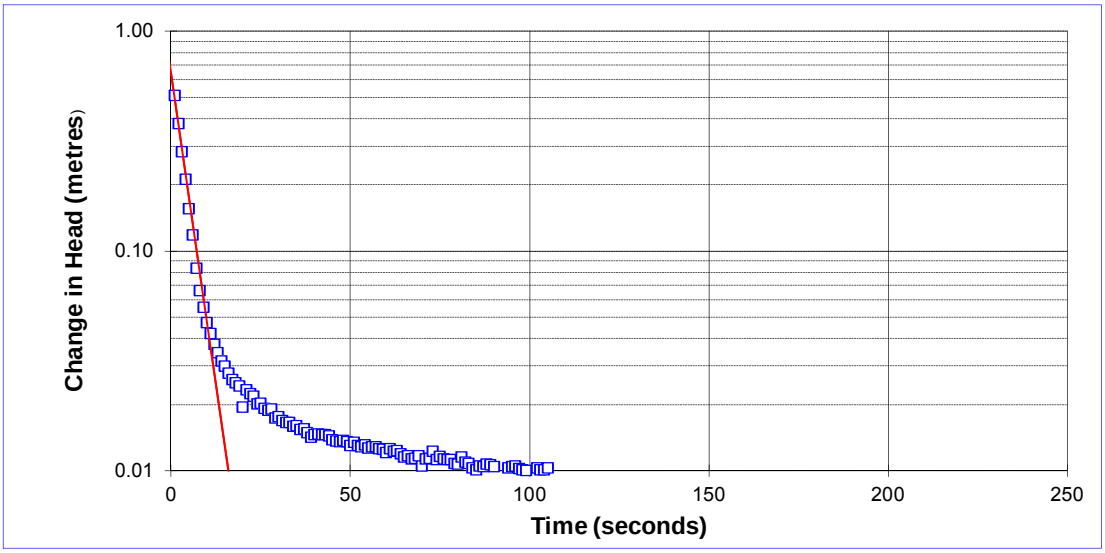
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.53
$ln(R_e/r_w)$	2.54
y_0 =	0.65
y_t =	0.01
t =	16.0

RESULTS

K=	8E-05	m/sec
K=	8E-03	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

FALLING HEAD TEST BH13-3B

Regional Group/Remer + Idone Lands
13-1121-0083

WELL NO.	BH13-3B	
DATE OF TEST	12/11/2013	
CASING STICK-UP	0.97	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	4.460	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	8	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.102	METRES
TOP OF OPEN INTERVAL	5.08	METRES (btoc)
BOTTOM OF OPEN INTERVAL	6.61	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	2.81	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.15	METRES
EQUIVALENT RADIUS	0.058	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.93	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			3.531	0	0.93	1.000
			3.550	1	0.91	0.980
			3.522	2	0.94	1.010
			3.805	3	0.66	0.705
			3.702	4	0.76	0.816
			3.724	5	0.74	0.792
			3.722	6	0.74	0.795
			3.722	7	0.74	0.795
			3.723	8	0.74	0.794
			3.723	9	0.74	0.794
			3.724	10	0.74	0.793
			3.724	11	0.74	0.793
			3.725	12	0.74	0.792
			3.706	13	0.75	0.812
			3.732	14	0.73	0.784
			3.725	15	0.74	0.792
			3.726	16	0.73	0.790
			3.725	17	0.73	0.791
			3.727	18	0.73	0.789
			3.728	19	0.73	0.788
			3.728	20	0.73	0.788
			3.729	21	0.73	0.786
			3.729	22	0.73	0.787
			3.729	23	0.73	0.787
			3.730	24	0.73	0.786
			3.731	25	0.73	0.785
			3.728	26	0.73	0.788
			3.731	27	0.73	0.785
			3.731	28	0.73	0.785
			3.731	29	0.73	0.784
			3.730	30	0.73	0.786
			3.732	31	0.73	0.783
			3.732	32	0.73	0.784
			3.733	33	0.73	0.783
			3.733	34	0.73	0.782
			3.733	35	0.73	0.782

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST BH13-3B

INTERVAL (metres below ground surface)

Top of Interval =	**4.11**
Bottom of Interval =	**5.64**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

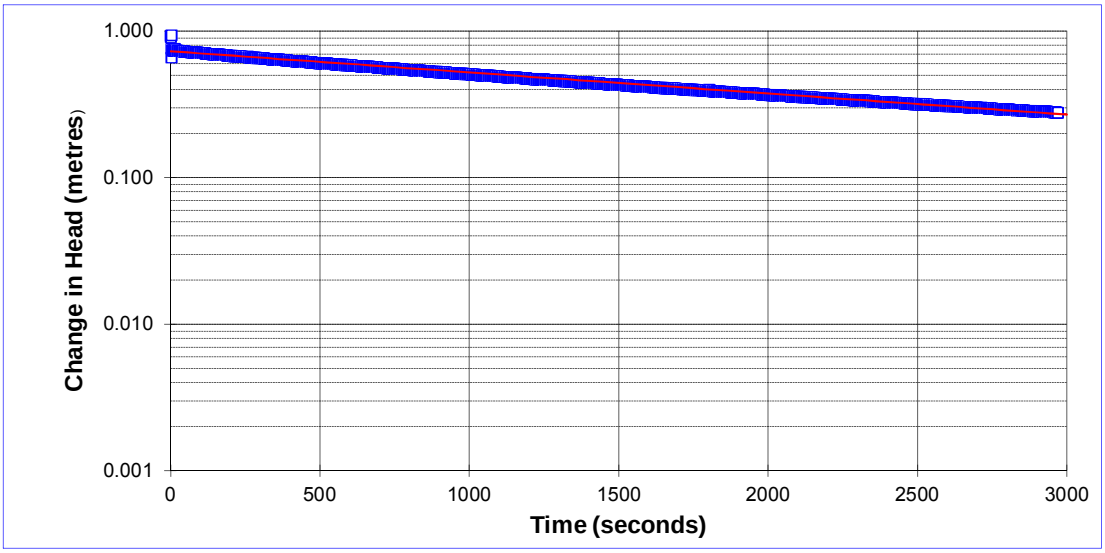
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.10**
L_e =	**1.52**
$\ln(R_e/r_w)$	**1.90**
y_0 =	**0.73**
y_t =	**0.27**
t =	**3000.0**

RESULTS

K=	**7E-08**	**m/sec**
K=	**7E-06**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-9

WELL NO. BH13-9

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	12/11/2013	
CASING STICK-UP	0.90	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.800	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	3.782	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.048	METRES
TOP OF OPEN INTERVAL	3.95	METRES (btoc)
BOTTOM OF OPEN INTERVAL	5.47	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	4.67	METRES
WATER TABLE TO BOTTOM OF SCREEN	4.67	METRES
EQUIVALENT RADIUS	0.031	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.63	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.433	0	1.63	1.000
			2.008	1	1.21	0.740
			1.936	2	1.14	0.696
			1.921	3	1.12	0.687
			1.788	4	0.99	0.605
			1.729	5	0.93	0.569
			1.729	6	0.93	0.569
			1.720	7	0.92	0.563
			1.713	8	0.91	0.559
			1.706	9	0.91	0.555
			1.701	10	0.90	0.552
			1.695	11	0.89	0.548
			1.689	12	0.89	0.545
			1.683	13	0.88	0.541
			1.678	14	0.88	0.538
			1.671	15	0.87	0.533
			1.641	16	0.84	0.515
			1.660	17	0.86	0.527
			1.654	18	0.85	0.523
			1.649	19	0.85	0.520
			1.644	20	0.84	0.517
			1.637	21	0.84	0.512
			1.633	22	0.83	0.510
			1.628	23	0.83	0.507
			1.625	24	0.82	0.505
			1.617	25	0.82	0.501
			1.612	26	0.81	0.497
			1.607	27	0.81	0.494
			1.603	28	0.80	0.492
			1.600	29	0.80	0.490
			1.595	30	0.80	0.487
			1.591	31	0.79	0.484
			1.585	32	0.79	0.481
			1.580	33	0.78	0.478
			1.572	34	0.77	0.473
			1.568	35	0.77	0.470

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-9

INTERVAL (metres below ground surface)

Top of Interval =	**3.05**
Bottom of Interval =	**4.57**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

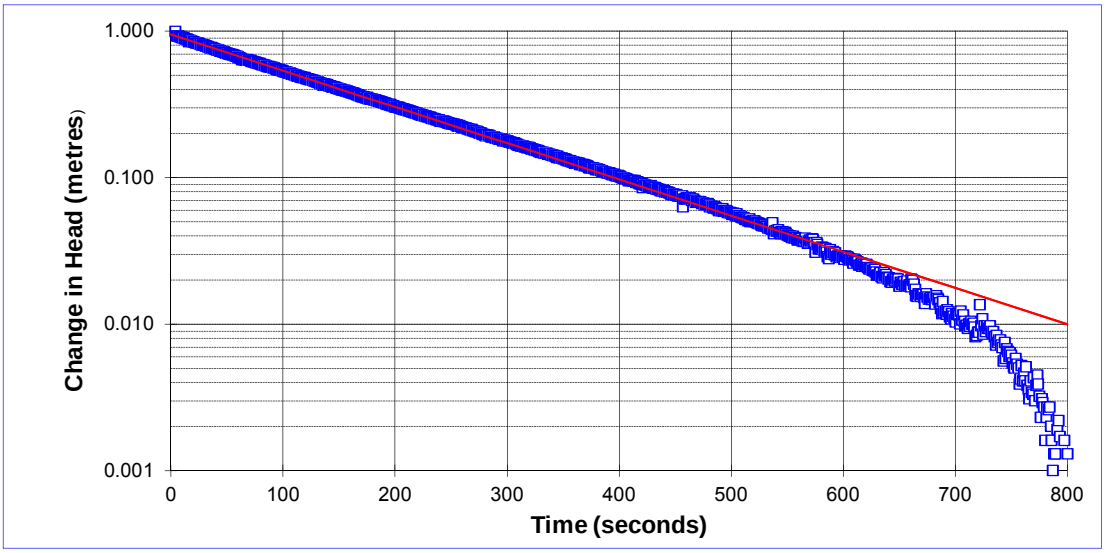
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.05**
L_e =	**1.52**
$\ln(R_e/r_w)$	**6.93**
y_0 =	**0.95**
y_t =	**0.01**
t =	**800.0**

RESULTS

K=	**5E-06**	**m/sec**
K=	**5E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

FALLING HEAD TEST BH13-13A

WELL NO. BH13-13A

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	12/11/2013	
CASING STICK-UP	0.87	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	3.780	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	5.57	METRES (btoc)
BOTTOM OF OPEN INTERVAL	7.09	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	2.31	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.31	METRES
EQUIVALENT RADIUS	0.026	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	2.38	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.404	0	2.38	1.000
			3.070	1	0.71	0.299
			3.280	2	0.50	0.211
			3.468	3	0.31	0.131
			3.724	4	0.06	0.024
			3.782	5	0.00	-0.001
			3.771	6	0.01	0.004
			3.768	7	0.01	0.005
			3.769	8	0.01	0.005
			3.772	9	0.01	0.003
			3.774	10	0.01	0.003
			3.775	11	0.01	0.002
			3.777	12	0.00	0.001
			3.778	13	0.00	0.001
			3.779	14	0.00	0.000
			3.779	15	0.00	0.000
			3.780	16	0.00	0.000
			3.780	17	0.00	0.000
			3.780	18	0.00	0.000
			3.780	19	0.00	0.000
			3.781	20	0.00	0.000
			3.780	21	0.00	0.000
			3.781	22	0.00	0.000
			3.781	23	0.00	-0.001
			3.781	24	0.00	0.000
			3.781	25	0.00	0.000
			3.781	26	0.00	0.000
			3.781	27	0.00	-0.001
			3.781	28	0.00	0.000
			3.781	29	0.00	0.000
			3.782	30	0.00	-0.001
			3.781	31	0.00	-0.001
			3.781	32	0.00	0.000
			3.782	33	0.00	-0.001
			3.781	34	0.00	0.000
			3.781	35	0.00	0.000

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST BH13-13A

INTERVAL (metres below ground surface)

Top of Interval =	4.70
Bottom of Interval =	6.22

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

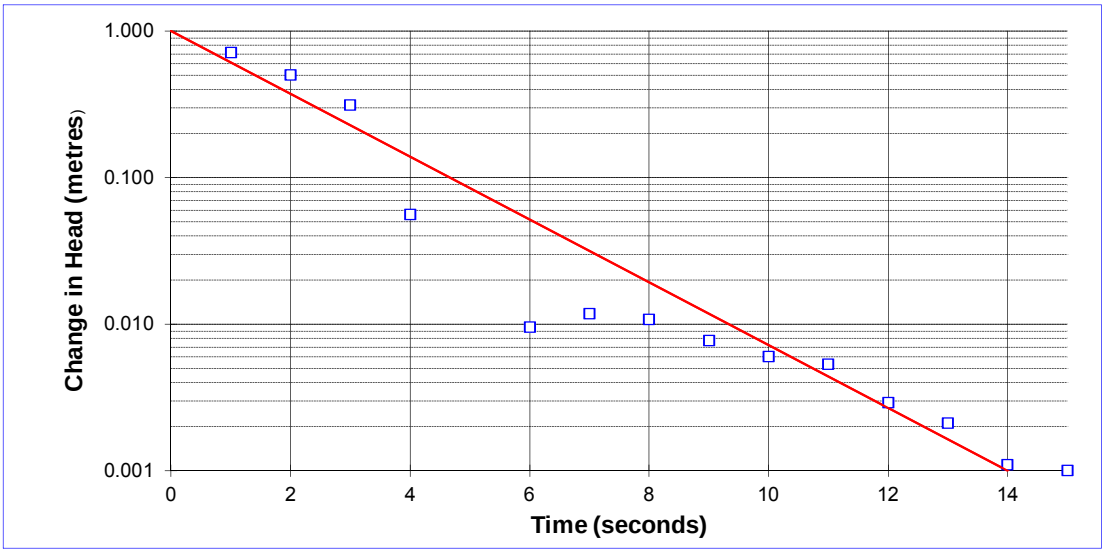
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.52
$ln(R_e/r_w)$	6.53
y_0 =	1.00
y_t =	0.00
t =	14.0

RESULTS

K=	4E-04	m/sec
K=	4E-02	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-13B

WELL NO. **BH13-13B**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	12/11/2013	
CASING STICK-UP	0.91	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	3.800	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	8	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.102	METRES
TOP OF OPEN INTERVAL	2.74	METRES (btoc)
BOTTOM OF OPEN INTERVAL	4.26	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	1.02	METRES
WATER TABLE TO BOTTOM OF SCREEN	0.46	METRES
EQUIVALENT RADIUS	0.058	METRES
OPEN INTERVAL LENGTH	0.46	METRES
STATIC IN SCREEN?	Yes	
MAX. HEAD CHANGE	0.11	METRES
MAX. HEAD IN SCREEN?	Yes	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	0	METRES
RADIUS OF SLUG	0	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	0.00	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **16/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			3.913	0	0.11	1.000
			3.903	1	0.10	0.910
			3.889	2	0.09	0.781
			3.886	3	0.09	0.756
			3.884	4	0.08	0.742
			3.882	5	0.08	0.719
			3.881	6	0.08	0.713
			3.881	7	0.08	0.710
			3.879	8	0.08	0.698
			3.879	9	0.08	0.693
			3.879	10	0.08	0.697
			3.878	11	0.08	0.687
			3.878	12	0.08	0.690
			3.859	13	0.06	0.517
			3.881	14	0.08	0.711
			3.878	15	0.08	0.688
			3.878	16	0.08	0.686
			3.878	17	0.08	0.690
			3.878	18	0.08	0.685
			3.877	19	0.08	0.679
			3.876	20	0.08	0.673
			3.878	21	0.08	0.688
			3.876	22	0.08	0.670
			3.876	23	0.08	0.671
			3.876	24	0.08	0.672
			3.875	25	0.08	0.665
			3.875	26	0.08	0.663
			3.875	27	0.07	0.660
			3.875	28	0.07	0.660
			3.874	29	0.07	0.654
			3.874	30	0.07	0.653
			3.874	31	0.07	0.651
			3.874	32	0.07	0.652
			3.874	33	0.07	0.653
			3.873	34	0.07	0.646
			3.874	35	0.07	0.650

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-13B

INTERVAL (metres below ground surface)

Top of Interval =	**1.83**
Bottom of Interval =	**3.35**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

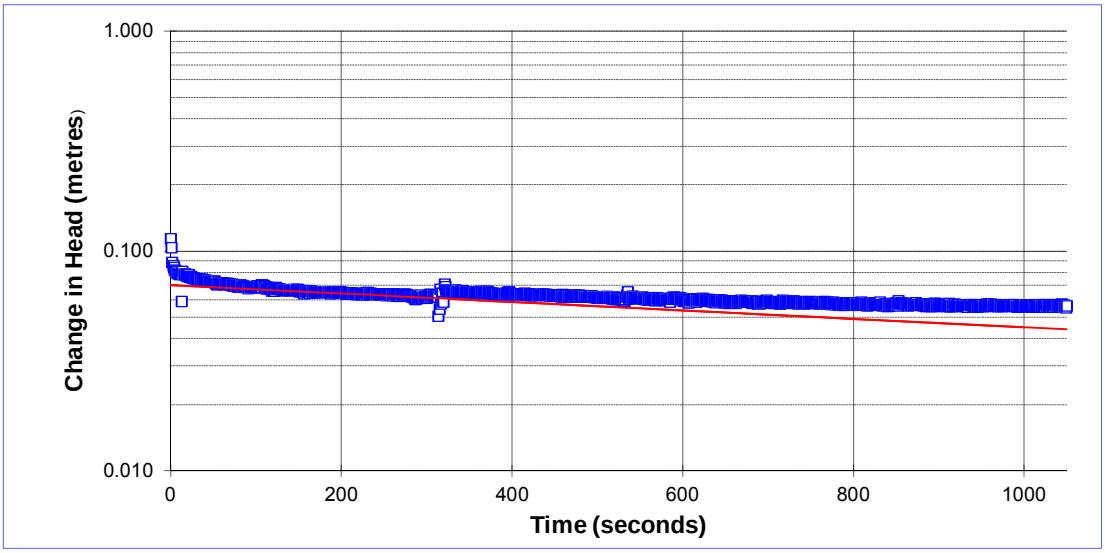
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.06**
L_e =	**1.52**
$\ln(R_e/r_w)$	**1.63**
y_0 =	**0.07**
y_t =	**0.05**
t =	**1000.0**

RESULTS

K=	**9E-08**	**m/sec**
K=	**9E-06**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 12/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-17A

WELL NO. **BH13-17A**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.83	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	2.610	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	5.88	METRES (btoc)
BOTTOM OF OPEN INTERVAL	7.10	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	1.83	METRES
WATER TABLE TO BOTTOM OF SCREEN	1.83	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.22	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.89	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **09/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			3.500	0	0.89	1.000
			2.970	25	0.36	0.404
			2.900	30	0.29	0.326
			2.820	40	0.21	0.236
			2.770	50	0.16	0.180
			2.740	60	0.13	0.146
			2.720	70	0.11	0.124
			2.700	80	0.09	0.101
			2.690	90	0.08	0.090
			2.680	100	0.07	0.079
			2.680	110	0.07	0.079
			2.675	120	0.06	0.073
			2.660	150	0.05	0.056
			2.655	180	0.04	0.051
			2.650	210	0.04	0.045
			2.645	240	0.04	0.039
			2.640	300	0.03	0.034
			2.640	360	0.03	0.034
			2.635	420	0.02	0.028
			2.635	480	0.02	0.028
			2.635	540	0.02	0.028
			2.630	600	0.02	0.022
			2.630	660	0.02	0.022
			2.630	720	0.02	0.022
			2.630	840	0.02	0.022

*** - Water level inferred from slug volume and well response data trend**

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-17A

INTERVAL (metres below ground surface)

Top of Interval =	**5.05**
Bottom of Interval =	**6.27**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

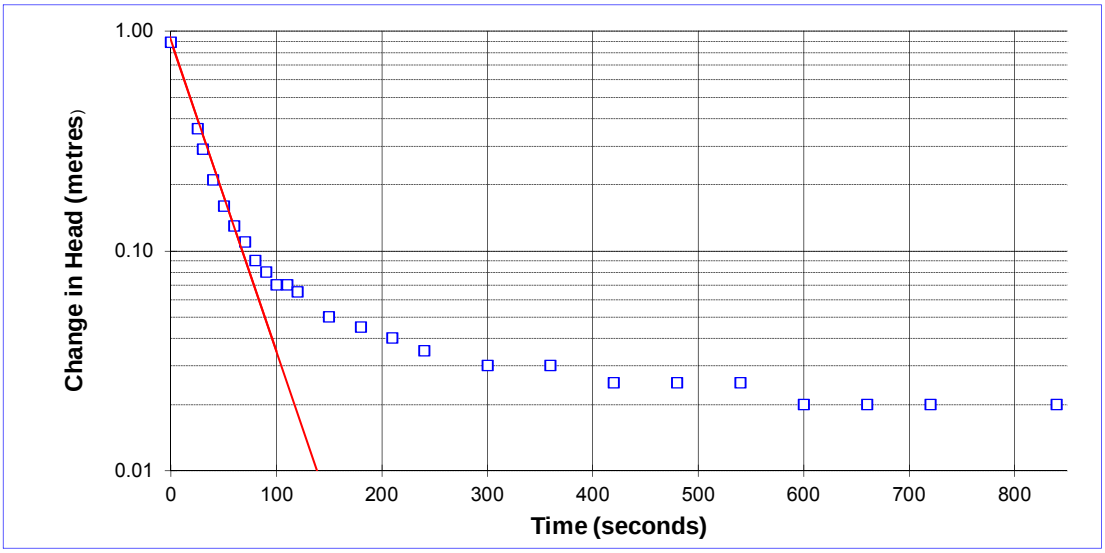
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.04**
L_e =	**1.22**
$\ln(R_e/r_w)$	**6.00**
y_0 =	**0.90**
y_t =	**0.04**
t =	**100.0**

RESULTS

K=	**3E-05**	**m/sec**
K=	**3E-03**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

RED = Calculated Value
BLUE = User defined value

FALLING HEAD TEST BH13-17B

Regional Group/Remer + Idone Lands
13-1121-0083

WELL NO. BH13-17B

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.87	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	2.170	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	8	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.102	METRES
TOP OF OPEN INTERVAL	2.70	METRES (btoc)
BOTTOM OF OPEN INTERVAL	4.22	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	3.14	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.05	METRES
EQUIVALENT RADIUS	0.06	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.09	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.077	0	1.09	1.000
			1.198	1	0.97	0.889
			1.360	2	0.81	0.741
			1.358	3	0.81	0.743
			1.360	4	0.81	0.741
			1.371	5	0.80	0.732
			1.383	6	0.79	0.720
			1.380	7	0.79	0.722
			1.409	8	0.76	0.696
			1.412	9	0.76	0.694
			1.425	10	0.75	0.682
			1.433	11	0.74	0.674
			1.442	12	0.73	0.666
			1.452	13	0.72	0.657
			1.461	14	0.71	0.649
			1.469	15	0.70	0.641
			1.476	16	0.69	0.635
			1.486	17	0.68	0.626
			1.490	18	0.68	0.622
			1.503	19	0.67	0.611
			1.512	20	0.66	0.603
			1.519	21	0.65	0.596
			1.527	22	0.64	0.589
			1.534	23	0.64	0.582
			1.543	24	0.63	0.574
			1.549	25	0.62	0.568
			1.555	26	0.61	0.563
			1.564	27	0.61	0.555
			1.569	28	0.60	0.550
			1.578	29	0.59	0.542
			1.584	30	0.59	0.536
			1.590	31	0.58	0.531
			1.597	32	0.57	0.524
			1.602	33	0.57	0.520
			1.610	34	0.56	0.512
			1.616	35	0.55	0.507

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST BH13-17B

INTERVAL (metres below ground surface)

Top of Interval =	1.83
Bottom of Interval =	3.35

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

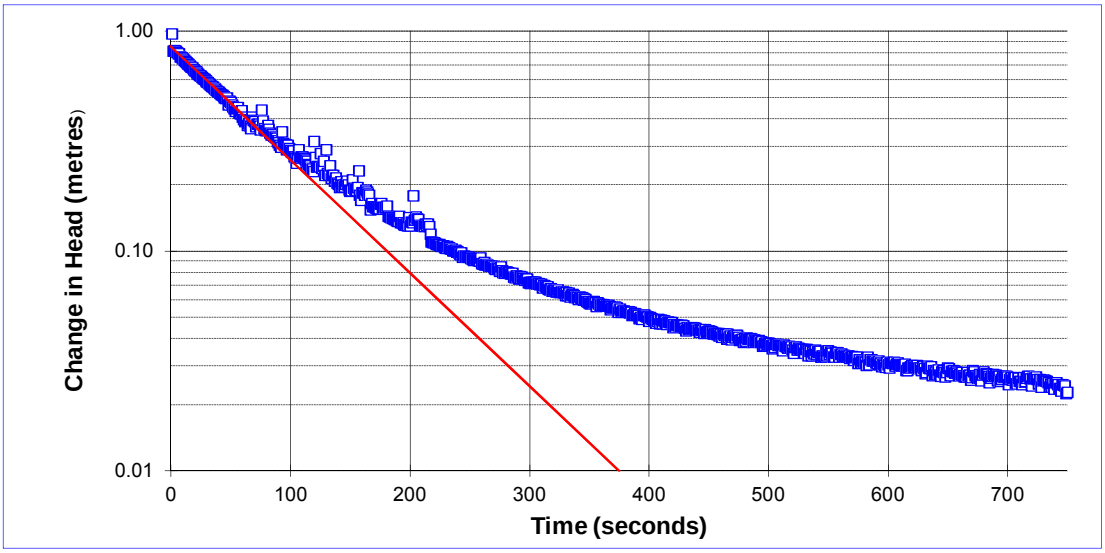
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.10
L_e =	1.53
$\ln(R_e/r_w)$	1.85
y_0 =	0.85
y_t =	0.01
t =	375.0

RESULTS

K=	3E-06	m/sec
K=	3E-04	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-18A Test#2

WELL NO. H13-18A Test#

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	28/10/2013	
CASING STICK-UP	0.87	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.810	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	5.14	METRES (btoc)
BOTTOM OF OPEN INTERVAL	6.66	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	2.44	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.44	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.28	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.2827137	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.1	0	1.28	1.000
			0.980	16	0.17	0.133
			0.910	20	0.10	0.078
			0.860	30	0.05	0.039
			0.845	50	0.03	0.027
			0.845	70	0.03	0.027
			0.844	80	0.03	0.027
			0.842	90	0.03	0.025
			0.841	120	0.03	0.024
			0.839	150	0.03	0.023
			0.839	180	0.03	0.023
			0.837	210	0.03	0.021
			0.835	240	0.02	0.020
			0.834	270	0.02	0.019
			0.833	300	0.02	0.018
			0.830	360	0.02	0.016
			0.830	480	0.02	0.016
			0.830	600	0.02	0.016

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-18A Test#2

INTERVAL (metres below ground surface)

Top of Interval =	**4.27**
Bottom of Interval =	**5.79**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

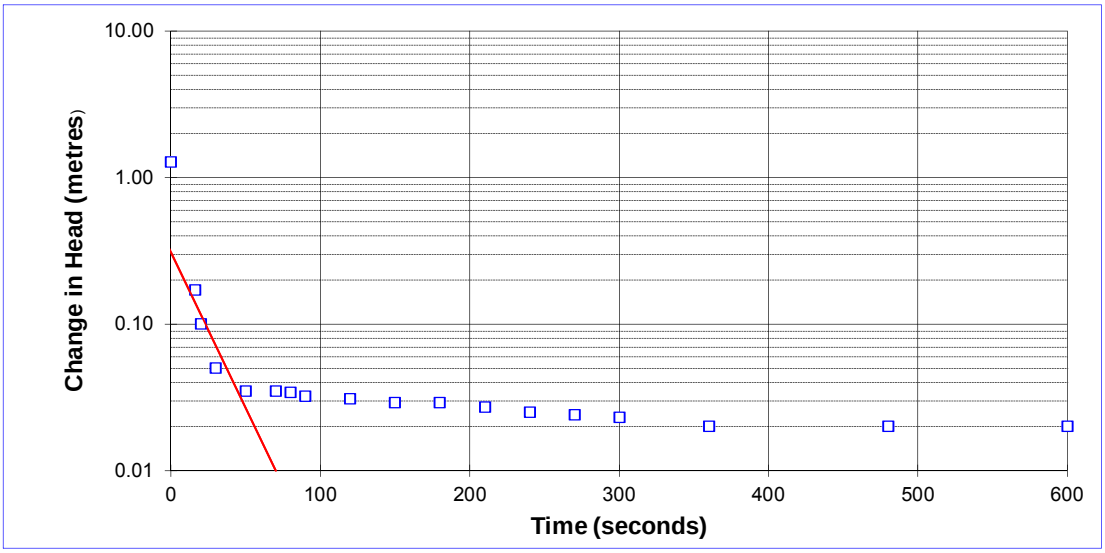
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.04**
L_e =	**1.52**
$\ln(R_e/r_w)$	**6.00**
y_0 =	**0.31**
y_t =	**0.01**
t =	**70.0**

RESULTS

K=	**3E-05**	**m/sec**
K=	**3E-03**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 28/10/13

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-18B

WELL NO. **BH13-18B**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	**28/10/2013**	
CASING STICK-UP	**0.89**	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	**0.980**	METRES (btoc)
CASING DIAMETER	**1.5**	inches
BOREHOLE DIAMETER	**8**	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.102	METRES
TOP OF OPEN INTERVAL	**1.66**	METRES (btoc)
BOTTOM OF OPEN INTERVAL	**3.19**	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	**3.27**	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.21	METRES
EQUIVALENT RADIUS	0.06	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.19	METRES
MAX. HEAD IN SCREEN?	Yes	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	**1.52**	METRES
RADIUS OF SLUG	**0.0175**	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.2827137	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **02/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.2	0	1.19	1.000
			1.780	10	0.80	0.672
			1.600	20	0.62	0.521
			1.540	30	0.56	0.471
			1.530	40	0.55	0.462
			1.525	50	0.55	0.458
			1.520	60	0.54	0.454
			1.515	70	0.54	0.450
			1.515	80	0.54	0.450
			1.510	90	0.53	0.445
			1.505	100	0.53	0.441
			1.500	110	0.52	0.437
			1.495	120	0.52	0.433
			1.450	150	0.47	0.395
			1.420	180	0.44	0.370
			1.385	210	0.41	0.340
			1.360	240	0.38	0.319
			1.340	270	0.36	0.303
			1.310	300	0.33	0.277
			1.260	360	0.28	0.235
			1.235	420	0.26	0.214
			1.205	480	0.23	0.189
			1.180	540	0.20	0.168
			1.160	600	0.18	0.151
			1.140	660	0.16	0.134
			1.120	720	0.14	0.118
			1.110	780	0.13	0.109
			1.100	840	0.12	0.101
			1.080	900	0.10	0.084
			1.070	960	0.09	0.076
			1.055	1140	0.08	0.063
			1.040	1320	0.06	0.050

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-18B

INTERVAL (metres below ground surface)

Top of Interval =	**0.77**
Bottom of Interval =	**2.30**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

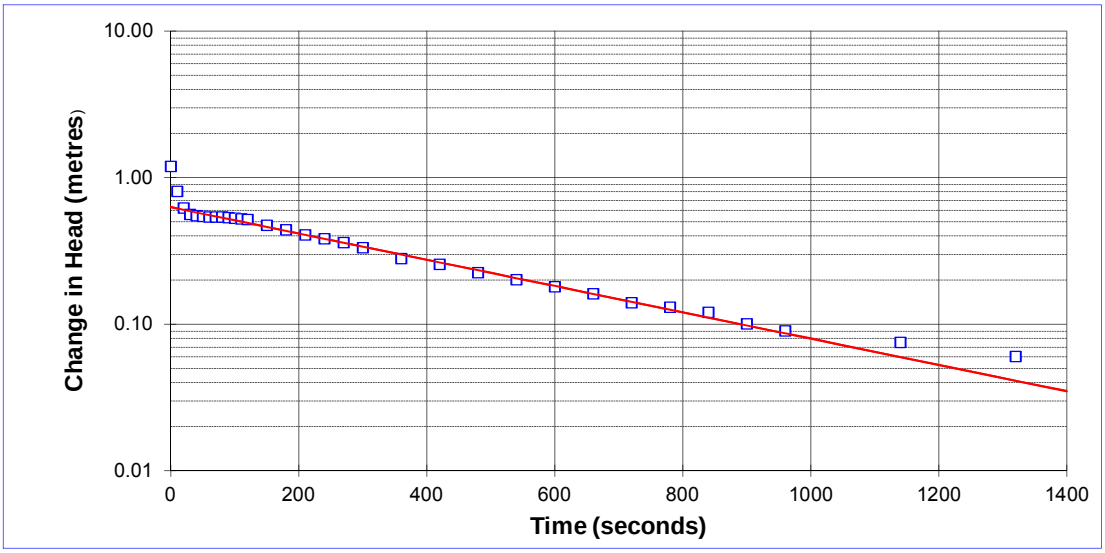
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.10
L_e =	1.53
$\ln(R_e/r_w)$	1.88
y_0 =	0.63
y_t =	0.04
t =	1400.0

RESULTS

K=	**5E-07**	**m/sec**
K=	**5E-05**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 28/10/13

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-20

WELL NO. BH13-20

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.84	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.390	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	4.5	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.057	METRES
TOP OF OPEN INTERVAL	4.80	METRES (btoc)
BOTTOM OF OPEN INTERVAL	6.33	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	5.22	METRES
WATER TABLE TO BOTTOM OF SCREEN	4.94	METRES
EQUIVALENT RADIUS	0.04	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.57	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.525	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005797	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	0.51	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.964	0	0.57	1.000
			1.923	1	0.53	0.930
			1.891	2	0.50	0.874
			1.864	3	0.47	0.826
			1.840	4	0.45	0.784
			1.818	5	0.43	0.747
			1.799	6	0.41	0.713
			1.782	7	0.39	0.683
			1.767	8	0.38	0.657
			1.751	9	0.36	0.628
			1.736	10	0.35	0.603
			1.723	11	0.33	0.580
			1.697	12	0.31	0.535
			1.697	13	0.31	0.535
			1.683	14	0.29	0.511
			1.674	15	0.28	0.495
			1.665	16	0.27	0.479
			1.655	17	0.26	0.461
			1.644	18	0.25	0.443
			1.636	19	0.25	0.428
			1.628	20	0.24	0.415
			1.620	21	0.23	0.400
			1.609	22	0.22	0.381
			1.603	23	0.21	0.372
			1.596	24	0.21	0.359
			1.588	25	0.20	0.346
			1.581	26	0.19	0.334
			1.575	27	0.18	0.322
			1.569	28	0.18	0.311
			1.562	29	0.17	0.300
			1.557	30	0.17	0.291
			1.551	31	0.16	0.281
			1.546	32	0.16	0.271
			1.541	33	0.15	0.263
			1.536	34	0.15	0.254
			1.532	35	0.14	0.247

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-20

INTERVAL (metres below ground surface)

Top of Interval =	3.96
Bottom of Interval =	5.49

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

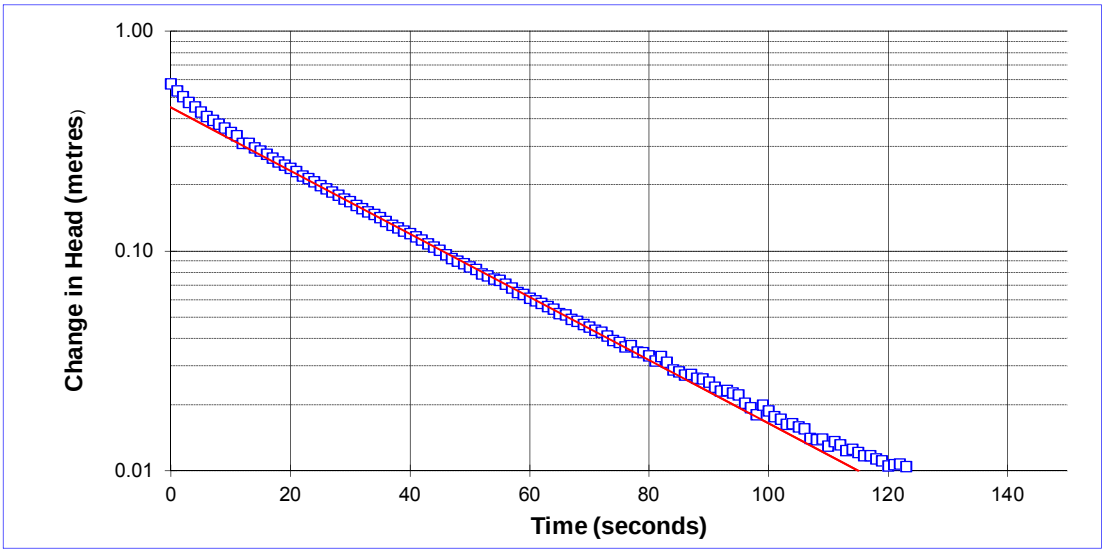
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.06
L_e =	1.53
$\ln(R_e/r_w)$	2.84
y_0 =	0.45
y_t =	0.01
t =	115.0

RESULTS

K=	1E-05	m/sec
K=	1E-03	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-24A Test#1

WELL NO. BH13-24A Test#1

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	28/10/2013	
CASING STICK-UP	0.91	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.050	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	2.98	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.038	METRES
TOP OF OPEN INTERVAL	7.77	METRES (btoc)
BOTTOM OF OPEN INTERVAL	8.99	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	8.00	METRES
WATER TABLE TO BOTTOM OF SCREEN	7.94	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.22	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.75	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	N/A	METRES
RADIUS OF SLUG	N/A	METRES
VOLUME OF SLUG ($\pi r^2 l$)	#VALUE!	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	#VALUE!	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

Approx volume purged (Litres)= 2
Initial Displacement (m) = 1.75

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.8	0	1.75	1.000
			2.580	20	1.53	0.874
			2.010	40	0.96	0.549
			1.380	60	0.33	0.189
			1.310	70	0.26	0.149
			1.280	90	0.23	0.131
			1.270	110	0.22	0.126
			1.260	120	0.21	0.120
			1.250	150	0.20	0.114
			1.245	180	0.20	0.111
			1.240	210	0.19	0.109
			1.235	240	0.19	0.106
			1.230	270	0.18	0.103
			1.227	300	0.18	0.101
			1.220	360	0.17	0.097
			1.205	480	0.16	0.089
			1.200	600	0.15	0.086
			1.185	780	0.14	0.077
			1.180	900	0.13	0.074
			1.170	1020	0.12	0.069
			1.165	1080	0.12	0.066
			1.160	1200	0.11	0.063
			1.150	1560	0.10	0.057
			1.130	1800	0.08	0.046

* Initial water level inferred from approximate volume purged during 10 seconds of waterra pur

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-24A Test#1

INTERVAL (metres below ground surface)

Top of Interval =	6.86
Bottom of Interval =	8.08

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

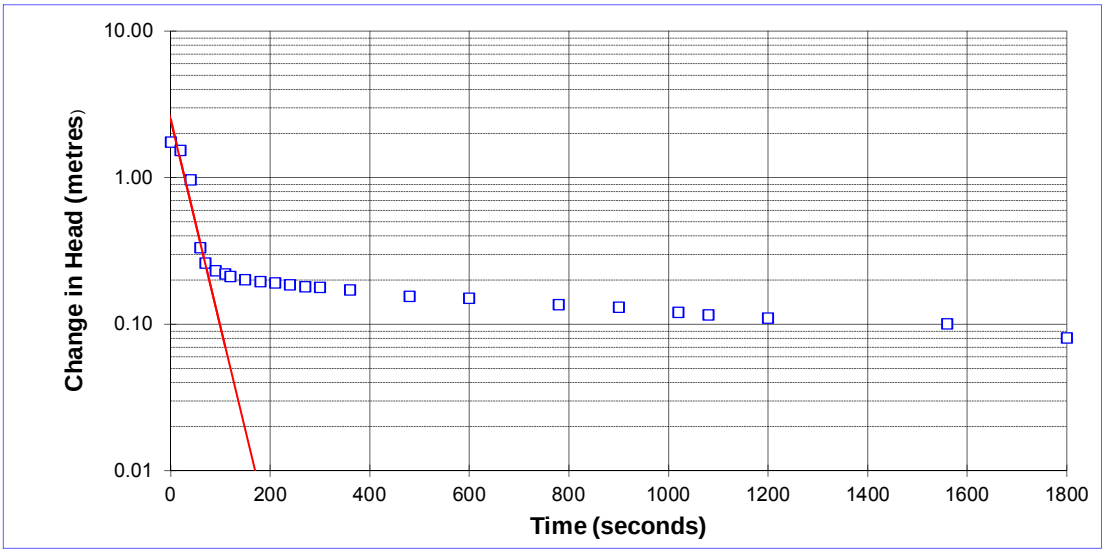
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.22
$ln(R_e/r_w)$	2.74
y_0 =	2.50
y_t =	0.07
t =	110.0

RESULTS

K=	1E-05	m/sec
K=	1E-03	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 28/10/13

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-24B Test#2

Regional Group/Remer + Idone Lands
13-1121-0083

WELL NO.	BH13-24B Test#2	
DATE OF TEST	28/10/2013	
CASING STICK-UP	0.93	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.980	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	3.98	METRES (btoc)
BOTTOM OF OPEN INTERVAL	5.50	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	5.59	METRES
WATER TABLE TO BOTTOM OF SCREEN	4.52	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	2.53	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	N/A	METRES
RADIUS OF SLUG	N/A	METRES
VOLUME OF SLUG ($\pi r^2 l$)	#VALUE!	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	#VALUE!	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

Approx volume purged (Litres)= 2
Initial Displacement (m) = 2.53

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			3.5	0	2.53	1.000
			2.890	20	1.91	0.755
			2.490	30	1.51	0.597
			2.130	50	1.15	0.455
			2.010	60	1.03	0.407
			1.870	70	0.89	0.352
			1.740	80	0.76	0.300
			1.640	90	0.66	0.261
			1.480	110	0.50	0.198
			1.430	120	0.45	0.178
			1.280	150	0.30	0.119
			1.190	180	0.21	0.083
			1.120	210	0.14	0.055
			1.080	240	0.10	0.040
			1.040	270	0.06	0.024
			1.020	300	0.04	0.016
			1.000	360	0.02	0.008
			0.985	420	0.01	0.002
			0.980	450	0.00	0.000

* Initial water level inferred from approximate volume purged during 10 seconds of waterra pump

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-24B Test#2

INTERVAL (metres below ground surface)

Top of Interval =	**3.05**
Bottom of Interval =	**4.57**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

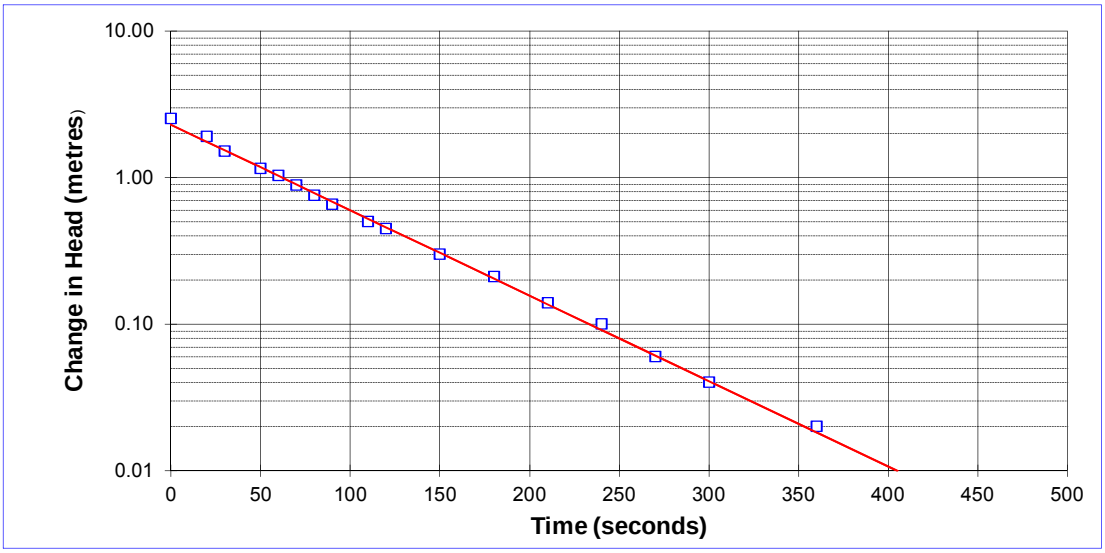
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.52
$ln(R_e/r_w)$	2.90
y_0 =	2.30
y_t =	0.01
t =	405.0

RESULTS

K=	**3E-06**	**m/sec**
K=	**3E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 28/10/13

Analysis By: CHM
Checked By: CAMC
Analysis Date: 02/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-25

Regional Group/Remer + Idone Lands
13-1121-0083

WELL NO.	BH13-25	
DATE OF TEST	07/11/2013	
CASING STICK-UP	0.99	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.790	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	3.12	METRES (btoc)
BOTTOM OF OPEN INTERVAL	4.65	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	5.69	METRES
WATER TABLE TO BOTTOM OF SCREEN	3.86	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.33	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	1.85	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.118	0	1.33	1.000
			1.635	1	0.85	0.636
			1.640	2	0.85	0.640
			1.665	3	0.87	0.659
			1.634	4	0.84	0.635
			1.631	5	0.84	0.633
			1.593	6	0.80	0.605
			1.584	7	0.79	0.598
			1.573	8	0.78	0.590
			1.565	9	0.77	0.583
			1.556	10	0.77	0.577
			1.548	11	0.76	0.571
			1.540	12	0.75	0.564
			1.532	13	0.74	0.559
			1.525	14	0.73	0.553
			1.516	15	0.73	0.547
			1.509	16	0.72	0.542
			1.505	17	0.71	0.538
			1.498	18	0.71	0.533
			1.491	19	0.70	0.528
			1.484	20	0.69	0.523
			1.477	21	0.69	0.517
			1.471	22	0.68	0.513
			1.464	23	0.67	0.508
			1.457	24	0.67	0.502
			1.452	25	0.66	0.498
			1.446	26	0.66	0.494
			1.440	27	0.65	0.489
			1.434	28	0.64	0.485
			1.429	29	0.64	0.481
			1.423	30	0.63	0.476
			1.417	31	0.63	0.472
			1.411	32	0.62	0.467
			1.405	33	0.62	0.463
			1.398	34	0.61	0.458
			1.395	35	0.61	0.456

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-25

INTERVAL (metres below ground surface)

Top of Interval =	2.13
Bottom of Interval =	3.66

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

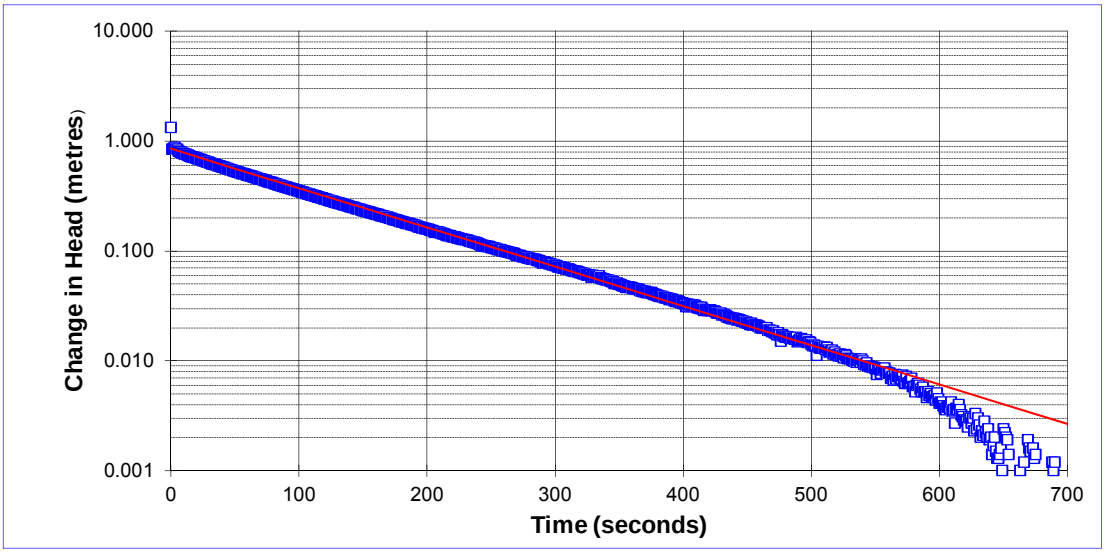
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.53
$ln(R_e/r_w)$	2.79
y_0 =	0.85
y_t =	0.01
t =	540.0

RESULTS

K=	2E-06	m/sec
K=	2E-04	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 07/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-26A

WELL NO. BH13-26A

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	07/11/2013	
CASING STICK-UP	0.95	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.940	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	4.84	METRES (btoc)
BOTTOM OF OPEN INTERVAL	6.36	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	5.42	METRES
WATER TABLE TO BOTTOM OF SCREEN	5.42	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.58	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005778	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	0.73	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.517	0	0.58	1.000
			1.518	1	0.58	1.000
			1.456	2	0.52	0.894
			1.443	3	0.50	0.871
			1.431	4	0.49	0.851
			1.422	5	0.48	0.834
			1.412	6	0.47	0.818
			1.404	7	0.46	0.804
			1.396	8	0.46	0.790
			1.388	9	0.45	0.776
			1.380	10	0.44	0.762
			1.374	11	0.43	0.751
			1.327	12	0.39	0.669
			1.355	13	0.42	0.719
			1.360	14	0.42	0.728
			1.349	15	0.41	0.709
			1.344	16	0.40	0.700
			1.337	17	0.40	0.687
			1.331	18	0.39	0.677
			1.323	19	0.38	0.663
			1.320	20	0.38	0.658
			1.315	21	0.38	0.650
			1.309	22	0.37	0.640
			1.304	23	0.36	0.631
			1.296	24	0.36	0.616
			1.290	25	0.35	0.606
			1.286	26	0.35	0.599
			1.285	27	0.35	0.598
			1.279	28	0.34	0.587
			1.275	29	0.34	0.580
			1.271	30	0.33	0.573
			1.266	31	0.33	0.565
			1.260	32	0.32	0.554
			1.257	33	0.32	0.548
			1.253	34	0.31	0.541
			1.248	35	0.31	0.534

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-26A

INTERVAL (metres below ground surface)

Top of Interval =	**3.89**
Bottom of Interval =	**5.41**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

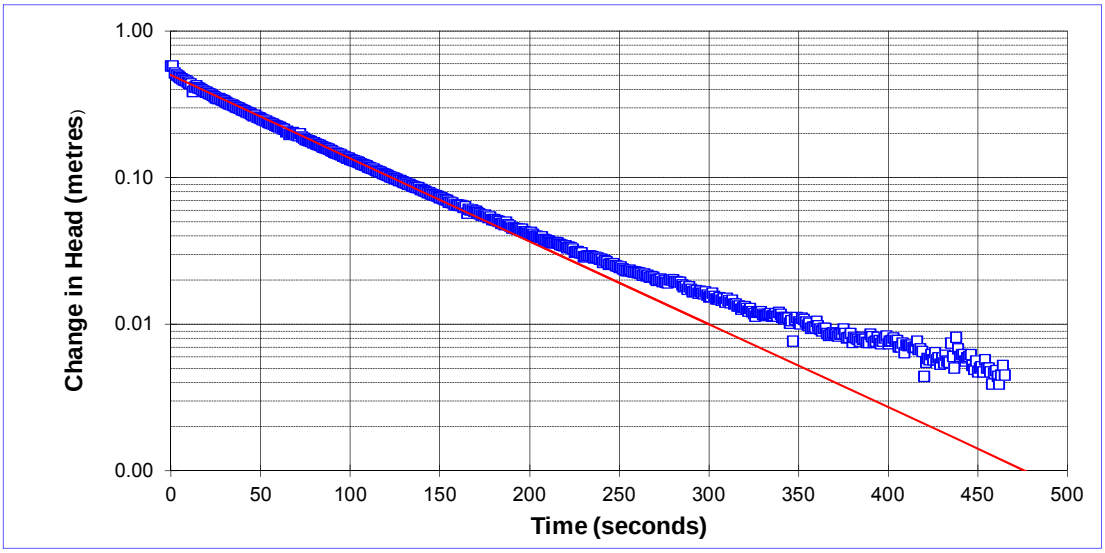
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.04**
L_e =	**1.52**
$\ln(R_e/r_w)$	**6.00**
y_0 =	**0.50**
y_t =	**0.01**
t =	**300.0**

RESULTS

K=	**7E-06**	**m/sec**
K=	**7E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 07/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-26B

WELL NO. **BH13-26B**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	07/11/2013	
CASING STICK-UP	0.90	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.900	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	2.12	METRES (btoc)
BOTTOM OF OPEN INTERVAL	3.64	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	3.00	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.74	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.98	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **16/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.876	0	0.98	1.000
			1.860	1	0.96	0.985
			1.845	2	0.94	0.968
			1.838	3	0.94	0.962
			1.832	4	0.93	0.955
			1.826	5	0.93	0.950
			1.821	6	0.92	0.944
			1.815	7	0.91	0.938
			1.810	8	0.91	0.932
			1.805	9	0.90	0.927
			1.800	10	0.90	0.923
			1.795	11	0.90	0.918
			1.791	12	0.89	0.913
			1.786	13	0.89	0.909
			1.782	14	0.88	0.904
			1.776	15	0.88	0.898
			1.774	16	0.87	0.896
			1.771	17	0.87	0.893
			1.763	18	0.86	0.884
			1.764	19	0.86	0.886
			1.759	20	0.86	0.880
			1.756	21	0.86	0.878
			1.752	22	0.85	0.873
			1.747	23	0.85	0.869
			1.743	24	0.84	0.865
			1.740	25	0.84	0.861
			1.737	26	0.84	0.858
			1.725	27	0.82	0.845
			1.720	28	0.82	0.840
			1.723	29	0.82	0.844
			1.722	30	0.82	0.843
			1.718	31	0.82	0.839
			1.711	32	0.81	0.831
			1.709	33	0.81	0.830
			1.706	34	0.81	0.826
			1.704	35	0.80	0.824

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-26B

INTERVAL (metres below ground surface)

Top of Interval =	**1.22**
Bottom of Interval =	**2.74**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

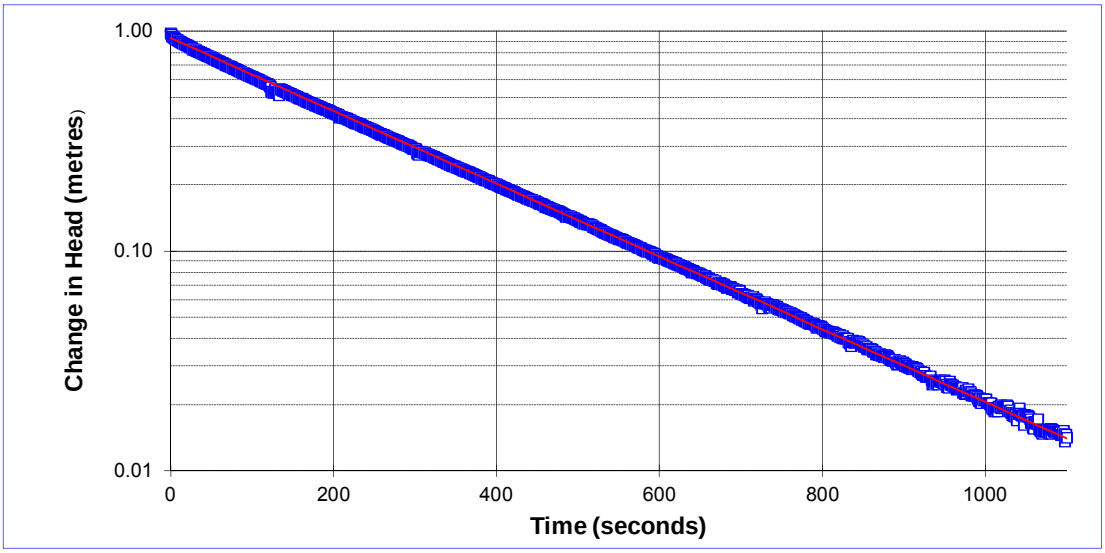
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.52
$ln(R_e/r_w)$	2.78
y_0 =	0.93
y_t =	0.10
t =	585.0

RESULTS

K=	**1E-06**	**m/sec**
K=	**1E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 07/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 16/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-29A

WELL NO. BH13-29A

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.95	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.020	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	4.61	METRES (btoc)
BOTTOM OF OPEN INTERVAL	6.13	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	5.36	METRES
WATER TABLE TO BOTTOM OF SCREEN	5.11	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.58	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.525	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005797	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	0.73	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.596	0	0.58	1.000
			1.556	1	0.54	0.930
			1.524	2	0.50	0.875
			1.497	3	0.48	0.827
			1.472	4	0.45	0.785
			1.451	5	0.43	0.748
			1.432	6	0.41	0.715
			1.414	7	0.39	0.684
			1.399	8	0.38	0.658
			1.383	9	0.36	0.630
			1.368	10	0.35	0.604
			1.355	11	0.34	0.582
			1.330	12	0.31	0.537
			1.330	13	0.31	0.537
			1.316	14	0.30	0.513
			1.307	15	0.29	0.498
			1.297	16	0.28	0.481
			1.287	17	0.27	0.464
			1.277	18	0.26	0.445
			1.268	19	0.25	0.431
			1.260	20	0.24	0.417
			1.252	21	0.23	0.403
			1.241	22	0.22	0.384
			1.236	23	0.22	0.375
			1.229	24	0.21	0.362
			1.221	25	0.20	0.349
			1.214	26	0.19	0.337
			1.207	27	0.19	0.325
			1.201	28	0.18	0.314
			1.195	29	0.17	0.303
			1.190	30	0.17	0.295
			1.184	31	0.16	0.284
			1.178	32	0.16	0.275
			1.173	33	0.15	0.266
			1.169	34	0.15	0.258
			1.164	35	0.14	0.250

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-29A

INTERVAL (metres below ground surface)

Top of Interval =	3.66
Bottom of Interval =	5.18

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

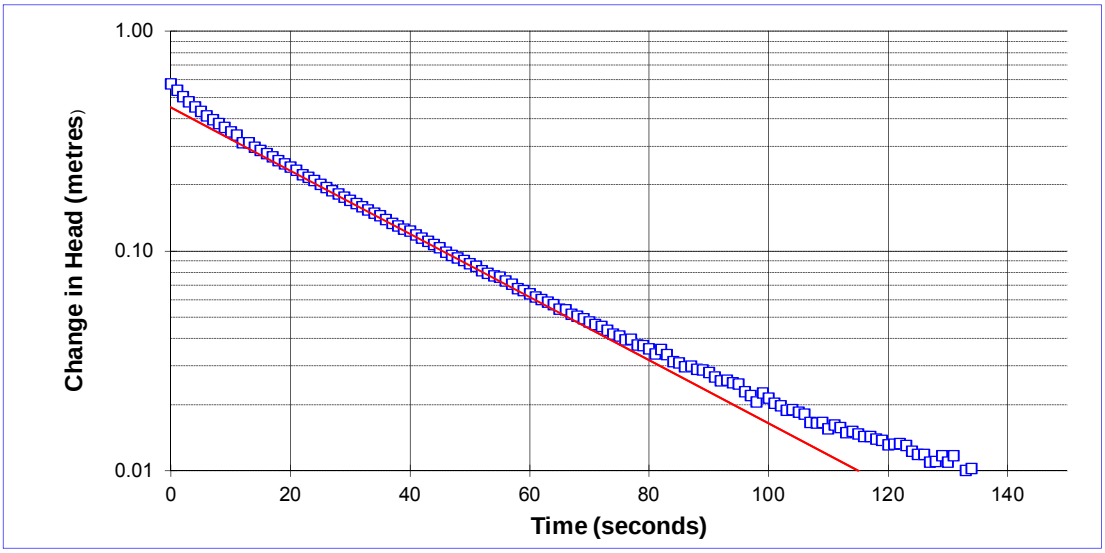
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.52
$ln(R_e/r_w)$	3.09
y_0 =	0.45
y_t =	0.01
t =	115.0

RESULTS

K=	9E-06	m/sec
K=	9E-04	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 06/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-29B

WELL NO. BH13-29B

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.86	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	0.895	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	1.77	METRES (btoc)
BOTTOM OF OPEN INTERVAL	3.30	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	2.50	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.41	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.94	METRES
MAX. HEAD IN SCREEN?	Yes	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005778	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	0.51	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 05/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.831	0	0.94	1.000
			1.782	1	0.89	0.947
			1.706	2	0.81	0.866
			1.676	3	0.78	0.834
			1.658	4	0.76	0.815
			1.636	5	0.74	0.792
			1.639	6	0.74	0.795
			1.633	7	0.74	0.788
			1.628	8	0.73	0.783
			1.626	9	0.73	0.781
			1.622	10	0.73	0.776
			1.619	11	0.72	0.774
			1.617	12	0.72	0.771
			1.615	13	0.72	0.769
			1.600	14	0.71	0.753
			1.610	15	0.71	0.763
			1.605	16	0.71	0.758
			1.602	17	0.71	0.755
			1.599	18	0.70	0.752
			1.596	19	0.70	0.749
			1.594	20	0.70	0.746
			1.591	21	0.70	0.743
			1.588	22	0.69	0.740
			1.584	23	0.69	0.735
			1.578	24	0.68	0.729
			1.571	25	0.68	0.722
			1.564	26	0.67	0.714
			1.559	27	0.66	0.709
			1.551	28	0.66	0.701
			1.545	29	0.65	0.694
			1.539	30	0.64	0.687
			1.532	31	0.64	0.680
			1.525	32	0.63	0.673
			1.520	33	0.62	0.667
			1.511	34	0.62	0.658
			1.507	35	0.61	0.654

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-29B

INTERVAL (metres below ground surface)

Top of Interval =	0.91
Bottom of Interval =	2.44

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

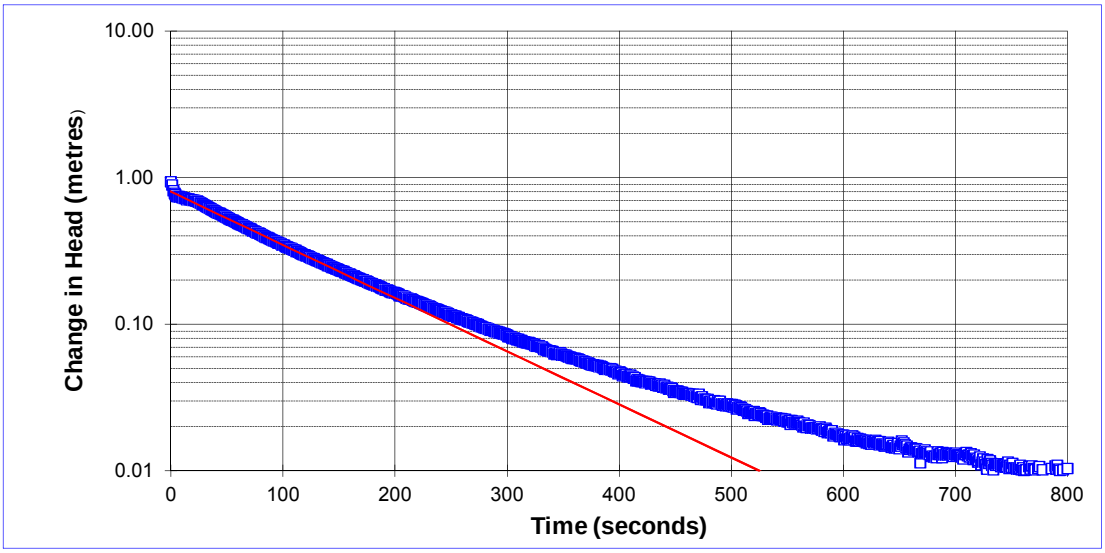
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.53
$\ln(R_e/r_w)$	2.80
y_0 =	0.80
y_t =	0.01
t =	525.0

RESULTS

K=	3E-06	m/sec
K=	3E-04	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 05/12/2013

RED = Calculated Value
BLUE = User defined value

FALLING HEAD TEST BH13-32A

Regional Group/Remer + Idone Lands
13-1121-0083

WELL NO.	BH13-32A	
DATE OF TEST	07/11/2013	
CASING STICK-UP	0.92	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.120	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	6.92	METRES (btoc)
BOTTOM OF OPEN INTERVAL	8.43	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	7.50	METRES
WATER TABLE TO BOTTOM OF SCREEN	7.31	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.51	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.81	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005778	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	0.73	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			0.314	0	0.81	1.000
			0.483	1	0.64	0.790
			0.639	2	0.48	0.597
			0.713	3	0.41	0.505
			0.684	4	0.44	0.540
			0.727	5	0.39	0.487
			0.738	6	0.38	0.473
			0.751	7	0.37	0.458
			0.761	8	0.36	0.445
			0.773	9	0.35	0.430
			0.785	10	0.33	0.415
			0.796	11	0.32	0.402
			0.805	12	0.32	0.391
			0.799	13	0.32	0.398
			0.816	14	0.30	0.377
			0.834	15	0.29	0.354
			0.841	16	0.28	0.346
			0.847	17	0.27	0.338
			0.853	18	0.27	0.331
			0.863	19	0.26	0.318
			0.870	20	0.25	0.309
			0.876	21	0.24	0.303
			0.876	22	0.24	0.303
			0.886	23	0.23	0.291
			0.893	24	0.23	0.282
			0.900	25	0.22	0.273
			0.907	26	0.21	0.264
			0.910	27	0.21	0.260
			0.916	28	0.20	0.253
			0.922	29	0.20	0.245
			0.927	30	0.19	0.240
			0.931	31	0.19	0.234
			0.935	32	0.18	0.229
			0.941	33	0.18	0.222
			0.945	34	0.18	0.217
			0.949	35	0.17	0.213

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST BH13-32A

INTERVAL (metres below ground surface)

Top of Interval =	**6.00**
Bottom of Interval =	**7.51**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

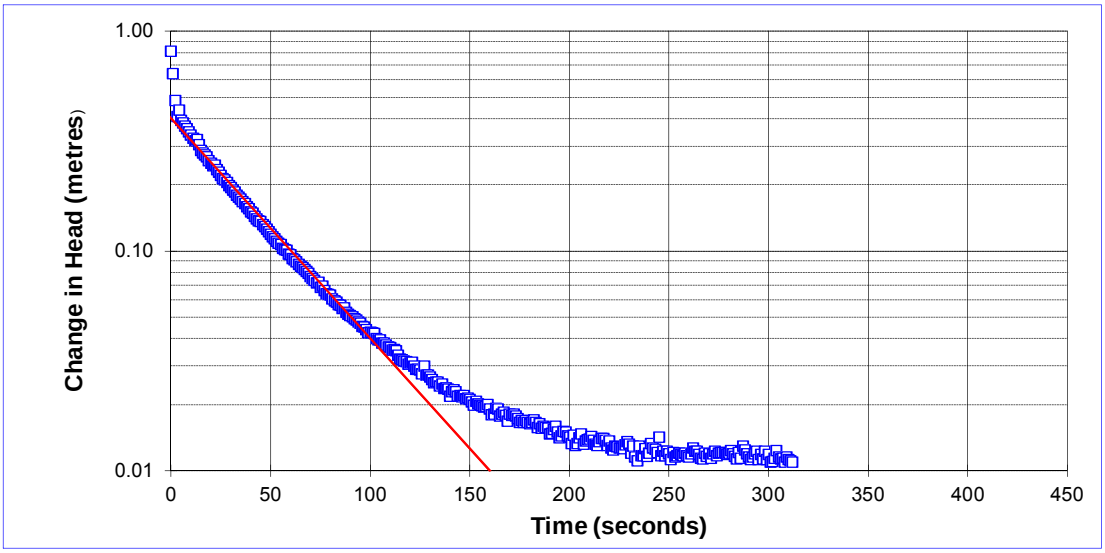
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.04**
L_e =	**1.51**
$\ln(R_e/r_w)$	**3.28**
y_0 =	**0.40**
y_t =	**0.01**
t =	**160.0**

RESULTS

K=	**6E-06**	**m/sec**
K=	**6E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 07/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-32B

WELL NO. BH13-32B

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	07/11/2013	
CASING STICK-UP	0.93	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.070	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	2.37	METRES (btoc)
BOTTOM OF OPEN INTERVAL	3.90	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	3.29	METRES
WATER TABLE TO BOTTOM OF SCREEN	2.83	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.88	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.28	METRES

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			1.946	0	0.88	1.000
			1.849	1	0.78	0.889
			1.829	2	0.76	0.866
			1.801	3	0.73	0.834
			1.780	4	0.71	0.811
			1.763	5	0.69	0.791
			1.749	6	0.68	0.775
			1.736	7	0.67	0.760
			1.721	8	0.65	0.743
			1.707	9	0.64	0.727
			1.690	10	0.62	0.708
			1.679	11	0.61	0.696
			1.670	12	0.60	0.685
			1.642	13	0.57	0.652
			1.640	14	0.57	0.650
			1.628	15	0.56	0.637
			1.623	16	0.55	0.631
			1.621	17	0.55	0.629
			1.616	18	0.55	0.623
			1.612	19	0.54	0.619
			1.606	20	0.54	0.612
			1.589	21	0.52	0.592
			1.578	22	0.51	0.580
			1.569	23	0.50	0.570
			1.557	24	0.49	0.556
			1.552	25	0.48	0.550
			1.543	26	0.47	0.540
			1.535	27	0.47	0.531
			1.527	28	0.46	0.522
			1.521	29	0.45	0.515
			1.516	30	0.45	0.509
			1.508	31	0.44	0.499
			1.500	32	0.43	0.491
			1.489	33	0.42	0.479
			1.480	34	0.41	0.468
			1.472	35	0.40	0.459

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-32B

INTERVAL (metres below ground surface)

Top of Interval =	1.44
Bottom of Interval =	2.97

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

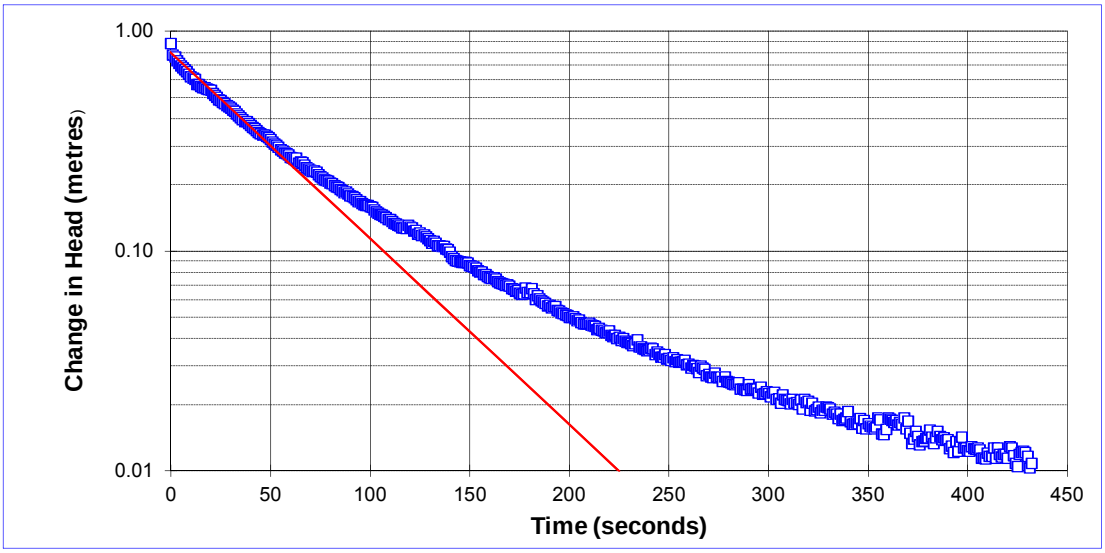
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.53
$ln(R_e/r_w)$	2.76
y_0 =	0.80
y_t =	0.01
t =	225.0

RESULTS

K=	6E-06	m/sec
K=	6E-04	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 07/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 09/12/2013

RED = Calculated Value
BLUE = User defined value

FALLING HEAD TEST BH13-33A Falling Head Test #1

WELL NO. **BH13-33A Falling Head Test #1**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.99	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.620	METRES (btoc)
CASING DIAMETER	1.25	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.016	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	6.25	METRES (btoc)
BOTTOM OF OPEN INTERVAL	7.77	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	6.38	METRES
WATER TABLE TO BOTTOM OF SCREEN	6.15	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.52	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	0.66	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.011	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0005778	UBIC METRES
RADIUS OF WELL	0.015875	METRES
INITIAL DISPLACEMENT	0.73	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **05/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			0.962	0	0.66	1.000
			1.169	1	0.45	0.685
			1.417	2	0.20	0.308
			1.450	3	0.17	0.258
			1.496	4	0.12	0.188
			1.528	5	0.09	0.140
			1.552	6	0.07	0.104
			1.568	7	0.05	0.079
			1.580	8	0.04	0.061
			1.589	9	0.03	0.048
			1.590	10	0.03	0.045
			1.602	11	0.02	0.027
			1.606	12	0.01	0.021
			1.608	13	0.01	0.018
			1.596	14	0.02	0.037
			1.595	15	0.02	0.037
			1.595	16	0.03	0.038
			1.604	17	0.02	0.025
			1.632	18	-0.01	-0.017
			1.627	19	-0.01	-0.011
			1.623	20	0.00	-0.005

BOUWER AND RICE SLUG TEST ANALYSIS
FALLING HEAD TEST BH13-33A Falling Head Test #1

INTERVAL (metres below ground surface)

Top of Interval =	5.26
Bottom of Interval =	6.78

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

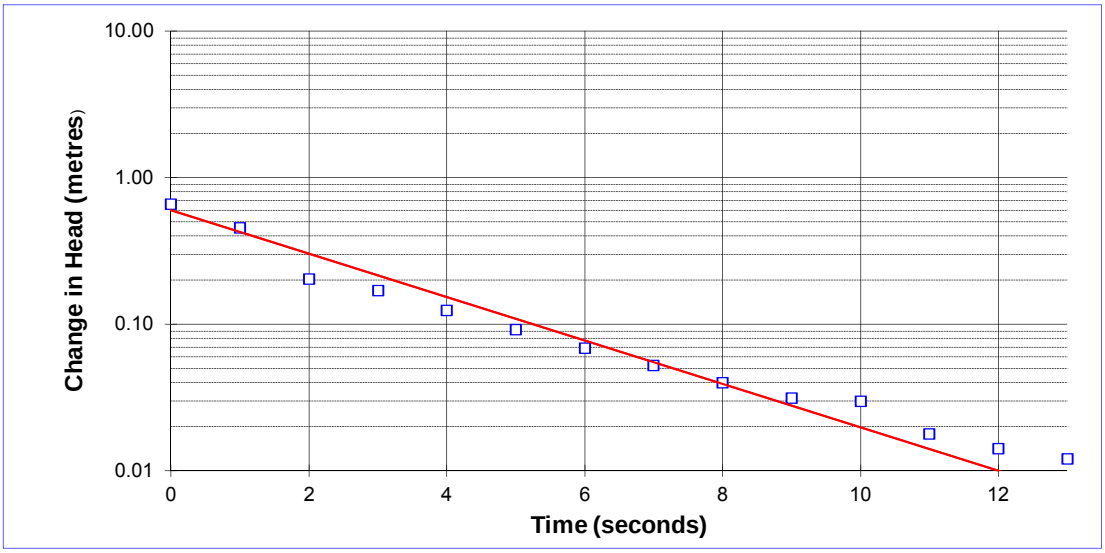
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	0.02
r_w =	0.04
L_e =	1.52
$\ln(R_e/r_w)$	3.18
y_0 =	0.60
y_t =	0.01
t =	12.0

RESULTS

K=	9E-05	m/sec
K=	9E-03	cm/sec



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 05/12/2013

RED = Calculated Value
BLUE = User defined value

RISING HEAD TEST BH13-33B

WELL NO. **BH13-33B**

Regional Group/Remer + Idone Lands
13-1121-0083

DATE OF TEST	08/11/2013	
CASING STICK-UP	0.86	METRES (ags)
INITIAL DEPTH TO WATER (STATIC)	1.590	METRES (btoc)
CASING DIAMETER	1.5	inches
BOREHOLE DIAMETER	3.5	inches
CASING RADIUS	0.019	METRES
BOREHOLE RADIUS	0.044	METRES
TOP OF OPEN INTERVAL	3.12	METRES (btoc)
BOTTOM OF OPEN INTERVAL	4.65	METRES (btoc)
SATURATED THICKNESS OF AQUIFER	3.49	METRES
WATER TABLE TO BOTTOM OF SCREEN	3.06	METRES
EQUIVALENT RADIUS	0.03	METRES
OPEN INTERVAL LENGTH	1.53	METRES
STATIC IN SCREEN?	No	
MAX. HEAD CHANGE	1.06	METRES
MAX. HEAD IN SCREEN?	No	

Slug Testing - Initial Displacement		
LENGTH OF SLUG	1.52	METRES
RADIUS OF SLUG	0.0175	METRES
VOLUME OF SLUG ($\pi r^2 l$)	0.0014624	UBIC METRES
RADIUS OF WELL	0.01905	METRES
INITIAL DISPLACEMENT	1.2827137	METRES

Analysis By: **CHM**
Checked By: **CAMC**
Analysis Date: **05/12/2013**

DATE	HR-MIN	SEC	DEPTH TO WATER (METRES)	ELAPSED TIME (SEC)	Displacement (METRES)	HEAD RATIO
			2.652	0	1.06	1.000
			2.531	1	0.94	0.887
			2.510	2	0.92	0.866
			2.489	3	0.90	0.847
			2.479	4	0.89	0.837
			2.469	5	0.88	0.828
			2.460	6	0.87	0.820
			2.451	7	0.86	0.811
			2.413	8	0.82	0.775
			2.422	9	0.83	0.784
			2.428	10	0.84	0.789
			2.418	11	0.83	0.780
			2.412	12	0.82	0.774
			2.404	13	0.81	0.767
			2.397	14	0.81	0.760
			2.390	15	0.80	0.753
			2.383	16	0.79	0.747
			2.377	17	0.79	0.741
			2.369	18	0.78	0.734
			2.363	19	0.77	0.729
			2.354	20	0.76	0.720
			2.351	21	0.76	0.716
			2.344	22	0.75	0.711
			2.337	23	0.75	0.704
			2.332	24	0.74	0.698
			2.316	25	0.73	0.684
			2.320	26	0.73	0.687
			2.313	27	0.72	0.681
			2.307	28	0.72	0.676
			2.301	29	0.71	0.670
			2.297	30	0.71	0.666
			2.291	31	0.70	0.661
			2.286	32	0.70	0.656
			2.280	33	0.69	0.650
			2.274	34	0.68	0.645
			2.268	35	0.68	0.639

BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST BH13-33B

INTERVAL (metres below ground surface)

Top of Interval =	**2.26**
Bottom of Interval =	**3.79**

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln\frac{y_0}{y_t}$$

where K=m/sec

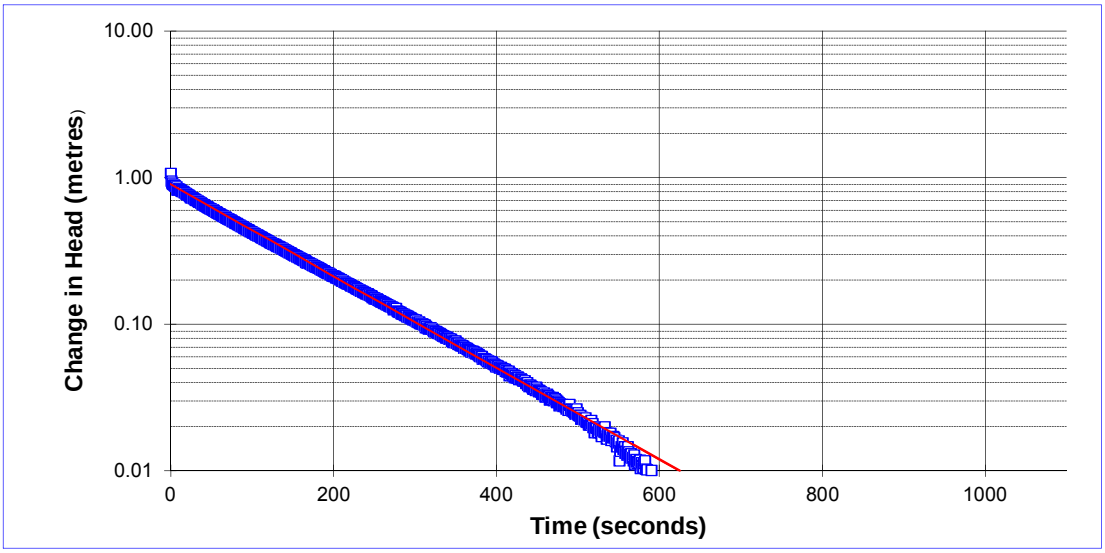
where:

r_c = casing radius (metres);
R_e = effective radius (metres);
L_e = length of screened interval (metres);
r_w = radial distance to undisturbed aquifer (metres)
y_0 = initial drawdown (metres)
y_t = drawdown (metres) at time t (seconds)

INPUT PARAMETERS	
r_c =	**0.02**
r_w =	**0.04**
L_e =	**1.53**
$\ln(R_e/r_w)$	**2.80**
y_0 =	**0.90**
y_t =	**0.01**
t =	**625.0**

RESULTS

K=	**2E-06**	**m/sec**
K=	**2E-04**	**cm/sec**



Project Name: Regional Group/Remer + Idone Lands
Project No.: 13-1121-0083
Test Date: 08/11/2013

Analysis By: CHM
Checked By: CAMC
Analysis Date: 05/12/2013

Inflow to Trench Equation: $Q=(K(h_o^2-h_p^2))/(0.733\ \log(R/r))+(2Kx(h_o^2-h_p^2))/(2L_o)$

K (m/sec) 4.1E-04

h_0 (m) 6.5

h_p (m) 1.0

r (m) 2.50

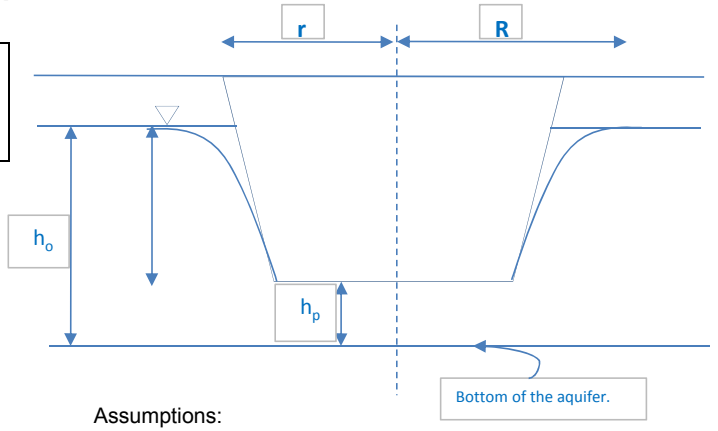
r -half width of trench

L_o = R - radius of influence

TRENCH DIMENSIONS

Width (2r) =	5	m
Length (x) =	120	m

Q (m3/s)	R	Rad of Inf. from edge	m^3/day	L/day
5.4E-01	4.5	2	46,776	46,775,726
3.2E-01	7.5	5	27,558	27,558,036
2.0E-01	12.5	10	16,880	16,879,967
1.4E-01	17.5	15	12,379	12,378,837
1.1E-01	22.5	20	9,882	9,882,378
8.3E-02	32.5	30	7,185	7,184,942
5.6E-02	52.5	50	4,848	4,847,674
4.2E-02	77.5	75	3,599	3,599,267
3.4E-02	102.5	100	2,947	2,946,785
2.6E-02	152.5	150	2,266	2,266,432
2.2E-02	202.5	200	1,910	1,910,469
2.0E-02	252.5	250	1,689	1,689,055
1.8E-02	302.5	300	1,537	1,536,800
1.5E-02	402.5	400	1,339	1,338,986
1.4E-02	502.5	500	1,214	1,214,492

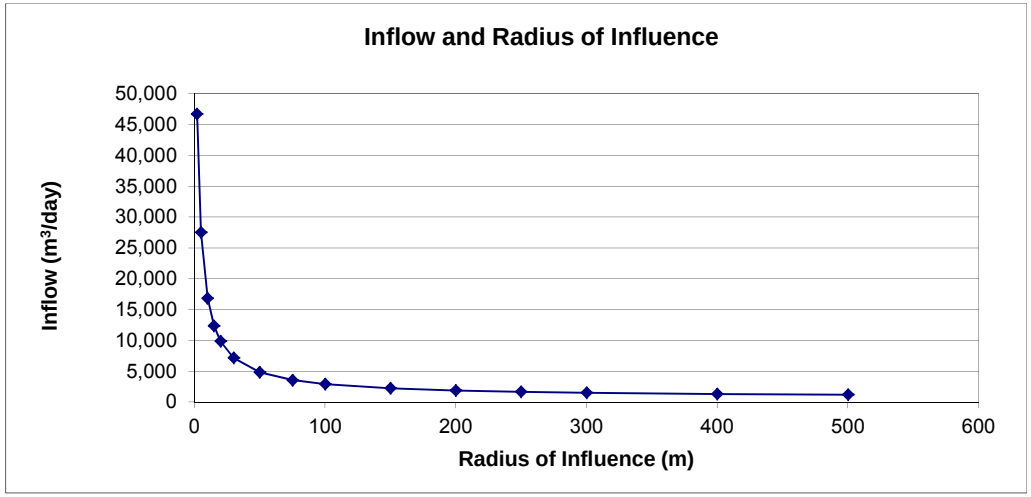


Assumptions:

Depth of trench dewatering (m) = 5.5

Sichart and Kyrieleis Equation: $R=3000\Delta h(K^{1/2})$

Radius of Influence (m) 334



APPENDIX D

Results of Basic Chemical Analysis
EXOVA Laboratories Ltd. Report No. 1323883

Client: Golder Associates Ltd. (Ottawa)
32 Steacie Drive
Kanata, ON
K2K 2A9
Attention: Ms. Christine Ko
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1323883
Date Submitted: 2013-10-28
Date Reported: 2014-01-30
Project: 13-1121-0083
COC #: 779818

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					1068678 Soil 2013-10-01 13-4 SA#2	1068679 Soil 2013-09-29 13-6 SA#6	1068680 Soil 2013-09-27 13-13 SA#5	1068681 Soil 2013-10-03 13-16 SA#2
Agri. - Soil	Electrical Conductivity	0.05	mS/cm		0.29	0.12	0.11	0.11
	pH	2.0			7.3	8.0	7.9	8.0
General Chemistry	Cl	0.002	%		0.019	<0.002	<0.002	0.004
	Resistivity	1	ohm-cm		3450	8330	9090	9090
	SO4	0.01	%		<0.01	<0.01	<0.01	<0.01

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	
					1068682 Soil 2013-10-04 13-23 SA#7	1068683 Soil 2013-10-09 13-31 SA#7
Agri. - Soil	Electrical Conductivity	0.05	mS/cm		0.18	0.13
	pH	2.0			8.1	8.2
General Chemistry	Cl	0.002	%		0.003	0.003
	Resistivity	1	ohm-cm		5560	7690
	SO4	0.01	%		0.03	0.02

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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