

210 Prescott Street, Unit 1 P.O. Box 189 Kemptville, Ontario K0G 1J0 (613) 860-0923

FAX: (613) 258-0475

#### **REPORT ON**

#### GEOTECHNICAL INVESTIGATION PROPOSED GREELY COMMERCIAL CENTER 5640 BANK STREET, 7041 MITCH OWENS ROAD and 7107 MARCO STREET CITY OF OTTAWA, ONTARIO

Project # 140208

Submitted to:

Otis Group of Companies 3338 Dufferin Street Toronto, Ontario M6A 3A4

DISTRIBUTION

4 copies City of Ottawa

2 copies Otis Group of Companies

1 copy Fotenn Planning & Urban Design

1 copy Kollaard Associates Inc.

Revision 0 – Submitted for Site Plan Approval Revision 1 - Re-submitted for Site Plan Approval November 6, 2014 February 10, 2015

Professional Engineers Ontario Authorized by the Association of Professional Engineers of Ontario to offer professional engineering services. Kollaard Associates

210 Prescott Street, Unit 1 P.O. Box 189 Kemptville, Ontario K0G 1J0 Civil • Geotechnical • Structural • Environmental • Hydrogeology

#### (613) 860-0923

FAX: (613) 258-0475

#### TABLE OF CONTENTS

1 B/	ACKGROUND INFORMATION AND SITE GEOLOGY	2
2 PI	ROCEDURE	4
3 SI	UBSURFACE CONDITIONS	6
3.1	General	6
3.2	Fill	6
3.3	Sand and Gravel/Sand/Silty Sand	7
3.4	Glacial Till	7
3.5	Bedrock	8
3.6	Groundwater	8
3.7	Corrosivity on Reinforcement and Sulphate Attack on Portland Cement	8
4 PI	ROPOSED COMMERCIAL DEVELOPMENT BUILDING FOUNDATIONS	9
4.1	General	9
4.	1.1 Foundations for Proposed Commercial Buildings	9
4.	1.2 Proposed Building Foundations Alternatives	9
4.2	Alternative 1)	10
4.	2.1 Excavation for Proposed Structures	10
4.	2.2 Engineered Fill	10
4.	2.3 Bearing Capacity	11
4.	2.4 Slab on Grade Support	12
4.3	Alternative 2)	13
4.	3.1 Foundation and Bearing Capacity	13
4.	3.2 Concrete Floor Slab on Grade Support	14
4.4	Alternative 3)	15
4.	4.1 Preloading and Surcharging	15
4.	4.2 Settlement Monitoring	16
4.	4.3 Engineered Pad	17
4.	4.4 Bearing Capacity	18
4.5	Frost Protection Requirements for Foundation Walls	18
4.6	Foundation Wall Backfill and Drainage	18
4.7	Frost Protection Requirements for Raft Foundation	19
5 Se	eismic Design for the Proposed Commercial Buildings	20
5.1	Site Classification	20
5.2	Potential for Soil Liquefaction	20
6 SI		21
6.1		22
6.2	Pipe Bedding and Cover Materials	22
6.3	I rench Backfill	23
6.4		24
	UUESS KUADWAY AND PAKKING AKEA PAVEMENIS	24
1.1		24
1.2		25
8 C		20



November 6, 2014(rev. Feb 10/15)

140208

Otis Group of Companies 3338 Dufferin Street Toronto, Ontario M6A 3A4

#### RE: GEOTECHNICAL INVESTIGATION PROPOSED GREELY COMMERCIAL CENTER 5640 BANK STREET, 7041 MITCH OWENS ROAD and 7107 MARCO STREET CITY OF OTTAWA, ONTARIO

Dear Sirs:

This report presents the results of a geotechnical investigation carried out for the above noted proposed commercial development to be located at the southwest corner of the intersection of Bank Street and Mitch Owens Road, Greely, City of Ottawa, Ontario (see Key Plan, Figure 1). The purpose of the investigation was to identify the subsurface conditions at the site based on a limited number of boreholes and test pits. Based on the factual information obtained, Kollaard Associates Inc. was to provide guidelines on the geotechnical engineering aspects of the project design; including construction considerations, which could influence design decisions.

# 1 BACKGROUND INFORMATION AND SITE GEOLOGY

In total, the subject property consists of about 13.7 hectares (34 acres) in plan area located at the southwest corner of the intersection of Bank Street and Mitch Owens Road and is commonly known as 5640 Bank Street,7041 Mitch Owens Road, and 7107 Marco Street, Greely, City of Ottawa, Ontario (see Key Plan, Figure 1). Information provided by ADA Architectural Design and Associates Inc. indicates plans are being prepared to develop the eastern about 5.6 hectares (13.75 acres) of the 13.7 hectares property into a proposed commercial centre. The 5.6 hectares comprising the proposed commercial centre is the subject site for this investigation.

It is understood the proposed commercial centre will consist of a nine unit, single storey strip plaza and four single storey individual buildings together with associated asphaltic surfaced parking and roadways. It is understood that the proposed commercial development will be serviced by private water supply and by private septic systems. It is also understood that there are plans for future



commercial development in the remaining portion of the 13.7 hectare property located west of the subject site.

Preliminary plans indicate that the proposed buildings will have standard steel or wood frame construction with conventional concrete spread footing foundations and concrete slab-on-grade construction. Surface drainage for the proposed buildings will be by means of swales and storm sewers.

Currently, the site is vacant. A review of historic aerial photographs as well as conversation with the original owners of the site indicate that the site was previously developed as a sand and gravel pit. The subject site is bordered on the north by Mitch Owens Drive, on the east by Bank Street, on the south by existing residential development and on the west by the remaining undeveloped portion of 13.7 hectare property followed by Old Prescott Road.

Based on a review of the surficial geology map for the site area, it is expected that the native soils at the site consist of medium to coarse grained sand and gravel with cobbles, boulders, followed by glacial till. Bedrock geology maps indicate that the bedrock underlying the site consists of dolostone and dolomitic limestone of the Oxford Formation.

Three drilled cased water wells were installed at the site as a requirement for a hydrogeological investigation completed for the site by others. From the water well records (Attachment A) it is considered that the geotechnical investigation will likely encounter sand and gravel and boulders from about 14.6 metres to about 15.8 metres below the ground surface. It is considered that limestone bedrock is underlying the site from about 14.6 to 15.8 metres below the ground surface.

Revised February 10, 2015

# 2 PROCEDURE

The field work for this investigation was carried out on August 25 to 29, 2014 and September 22, 2014. From August 25 to 29, 2014, twenty-one boreholes, numbered BH1 to BH21 were put down at the site using a track mounted drill rig equipped with a hollow stem auger owned and operated by Marathon Drilling of Greely, Ontario. An additional test hole BH22 was advanced by hand on August 28, 2014 On September 22, 2014, five test pits numbered TP1 to TP5 were put down at the site using a track mounted excavator supplied and operated by a local contractor. The location of the proposed buildings within the commercial development was indicated to us on a site plan provided by ADA Architectural Design Associates Inc., entitled Commercial Development, Mitch Owens Road & Bank Street., Greely (Ottawa), Ontario, Project 2010-060, Drawing Number A1.1, dated September 11, 2014.

BH1 to BH21 were advanced to various depths below the existing ground surface using a track mounted drill rig supplied and operated by a local drilling contractor. Sampling of the overburden materials encountered at the boreholes was carried out at regular 0.75 metre depth intervals using a 50 millimetre diameter drive open conventional split spoon sampler in conjunction with standard penetration testing to depths of about 0.9 to 12.0 metres below the existing ground surface (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils and ASTM D-1587 – Thin Walled Tube Sampling of Soils).

The subsurface soil conditions at the boreholes were identified based on visual examination of the samples recovered and standard penetration tests (ASTM D-1585) as well as laboratory test results on select samples. Groundwater conditions at the boreholes were noted at the time of drilling. Standpipes were installed at BH3-5151, BH8-5116, BH10-5113 and BH17-5119 for subsequent ground water level monitoring. The boreholes were loosely backfilled with the auger cuttings upon completion of drilling.

The test pits were advanced to depths ranging between about 2.1 to 3.4 metres below the existing ground surface. The subsurface conditions encountered at the test pits were classified based on visual and tactile examination of the materials exposed on the sides and bottom of the test pits and the difficulty of digging. The groundwater conditions were observed in the open test pits at the time of excavating. The test pits were loosely backfilled with the excavated materials upon completion of the fieldwork.

Two soil samples were submitted to determine the grain size distribution and hydrometer analysis. One soil sample at BH6-5111 was submitted for grain size distribution and hydrometer analysis (ASTM D422). One soil sample at BH17-5119 was submitted for sieve analysis (ASTM C136). A



sample of soil obtained from test pit 1 was delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack and soil corrosion on buried concrete and steel.

The field work was supervised throughout by a member of our engineering staff who located the boreholes and test pits in the field, logged the boreholes and test pits and cared for the samples obtained. A description of the subsurface conditions encountered at the boreholes and test pits are given in the attached Record of Borehole sheets and Table I – Record of Test Pit sheets. The results of the laboratory testing of the soil samples are presented in the Laboratory Test Results section and Attachment A following the text in this report. The approximate locations of the boreholes and test pits are shown on the attached Site Plan, Figures 2 and 3.

The ground surface elevation at the test pit locations were determined, in the field, relative to a site benchmark provided by WMI & Associates Limited, Greely Commercial Center Grading Plan, Project Number 11-183, Drawing Number GR, dated February 4, 2014. The site benchmark is described as the #3 Concrete Monument 001196530377 located on the north side of Mitch Owens Road, about 250 metres west of the intersection of Mitch Owens Road and Bank Street. The elevation of the concrete monument is referenced as 113.99 metres geodetic.

# 3 SUBSURFACE CONDITIONS

#### 3.1 General

As previously indicated, a description of the subsurface conditions encountered at the boreholes and test pits is provided in the attached Record of Borehole and Record of Test Pits Sheets following the text of this report. The test pit and borehole logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than the test hole locations may vary from the conditions encountered at the test holes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the test pit and borehole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following is a brief overview of the subsurface conditions encountered at the test pits and boreholes. In general, the test pits and boreholes encountered a layer of fill materials followed by native grey brown fine to coarse sand and gravel, fine to coarse sand and gravel, silty sand or silty sand with a trace to some gravel, cobbles and boulders (Glacial Till).

#### 3.2 Fill

At all the test holes, fill materials ranging in thickness from surficial to about 9.6 metres below the existing ground surface were encountered. The fill materials in general consisted of either: silty clay containing trace sand, gravel, cobbles; silty clay containing some sand, gravel, cobbles and large boulders; or silty sand containing some gravel cobbles and boulders and trace clay. Trace to some topsoil, concrete, metal, wood and rubber debris was identified in the fill at localized locations. In general, the fill thickness ranges from less than 0.9 metres to greater than 8.2 metres across the site. Based on the results of the standard penetration tests carried out within the fill, the state of compaction of the silty clay is inconsistent and varies between soft to stiff. The state of packing of the sand fill is also inconsistent and in general varies from compact to dense. The fill material was fully penetrated at all of the borehole and test pit locations with the exception of BH2, BH7, BH12, BH16, BH21 and TP3.

# 3.3 Sand and Gravel/Sand/Silty Sand

A deposit of loose to compact, grey brown to grey fine to medium/fine to coarse sand and gravel with a trace of silt, clay and cobbles and/or silty sand was encountered below the fill materials at all of the test pits and boreholes where the fill was fully penetrated, except BH6-5111 and the test pits put down on April 24, 2014. The test pits and boreholes terminated in the sand and gravel and or silty sand at depths ranging from about 1.0 to 10.5 metres below the existing ground surface. Based on the standard penetration value (N), which ranged from about 20 to 94 blows per 0.3 metres, the fine to coarse sand and gravel was observed to be in a compact to very dense state of packing. Based on the standard penetration value (N), which ranged from about 2 to 27 blows per 0.3 metres, the silty sand was observed to be in a very loose to compact state of packing.

A sample of sand obtained from BH17-5119 (7.6 to 8.2 metres) was submitted to Stantec for grain size distribution testing (ASTM C136) and hydrometer testing (ASTM D422). The results of the testing are provided in the Laboratory Testing Results section at the end of this report.

The results of the sieve analysis for the sample from BH17-5119 indicates the sample has a gravel content of 27.9 percent, a sand content of 59.9 percent and a silt & clay content of 12.2 percent.

The results of the laboratory testing are located in Attachment A.

# 3.4 Glacial Till

Glacial till was encountered beneath the fill materials at BH6-5111. The glacial till consisted of gravel, cobbles and boulders, in a matrix of grey brown to grey silty sand, with a trace to some clay. The glacial till was observed to be in a dense to very dense compact state of packing based on the standard penetration value (N), which ranged from about 40 to 94 blows per 0.3 metres. Practical refusal was experienced on a large cobble or boulder at about 3.2 metres below the existing ground surface.

A sample of glacial till obtained from BH6-5111 (1.52 to 2.1 metres) was submitted to Stantec for grain size distribution testing (ASTM C136) and hydrometer testing (ASTM D422). The results of the laboratory grain size distribution analysis for the sand sample obtained from BH6-5111 indicates the sample has a gravel content of about 32 percent, a sand content of about 40 percent and a silt & clay content of about 23 percent.

# 3.5 Bedrock

Three drilled cased water wells were installed at the site as a requirement for a hydrogeological investigation completed by others for the site. From the water well records (Attachment A) it is considered that the geotechnical investigation will likely encounter sand and gravel and boulders to about 14.6 metres to 15.8 metres below the ground surface. It is considered that limestone bedrock is underlying the site beginning at about 14.6 to 15.8 metres below the ground surface.

#### 3.6 Groundwater

Some groundwater seepage was observed within BH8-5116, BH9-5115, BH10-5113, BH18-5107, BH19-5106 and BH20-5110 at about 2.8, 3.8, 3.8, 5.7, 6.7 and 7.1 metres, respectively, below existing ground surface at the time of drilling. On September 11, 2014, groundwater was measured in standpipes installed in BH8-5116, BH10-5113 and BH17-5119 at depths of about 2.5, 1.2 and 4.6 metres below existing ground surface. BH3-5121 was observed to be dry. The test pits were dry at the time of excavation on September 22, 2014. It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

# 3.7 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of a soil sample for submitted for chemistry testing related to corrosivity is summarized in the following table.

Item	Threshold of Concern	Test Result	Comment
Chlorides (CI)	Cl > 0.04 %	< 0.002	Negligible concern
nH	5.0 < pH	8.0	Neutral/Slightly Basic
pri l	0.0 < pr	0.0	Negligible concern
Resistivity	R < 1500 ohm-cm	11100	Negligible concern
Sulphates (SO <sub>4</sub> )	SO <sub>4</sub> > 0.1%	<0.01	Negligible concern

Based on the chemical test results, Type GU General use Hydraulic Cement may be used for this proposed development. No special protection is required for reinforcement steel within the concrete walls.

# 4 PROPOSED COMMERCIAL DEVELOPMENT BUILDING FOUNDATIONS

#### 4.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the information from the test holes and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this report.

# 4.1.1 Foundations for Proposed Commercial Buildings

The results of this investigation indicate that the site is mostly underlain by a deposit of sand and gravel/silty sand and/or glacial till beneath a considerable thickness of deleterious fill materials. Based on the subsurface investigation, it is expected that fill materials will be encountered at all of the proposed building locations. It is expected that the fill material will vary in thickness from less than 0.1 m to about 9.6 metre. The fill was observed to consist of silty clay and/or sand containing, at some locations, a trace to some asphaltic concrete, concrete debris, boulders, and some deleterious materials such as wood and topsoil.

The fill materials are inconsistent and not considered suitable for the support of the proposed building structures using conventional slab on grade foundations.

The selection of the foundation alternatives should be based, among other factors, on the structural requirements of the building, the proposed grades, overall cost for the foundations and soil removal/disposal, availability of equipment, and schedule.

# 4.1.2 Proposed Building Foundations Alternatives

In view of the thickness and inconsistency of the fill materials encountered at the site, it is considered that the proposed buildings may be founded on:

- 1) Spread footings bearing on undisturbed native material or on an engineered fill placed on undisturbed fine to coarse sand, silty sand or glacial till, or;
- 2) On deep foundations such as driven piles deriving support in end bearing on very dense glacial till or bedrock, or;
- 3) A structurally designed raft foundation placed on an engineering pad bearing on fill material in conjunction with preloading and surcharge of the fill material.

# 4.2 Alternative 1)

# Spread footings bearing on undisturbed native material or on an engineered pad placed on undisturbed native fine to coarse sand and gravel, silty sand or glacial till.

# 4.2.1 Excavation for Proposed Structures

Any excavation for the proposed structures will likely be carried out through surficial topsoil and fill material consisting of silty clay or silty sand and sand and gravel containing boulders to the native sand, silty sand and gravel/silty sand or glacial till. The sides of the excavation should be sloped in accordance with the requirements of Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the fill material above the ground water level ,can be classified as Type 3 soil and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical extending upwards from the base of the excavation. Should ground water be encountered within the silty sand fill material, the steepness of the excavation side slopes may have to be reduced.

The excavations within the fill and native materials above the groundwater level should not present any serious constraints. In contrast, excavations below the groundwater level if encountered could present some constraints. In that case, there is potential for disturbance to the soil on the sides and bottom of the excavations and relatively flat side slopes may be required to prevent sloughing of material into the excavation unless the groundwater level is lowered in advance of the excavation. In this case, the groundwater inflow should be controlled throughout the excavation by pumping from sumps within the excavation. Notwithstanding, some disturbance and loosening of the subgrade materials could occur, an allowance should be made for subexcavation of any disturbed soil at the subgrade level.

# 4.2.2 Engineered Fill

Where fill material is encountered below proposed founding level, the fill material should be removed and replaced with compacted granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standards Specifications (OPSS)

140208



requirements for Granular A or Granular B Type II and should be compacted in maximum 300 millimetre thick loose lifts to at least 95 percent of the standard Proctor maximum dry density. To allow the spread of load beneath the footings, the engineered fill should extend out from the edges of the footing a horizontal distance of 0.5 metres and then down and out at 1 horizontal to 1 vertical, or flatter. The excavations for the proposed buildings should be sized to accommodate this fill placement. Currently, OPSS documents allow recycled asphaltic concrete to be used in Granular A and Granular B Type II materials. If the source of recycled material cannot be verified, it is suggested that any granular materials used below the founding level be composed of virgin materials only.

# 4.2.3 Bearing Capacity

Spread footings founded on undisturbed native materials or on a pad of properly constructed engineered fill placed on undisturbed native materials, may be designed as follows:

Subgrade Material	Maximum Allowable Bearing Pressure for Serviceability limit States (kPa)	Factored Ultimate Bearing Resistance (kPa)
Native Compact Sand or Silty sand	90	150
Dense Glacial Till	200	300
Engineered Fill of less than 1 m thickness	150	200
Engineered Fill of greater than 1 m thickness	200	300

The above allowable bearing pressure/resistance are suitable for footings a minimum of 0.6 metres in width. There are no grade raise restrictions adjacent to the proposed structure associated with this option.

Provided that the engineered fill is compacted to the required density and all loose or disturbed soil is removed from the bearing surfaces prior to concrete placement, the total and differential settlement of the footings should be less than 25 millimetres and 20 millimetres, respectively. The subgrade surface should be inspected by geotechnical personnel prior to the placement of engineered fill material and concrete. Field density testing should be carried out on the engineered fill during placement.



Revised February 10, 2015

#### 4.2.4 Slab on Grade Support

For predictable performance of the proposed concrete floor slabs, the existing fill should be subexcavated to a minimum depth of 0.9 metres below the proposed underside of floor slab elevation where not previously excavated. Any deleterious fill such as wood debris or topsoil encountered at that level should be removed. The exposed subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be further sub-excavated and replaced with suitable engineered fill. It is recommended that a standard 8 millimetre polyethylene vapour barrier be placed below the concrete floor slab.

The engineered fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The engineered fill materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density.

The proposed "Granular A' or 'Granular B' fill beneath the concrete floor slab can be replaced with approval by the geotechnical engineer with recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type II.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding about 5 metres.

Under slab drainage is not considered necessary provided that the floor slab level is everywhere above the finished exterior ground surface level. If any areas of the proposed buildings are to remain unheated during the winter period, thermal protection of the slab on grade may be required. Further details on the insulation requirements could be provided, if necessary.



#### 4.3 Alternative 2)

# Deep Foundations such as driven piles deriving support in end bearing on very dense glacial till or bedrock

#### 4.3.1 Foundation and Bearing Capacity

Where the fill materials extend significantly below the water level or are of sufficient thickness to make it uneconomical to completely remove the fill materials, the foundations for the proposed buildings could be supported on end bearing driven piles. In this case, all load bearing walls and columns should be placed on a foundation supported on end bearing driven pile. Mixed foundation types are not recommended. End bearing driven piles for the proposed structures could consist of concrete filled steel pipe piles or steel H Piles.

The end bearing piles should be driven to termination on either very dense glacial till or bedrock. Termination for closed ended pipe piles can be taken as a minimum number of 10 blows to advance the pile downward a maximum of 12 millimetres, using a hammer developing some 27 kilojoules of energy per blow. Termination for a steel H Pile can be taken as a minimum number of 10 blows to advance the pile downward a maximum of 12 millimetres using a hammer developing some 54 kilojoules of energy per blow.

As a design example, for a 245 millimetre diameter steel pipe pile with a wall thickness of 8.9 millimetres, driven closed ended to termination consisting of a set of 10 blows for the last 12 millimetres using a hammer developing some 27 kilojoules of energy per blow, the Serviceability Limit State (SLS) allowable load could be taken as of 915 kilonewtons. As a second example, for a 194 millimetre diameter steel pipe pile with a wall thickness of 13.8 millimetres, driven closed ended to termination, the SLS allowable load could be taken as 930 kilonewtons. The Ultimate Limit State (ULS) load for the above steel pipe pile designs is 1,800 kilonewtons. The above designs assume that the steel for the pipe piles has a minimum yield strength of 340 megapascals and that the pipe pile is filled with 30 megapascals compressive strength concrete.

As it will not be possible to inspect the H piles for damage and/or bending after driving and in view of the presence of cobbles and boulders in the glacial till through which the piles will be driven, the use of a relatively heavy steel H Pile equipped with a cast steel driving shoe is suggested to minimize the damage to the pile tip which may be caused by these conditions.

As a design example, for an HP 320 x 110 steel H-pile, the SLS allowable load could be taken as 1,150 kilonewtons and the ULS load could be taken as 1,800 kilonewtons, respectively. The H piles should be set to a termination of 10 blows for the last 12 millimetres of penetration using a hammer transferring about 54 kilojoules of energy per blow.



The contractor should be required to submit a copy of the proposed pile type and driving criteria for review and acceptance by the engineer prior to the start of construction. Furthermore, the specifications for the project should make provision for dynamic testing of piles selected by the engineer to verify the transfer energy and pile load capacities.

Based on our previous piling experience in this area, it is possible that several rounds of restriking could be required to achieve performance of the final set. Therefore, provision should be made for restriking all of the piles at least once to confirm the set. Piles that do not meet the design criteria on the first or subsequent restrike would require additional restriking. A minimum of two days should be allowed before restriking a pile.

The post construction settlement of the end bearing driven pile foundations using the above recommended SLS bearing pressures are expected to be less than 12 millimetres.

# 4.3.2 Concrete Floor Slab on Grade Support

It is assumed that fill materials would not have been removed if a foundation supported by driven piles was selected. For predictable performance of the proposed concrete floor slabs, the existing fill should be sub-excavated to a minimum depth of 0.9 metres below the proposed underside of floor slab elevation. Any deleterious fill such as wood debris or topsoil encountered at that level should be removed. The exposed subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be further sub-excavated and replaced with suitable engineered fill.

The fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The engineered fill materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. It is recommended that a standard 8 millimetre polyethylene vapour barrier be placed below the concrete floor slab.

The proposed "Granular A' or 'Granular B' fill beneath the concrete floor slab can be replaced with approval by the geotechnical engineer with recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type II.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the



thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding about 5 metres.

Under slab drainage is not considered necessary provided that the floor slab level is everywhere above the finished exterior ground surface level. If any areas of the proposed buildings are to remain unheated during the winter period, thermal protection of the slab on grade may be required. Further details on the insulation requirements could be provided, if necessary.

# 4.4 Alternative 3)

# A structurally designed raft foundation placed on an engineering pad bearing on fill material in conjunction with preloading and surcharge of the fill material

A significant thickness of silty clay and sand fill materials were encountered along the northern portion of the development. From the proposed site plan it is understood that proposed buildings CRU11, CRU12 and CRU13 will be constructed along this side of the development. These proposed buildings are relatively small structures with footprints of about 745, 370 and 1180 square metres respectively. The risk associated with founding buildings on un-engineered fill materials is unpredictable and potentially excessive differential and total settlement. It is considered that this risk could be mitigated for small buildings by preloading the proposed building area in conjunction with founding the building on an engineered pad.

It is considered that these buildings could be constructed on structurally engineered cast-in-place concrete raft foundations designed to accommodate potential differential movement of 25 millimetres and total settlement of 50 millimetres. Each raft foundation should be placed on an area suitably prepared by a combination of the placement of an engineered pad and preloading outlined below.

# 4.4.1 Preloading and Surcharging

Preloading and Surcharging the areas of the proposed buildings will allow the subgrade soils to settle in advance of the construction of the engineered pad and proposed building.

Preloading and surcharging consists of placing a temporary surcharge load above the design finished floor level for a period of time or preload period prior to construction of the proposed buildings. The surcharge load will apply a stress equivalent to or in excess of the 'design' level, after accounting for the future foundation loads in order to accelerate any potential settlements prior to construction and to reduce the potential for post-construction 'creep' settlements which could occur in the long term.



The magnitude of the surcharge load is a dependent on the foundation loading and on the finished grade design elevation, the duration of the preloading period, and on the acceptable magnitude of the post construction settlement.

It is understood that the foundation design for the proposed buildings has not been completed at this time. However it is understood that the buildings will be commercial with a steel post and beam structure. The loading from these buildings typically consists of a sum of the snow load (2.5 kPa), building dead load (3 kPa), building live load (4.8 kPa), and foundation load (4 kPa). Estimated total load is approximately 15 kPa therefore a minimum estimated surcharge of 1 metre above finished floor level will be required. It is considered that the surcharge fill could consist of existing material obtained during constructions from other areas of the development, or could consist of imported fill material.

In order to reduce the potential for post-construction 'creep' settlement and to account for unexpected loading, it is recommended that the surcharge height be increased to 2.5 metres thickness. The upper surface of the surcharge load should extend to about 3.0 metres outside of the outer edge of the proposed building footprints and should be sloped down and out at no steeper than 1 horizontal to 1 vertical (1H:1V). It is expected that any initial consolidation of the existing fill materials under the proposed surcharge load will be relatively rapid. As such an initial settlement monitoring period of 6 months is proposed.

The subgrade settlements would need to be monitored to establish when sufficient settlements have occurred such that construction could proceed. The settlement monitoring should be carried out by measuring the movements of three settlement plates placed at selected locations within the surcharge area of each proposed building for a total of nine plates. Once the monitoring of the settlement plates indicates that sufficient settlements have occurred, the surcharge could be removed and the building constructed.

# 4.4.2 Settlement Monitoring

The subgrade settlements would need to be monitored to establish when sufficient settlements have occurred such that the proposed building construction could proceed. It is considered that settlement plates will form the most cost-effective and reliable method of monitoring the settlements. A minimum of three settlement plates per building location is recommended for this development. Construction details for the settlement plates are given on Figure 4.

The installation of the settlement plates should occur prior to the placement of the surcharge fill, so that all of the settlements will be captured by the monitoring. The settlement plates must also be installed on a level and stable surface. Non-yielding survey benchmarks will also be required, which will not be affected (or caused to settle) by the construction. During settlement monitoring,



additional data including extent and height of surcharge pile and type and unit weight of surcharge fill material should be collected.

It is proposed that the settlement plate (rod) elevations be collected every week during the initial phase of monitoring (i.e., the first month after completion of surcharge filling). Thereafter, the elevations may be collected on a bi-weekly or monthly basis, depending on the rate of settlement. Given the fairly rapid expected rate of settlement, less frequent monitoring would make it difficult to evaluate the rate of on-going settlement. The rate of settlement may be an important measure of success of the surcharge/pre-load and will be critical information for deciding when sufficient pre-load time has passed and that the surcharge can be removed.

The decision as to when sufficient surcharge/pre-load time has passed will depend primarily upon the most recent rate of settlement, in comparison to the preceding measured rates of settlement. Once the monitoring of the settlement plates indicates that sufficient settlements have occurred, the surcharge could be removed. However, it is also possible that, if the monitoring indicates a high magnitude of on-going secondary compression (i.e., creep) settlements, then the surcharge could potentially need to be increased. Once the surcharge fill has been removed, the engineered pad could be constructed to support the proposed foundations.

# 4.4.3 Engineered Pad.

The existing fill should be sub-excavated to a minimum depth of 0.9 metres below the proposed underside of raft foundation. The excavation should be sized to accommodate an engineered pad constructed to extend a horizontal distance of 0.5 metre beyond the outside edge of the raft foundation than down and out at a maximum slope of 1 horizontal to 1 vertical. Any deleterious fill such as wood or organic debris encountered at that level should be removed. The exposed subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be further sub-excavated. A nonwoven 6 ounce geotextile fabric such as Mirafi 160N or approved alternative should be placed on the approved subgrade surface prior to the placement of any engineered fill. It is recommended that a standard 8 millimetre polyethylene vapour barrier be placed below the concrete floor slab.

The engineered fill should consist of granular material meeting Ontario Provincial Standards Specifications (OPSS) requirements for Granular A or Granular B Type II and should be compacted in maximum 300 millimetre thick loose lifts to at least 95 percent of the standard Proctor maximum dry density. To allow the spread of the load beneath the raft foundation, the engineered fill should extend out from the edges of the footing a horizontal distance of 0.5 metres and then down and out at 1 horizontal to 1 vertical, or flatter. The excavations for the proposed buildings should be sized to accommodate this fill placement.



Provided everywhere the proposed finished floor surfaces are above the exterior finished grade and provided the exterior grade is adequately sloped away from the proposed buildings, no perimeter foundation drainage system is required.

# 4.4.4 Bearing Capacity

The raft foundation may be designed with an average distributed allowable bearing pressure across the foundation of 20 kPa for Serviceability limit States (kPa) and 40 kPa factored ultimate bearing resistance for ultimate limit states design. Where concentrated loading may occur at column or load bearing wall locations requiring a thickening of the raft foundation, the thickened edge, strip or pad may be designed for a maximum allowable bearing pressure of 100 kPa for SLS design and 175 kPa for ULS assuming all of the load is transferred to the thickened portion only.

# 4.5 Frost Protection Requirements for Foundation Walls

All exterior footings and those in any unheated parts of the proposed buildings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, exterior footings constructed in areas that are to be cleared of snow during the winter period should be provided with at least 1.8 metres of earth cover for frost protection purposes.

The depth of frost cover could be reduced for footings bearing on engineered fill over the fine to coarse sand and gravel, silty sand or glacial till. In this case, the combined thickness of earth cover and the engineered fill should be at least 1.5 metres for frost protection purposes. Alternatively, the required frost protection could be provided using a combination of earth cover and extruded polystyrene insulation. Detailed guidelines for footing insulation frost protection could be provided upon request.

# 4.6 Foundation Wall Backfill and Drainage

To prevent possible foundation frost jacking, the backfill against the foundations should consist of free draining, non-frost susceptible material such as sand or sand and gravel meeting OPSS Granular B Type I grading requirements. Alternatively, foundations could be backfilled with native material in conjunction with the use of an approved proprietary drainage layer system against the foundation wall. It is pointed out that there is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. This could be mitigated by backfilling the upper approximately 0.6 metres with non-frost susceptible granular material.



Where the backfill material will ultimately support a pavement structure or walkway, it is suggested that the foundation wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor dry density value.

Provided everywhere the proposed finished floor surfaces are above the exterior finished grade and provided the exterior grade is adequately sloped away from the proposed buildings, no perimeter foundation drainage system is required.

# 4.7 Frost Protection Requirements for Raft Foundation

The subgrade below the raft foundation should be protected from freezing by the use of rigid insulation placed beneath and extending out beyond the edge of the foundation. The rigid insulation should consist of high density extruded polystyrene insulation with a minimum compressive strength of 275 kPa at 5% deformation such as DOW HI40 or approved alternative. The insulation should extend out a minimum of 1.2 metres beyond the outside edge of the foundation. The insulation should also extend a minimum of 1.2 metres beneath the foundation measured from the outside edge and across the entire width of any unheated building space.

It is noted that the subgrade surface should be free of any loose material and completely flat prior to the placement of the rigid insulation. The joints in the insulation should be tapped as required to ensure individual sheets remain tightly placed together. Foot and equipment traffic on the insulation should be minimized as much as possible to prevent cracking of the insulation.

#### 5 Seismic Design for the Proposed Commercial Buildings

#### 5.1 Site Classification

Based on the information from the boreholes and the test pits, for seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class D. The subsurface conditions below the proposed foundation design level consists of loose to moderately well compacted silty clay or sand fill or native undisturbed sand overlying bedrock at 14.6 to 15.8 metres below the existing ground surface.

Alternatively:

	Average Conditions Encountered At the Site													
Layer	Description	Depth (m)	d <sub>i</sub> (m)	N(60) <sub>i</sub> (blows / 0.3m)	d <sub>i</sub> /N <sub>i</sub>									
1	Fill	0	4.1	8	0.513									
2	Fill	4.1	5.5	13	0.423									
4	Fill	9.6	5.25	10	0.270									
5	Sand	12.3	0.8	25	0.140									
7	Bedrock	15.8	14.1	100	0.142									
	sum(d <sub>i</sub> /N(60) <sub>i</sub> ) 1.48													
	d_{c/(sum(d <sub>i</sub> /N(60) <sub>i</sub> ) 20.2													

Seismic Site Response Site Class Calculation

Since N(60) = 15 < 20.2 < 50, the seismic site response is Site Class D.

#### 5.2 Potential for Soil Liquefaction

Consideration for the potential for soil liquefaction of the existing silty clay and sand fill underlying sand overburden was determined by considering the ratio between the cyclic resistance ratio (CRR) to the cyclic stress ratio (CSR) for the soils between the proposed underside of footing level and the depth at which refusal to further advancement using standard penetration testing was attained. The CRR value was determined from a mathematical expression as determined by Rauch (1997) of the base curve obtained from Robertson and Fear (1996). The CSR was determined from Seed and Idriss (1971). It is considered that a soil with a normalized SPT of greater than 30 is non-liquefiable. It is also considered that a soil with a CRR/CSR ratio of greater than one is not liquefiable. The average CRR / CSR ratio for the fill and sand materials encountered between the surface and the underlying bedrock is 1.1. As such the subgrade soils at the site are not considered to be liquefiable.

Revised February 10, 2015

#### 6 SITE SERVICES

Based on a review of the proposed site servicing plan, the site will be serviced by a "Communal onsite septic system, communal well and storm sewers out letting to a storm pond. The sanitary flow from each building will be directed by gravity through sanitary sewers to a lift station where it will be distributed to the septic system. The water services will be provided by pressurized water mains. Both the sanitary sewers and the water services will be installed below frost depth. The storm water flow will be conveyed by storm sewers via gravity flow to a storm pond. From the site servicing drawing, a significant portion of the proposed storm and sanitary sewers will be located in the areas where there are significant fill thicknesses.

In order to avoid potential unacceptable movement of the storm and sanitary sewers due to the further consolidation of the fill, the following is considered:

- Where the sanitary or storm sewer is area effected by the removal of the existing fill and replacement with engineered fill in order to support a proposed building, the engineered fill should be extended to include the sanitary or storm service.
- Where the existing fill does not extend more than 1.0 metres beyond the proposed underside of bedding layer, the existing fill should be removed and replaced with engineered fill.
- Where the sanitary and storm sewers will be located in areas of where the existing fill thickness extends beyond 1.0 metres below the underside of bedding area, the area should be preloaded and surcharged prior to the installation of the sewers. The preloading and surcharging may be completed as detailed for the support of the proposed buildings in Alternative 3 above. The surcharge fill thickness should extend to 2.5 metres above the proposed finished grade of the site where the service is being installed.

Revised February 10, 2015

#### 6.1 Excavation

The excavations for the site services will be carried out through topsoil, fill and potentially sand and glacial till. The sides of the excavations in overburden materials should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Ontario Occupational Health and Safety Act. Where space constraints dictate, the excavation and backfilling operations should be carried out within a tightly fitting, braced steel trench box. It is expected that the groundwater level will likely not be encountered during excavation however allowance for surface water runoff and variable groundwater levels within the fill should be made.

Any groundwater inflow into the service trenches should be handled by pumping from sumps from within the excavations.

Where the services will be located in areas of significant fill thickness, the service trench should be over excavated an additional 0.5 metres below required to achieve the minimum bedding thickness. The bottom of the trench may be brought back to required bedding elevation using compacted granular material meeting the requirements for OPSS Granular A, Granular B type 1, Granular B type 2 or recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type 2. The granular material should be compacted in lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

# 6.2 Pipe Bedding and Cover Materials

It is suggested that the service pipe bedding material consist of at least 150 millimetres of granular material meeting OPSS requirements for Granular A. A provisional allowance should, however, be made for subexcavation of any disturbed material encountered at subgrade level. Granular material meeting OPSS specifications for Granular B Type II could be used as a sub-bedding material. The use of clear crushed stone as bedding or sub-bedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The sub-bedding, bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

#### 6.3 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable existing fill materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetrations (i.e. 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway.

Where existing fill is used, it should match the native materials exposed on the trench walls. Some of the native materials from the lower part of the trench excavations may be wet of the optimum water content for compaction. Depending on the weather conditions encountered during construction, some drying of materials and/or recompaction may be required. Any wet materials that cannot be compacted to the required density should either be wasted from the site or should be used outside of existing or future roadway areas. Any boulders larger than 300 millimetres in size should not be used as service trench backfill. Backfill below the zone of seasonal frost penetration could consist of either acceptable existing fill material or imported granular material conforming to OPSS Granular B Type I.

If the existing fill material is not suitable for reuse as described above, the service trenches may be backfilled using material meeting the requirements for OPSS Granular B Type 1 or using recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type 2. In this case the service should be installed with frost tapers extending out from the edge of the service trench at a maximum slope angle of 3 horizontal to 1 vertical beginning at 1.5 metres below finished grade.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, sidewalks, etc., the trench should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced to 90 percent where the trench backfill is not located within or in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

#### 6.4 Seepage Barriers

It is expected however that the sewer trenches will not extend into the ground water level. Should this occur however, the permanent lowering of the groundwater level at the site can be caused by drainage through the granular bedding and cover materials within the sewer trenches. Groundwater lowering can cause stress within the silty clay fill materials which underlie the site and in turn result in settlement of footings/foundations and services.

Should groundwater be encountered during excavation for the site services, it is recommended that clay dykes be provided within sewer trenches at about 90 metre spacing to minimize the possibility of groundwater lowering at this site due to the presence of the proposed sewers.

# 7 ACCESS ROADWAY AND PARKING AREA PAVEMENTS

#### 7.1 Preparation

In preparation for pavement construction at this site the existing fill should be sub-excavated to a minimum depth of 1.0 metres below the proposed finished roadway and parking area surface. The excavation should be sized to accommodate a granular structure constructed to extend down and out at a maximum slope of 1 horizontal to 1 vertical from the edge of the parking area or road way. Any deleterious fill such as wood debris or topsoil encountered at that level should be removed. The exposed subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be further sub-excavated. The sub-grade should be shaped and crowned to promote drainage of the roadway area granular. A nonwoven 6 ounce geotextile fabric such as Mirafi 160N or approved alternative should be placed on the approved subgrade surface prior to the placement of any engineered fill.

For any areas of the site that require the sub-grade to be raised to proposed roadway area subgrade level, the material used should consist of OPSS select sub-grade material, OPSS Granular B Type I or Type II, or recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type 2. Materials used for raising the sub-grade to proposed roadway area subgrade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.



#### 7.2 Structure

For pavement areas subject to cars and light trucks the pavement should consist of:

50 millimetres of hot mix asphaltic concrete (HL3) over 150 millimetres of OPSS Granular A base over 300 millimetres of OPSS Granular B, Type II subbase (50 or 100 millimetre minus crushed stone)

For pavement areas subject to heavy truck/bus loading the pavement should consist of:

40 millimetres of hot mix asphaltic concrete (HL3) over
40 millimetres of hot mix asphaltic concrete (HL8) over
150 millimetres of OPSS Granular A base over
400 millimetres of OPSS Granular B, Type II subbase (50 or 100 millimetre minus crushed stone)

The specified OPSS Granular B, Type II subbase material may be replaced as approved by the geotechnical engineer by recycled crushed concrete meeting the grading requirements for 50 mm minus OPSS Granular B Type 2. In this case the thickness of the granular subbase layer should be reduced by 50 mm and the Granular A base layer thickness should be increase by 50 mm to 200 mm.

Compaction of the granular pavement materials should be carried out in maximum 300 millimetre thick loose lifts to 100 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

The above pavement structures will be adequate on an acceptable sub-grade, that is, one where any roadway fill and service trench backfill has been adequately compacted. If the roadway subgrade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

#### 8 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended and to re-evaluate the guidelines provided in the report with respect to the actual project plans. Items such as actual foundation wall/column loads, whether or not the basement or below grade parking structure is heated, etc could have significant impacts on foundation type, frost protection requirements, etc.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All footing areas and any engineered fill areas for the proposed buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable subgrade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to ensure that the materials used conform to the grading and compaction specifications.

The placing and compaction of sewer bedding, cover and backfill should be inspected to ensure that the materials used conform to the specifications from both a materials and compaction point of view.

Preloading and Surcharging should be carried out under the supervision of and be monitored by Kollaard Associates Inc.

Any recycled crushed concrete proposed for use in the development should be approved by Kollaard Associates Inc. prior to use.

The subgrade for the access roadway and parking areas should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the pavement granular materials to ensure the materials meet the specifications from a compaction point of view.

The native sand deposits at this site will be sensitive to disturbance from construction operations, from rainwater or snow melt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

The soil samples obtained as part of this investigation will be maintained in storage for a period of 3 months following the issuance of this report, unless otherwise instructed.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Regards, Kollaard Associates Inc.

Uan / at



Dean Tataryn, B.E.S., EP.

Steve DeWit, P.Eng.

Attachments: Record of Boreholes Record of Test Pits Figure 1 – Key Plan Figure 2 – 2011 Aerial – Entire Site Figure 3 – 2011 Aerial – Current Development Site Figure 4 – Settlement Plate Construction Attachment A – Laboratory Test Results for Chemical Properties Attachment B – Laboratory Test Results for Physical Properties – Stantec Laboratory Test Results for Soils Attachment C – Water Well Records

RECORD OF BOREHOLE BH1-5123															
PRO CLI LOO	PROJECT: Proposed Greely Commercial Center       PROJECT NUMBER: 140208         CLIENT: OTIS GROUP OF COMPANIES       DATE OF BORING: August 25, 2014         LOCATION: 5640 Bank Street and 701 Mitch Owens Road       SHEET 1 of 1         PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm       DATUM:														
	SOIL PROFILE	5100, 0	.7 011111	SA	MPL	ES									
SCALE ters)		PLOT	ELEV.	R.		/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80	DYNAMIC CONE PENETRATION TEST							
DEPTH (me	DESCRIPTION	STRATA	(M)	NUMB	ТҮРЕ	BLOWS	REM. SHEAR STRENGTH           ○         Cu, kPa         ○           20         40         60         80	blows/300 mm 10 30 50 70 90							
_0	Ground Surface		105.53												
_	Topsoil (FILL) Yellow brown silty sand, some gravel, cobbles and boulders, trace topsoil and grapular stope (FILL)		0.00	1	ss	25									
- - - - -1						10									
- - -			104.01	2	55	12									
- - - 	Grey brown fine to medium SAND, trace to some gravel and cobbles		1.52	3	SS	23									
-	End of Borehole, refusal on large		2.13												
	Sourcei								Borehole dry						
									on August 25, 2014.						
-3															
-4															
5															
6															
- 7															
-8															
	Kollaard Associates														
	BORING METHOD: Power Auger			Al	JGER	eers TYF	E: 200 mm Hollow Stem	CHECKED: SD							

RECORD OF BOREHOLE BH2-5122															
PRO CLI LOO PEN	PROJECT: Proposed Greely Commercial Center     PROJECT NUMBER: 14020       CLIENT: OTIS GROUP OF COMPANIES     DATE OF BORING: August       LOCATION: 5640 Bank Street and 701 Mitch Owens Road     SHEET 1 of 1       PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm     DATUM:														
	SOIL PROFILE			SA	MPL	ES									
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH           ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH         ○         Cu, kPa         ○           20         40         60         80	blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION					
-0	Ground Surface	~	105.24												
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay (FILL)			1	SS	18									
				2	33	23									
<u>-</u> 2			103.11	3	35	23									
	End of Borehole, refusal on large boulder		2.13							Borehole dry on August 25, 2014.					
	DEPTH SCALE: 1 to 50       Kollaard Associates       LOGGED: DT         BORING METHOD: Power Auger       AUGER TYPE: 200 mm Hollow Stem       CHECKED: SD														

	RECORD OF BOREHOLE BH3-5121												
PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitt NETRATION TEST HAMMER: 63.5kg. [	center ch Owe Drop. 0.	ns Road 76mm					PROJECT I DATE OF B SHEET 1 of DATUM:	NUMB BORIN	<b>ER:</b> 140208 <b>G:</b> August 25, 2014			
	SOIL PROFILE			SAM		ES							
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH         DYNAL           ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH           °         Cu, kPa         °           20         40         60         80           °         Cu, kPa         °         10         30	VIC CONE TRATION FEST s/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION			
0	Ground Surface	~	106.00										
1	Topsoil (FILL) Grey brown silty sand, some gravel, cobbles and boulders, trace of glass at about 1.8 metres depth (FILL)		0	1	SS SS	9							
				3	ss	23							
2	Grey fine to medium SAND trace to		<u>103.54</u> 2.46	4		20							
3	some gravel and cobbles	•		-		50		· · · · · · · · · · · · · · · · · · ·					
				5	55	24							
		••••		6	SS	24							
5				7	SS	48							
- 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13	End of Borehole, refusal on large boulder or bedrock		100.21	8	SS	94				Borehole dry, August 25, 2014. Water level measured in standpipe at about 5.6 metres below existing ground surface, September 12, 2014.			
DEPTH SCALE: 1 to 75 Kollaard Associates LOGGED: DT													
	BORING METHOD: Power Auger			AL	JGER	TYP	200 mm Hollow Stem C	HECKED: SD					

RECORD OF BOREHOLE BH4-5120												
PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg. D	enter h Owe	ens Road .76mm					PROJECT DATE OF E SHEET 1 0 DATUM:	NUMB BORIN 1	<b>ER:</b> 140208 <b>G:</b> August 25, 2014		
	SOIL PROFILE	, iop, o		SA	MPL	ES						
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 	DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
0	Ground Surface	$\sim$	106.38									
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay and topsoil (FILL)			1	SS	13						
1 				2	SS	6						
2				3	SS	8						
			103.41	4	SS	22				Borehole dry on August 25, 2014.		
	End of Borehole, practical refusal on large boulder		2.97							2014.		
DEPTH SCALE: 1 to 50       Kollaard Associates       LOGGED: DT         BORING METHOD: Power Auger       AUGER TYPE: 200 mm Hollow Stem       CHECKED: SD												

RECORD OF BOREHOLE BH5-5118															
PRO CLI LOO PEN	PROJECT: Proposed Greely Commercial Center     PROJECT NUMBER: 14       CLIENT: OTIS GROUP OF COMPANIES     DATE OF BORING: Aug       LOCATION: 5640 Bank Street and 701 Mitch Owens Road     SHEET 1 of 1       PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm     DATUM:       SOIL PROFILE     SAMPLES														
	SOIL PROFILE			SA	MPL	ES									
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH         D           20         40         60         80           REM. SHEAR STRENGTH           0         Cu, kPa         0           20         40         60         80           REM. SHEAR STRENGTH           0         Cu, kPa         0           20         40         60         80           10         10         10	blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION					
-0-	Ground Surface	$\sim$	105.59												
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay and topsoil (FILL)		404.50	1	ss	28									
-1 	Yellow to grey brown fine to medium SAND, trace to some gravel, cobbles		1.01	2	SS	23									
2			103.46	3	ss	20									
	End of Borehole		2.13							Borehole dry on August 26, 2014.					
8															
DEPTH SCALE: 1 to 50       Kollaard Associates       LOGGED: DT         BORING METHOD: Power Auger       AUGER TYPE: 200 mm Hollow Stem       CHECKED: SD															

PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	Center ch Owe Drop, 0	ens Road .76mm					PROJECT DATE OF E SHEET 1 o DATUM:	NUMB BORIN f 1	<b>ER:</b> 140208 <b>G:</b> August 26, 2014		
	SOIL PROFILE			SA	MPL	ES		DYNAMIC CONE				
(meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	түре	BLOWS/0.3m	Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH           ○         Cu, kPa         ○           20         40         60         80           20         40         60         80           20         40         60         80	PENETRATION TEST blows/300 mm 10 30 50 70 90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
0	Ground Surface	$\sim$	108.25									
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay and topsoil (FILL)	$\sim$	0.00	1	SS	10						
1	Grey brown silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		107.27 0.98	2	SS	40						
2				3	ss	74						
				4	SS	43				Borehole dry on August 26,		
3		•	105.10	F		50				2014.		
4 5 7 8	large boulder											
DEPTH SCALE: 1 to 50 BORING METHOD: Power Auger Auger Auger Auger Auger CHECKED: SD												

	RECORD OF BOREHOLE BH7-5117														
PRO CLI LOO PEN	PROJECT: Proposed Greely Commercial Center     PROJECT NUMBER: 14       CLIENT: OTIS GROUP OF COMPANIES     DATE OF BORING: August       LOCATION: 5640 Bank Street and 701 Mitch Owens Road     SHEET 1 of 1       PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm     DATUM:														
	SOIL PROFILE			SA	MPL	ES									
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 REM. SHEAR STRENGTH ○ Cu, kPa ○ 20 40 60 80 	blows/300 mm		PIEZOMETER OR STANDPIPE INSTALLATION					
0	Ground Surface	$\sim$	105.41												
	Grey brown sand silt, some gravel, cobbles and boulders, sandy silty clay, trace gravel, cobbles, boulders and topsoil (FILL)	$\sim$		1	SS	13									
- 					2	SS	23								
2				3	ss	8									
- - - - - - - - - -	End of Parabola, Drastical refusal on		102.42	4	ss	21				Borehole dry on August 26, 2014.					
	large boulder														
7															
	DEPTH SCALE: 1 to 50       Engineers       LOGGED: DT         BORING METHOD: Power Auger       AUGER TYPE: 200 mm Hollow Stem       CHECKED: SD														

RECORD OF BOREHOLE BH8-5116												
PR CLI LO PE	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	enter h Owe	ens Road .76mm	I					PROJECT   DATE OF E SHEET 1 of DATUM:	NUMB BORIN f 1	ER: 140208 G: August 26, 2014	
	SOIL PROFILE	-17-	-	SA	MPL	.ES						
SCALE ters)		PLOT	ELEV.	ĸ		0.3m	UNDIST. SHEAR STREI × Cu, kPa 20 40 60	NGTH × 80	PENETRATION TEST	ONAL STING	PIEZOMETER OR	
DEPTH (me	DESCRIPTION	STRATA	(M)	NUMBI	TYPE		<b>REM. SHEAR STREN(</b> ○ Cu, kPa 20 40 60	GTH 80	blows/300 mm	ADDITI LAB TE	INSTALLATION	
	Ground Surface		104.76									
	Topsoil (FILL)	Ħ	0.00	1	ss	5						
1	Grey brown sing day (FILL)	H		2	ss	5						
		H		-		40						
2	Grev brown sand trace gravel		102.66	3	55	40		_				
	cobbles, boulders and clay (FILL)	•	101 71	4	ss	18						
-3	Grey silty clay, trace to some gravel and organics (FILL)	H	3.05	5	ss	1						
4		H		6	ss	2		_				
5		H		7	SS	wн						
		H	99.02	8	ss	7						
6	Dark brown sandy silty clay with organics (FILL)	$\left  \widetilde{} \right $	98.66									
Ē	Grey brown fine to coarse SAND, some cobbles and boulders	•	98.06	9	SS	35						
7	End of Borehole, Practical refusal on large boulder or bedrock		6.70					_				
8								_				
											measured in	
9								_			borehole at about 2.8	
											metres below existing ground	
10								_			surface, August	
											level measured	
											about 2.5	
11 											metres below existing ground	
Ē											surface, September 12,	
12								_			-	
13								_				
Kollaard Associates												
	DEPTH SCALE: 1 to 75 LOGGED: DT											
	BORING METHOD: Power Auger			AL	JGEF	R TYF	E: 200 mm Hollow Stem		CHECKED: SD			

PR CLI LO PE	OJECT: Proposed Greely Commercial Commercial Commercial Companies IENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitc NETRATION TEST HAMMER: 63.5kg, D	enter h Owe	REC ens Road .76mm		RD	OF	BOREHOLE BH9-	5115 PROJECT DATE OF E SHEET 1 0 DATUM:	NUMB BORIN f 1	<b>ER:</b> 140208 <b>G:</b> August 26, 2014
	SOIL PROFILE			SA	MPL	ES				
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH           ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH         ○         Cu, kPa         ○           20         40         60         80	DIVIANUC CONE           PENETRATION           TEST           blows/300 mm           10         30         50         70         90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-0-	Ground Surface		104.70							
	Grey brown silty clay, trace to some sand, gravel (FILL)			1	SS	10				
- - - - - 1 -				2	SS	8			-	
2				3	SS	2				
- - - - - - - - - - - - - - - - - - -				4	SS	3				
				5	SS	1				Ţ
4				6	SS	4				Water observed in
5 5 				7	SS	3				borehole at about 3.8 metres below the existing ground
	Grey brown fine to coarse SAND, trace to some gravel and cobbles		98.96 5.74	8	SS	20				surface, August 26, 2014
	End of Borehole, Practical refusal on	•	98.00	9	SS	44				
- 7 	large boulder									
- - - - - - - - - - - - - - - - - - -										
	DEPTH SCALE: 1 to 50 BORING METHOD: Power Auger	1	(K		Koll Engin		d Associates	LOGGED: DT		

			REC	CO	RD	OF	BOREHOLE BH10	-5113	
PR CLI LO PEI	DJECT: Proposed Greely Commercial Co ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitcl NETRATION TEST HAMMER: 63.5kg, D	enter h Owe rop, 0.	ns Road 76mm					PROJECT NUN DATE OF BOR SHEET 1 of 1 DATUM:	<b>IBER:</b> 140208 ING: August 27, 2014
	SOIL PROFILE			SA	MPL	ES			
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	Cu, kPa         ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH           0         Cu, kPa         0           20         40         60         80	PENETRATION TEST         DOM           blows/300 mm         10         30         50         70         90         4	PIEZOMETER OR STANDPIPE INSTALLATION
-0-	Ground Surface		103.78						
	Grey brown silty clay, trace to some sand and gravel (FILL)	H	0.00	1	SS	4			
1		H		2	SS	2			
2	Yellow brown silty sand,some gravel, cobbles and boulders, trace clay		101.95 1.83 101.50	3	SS	18			
	(FILL) Grey brown silty clay, trace to some sand, gravel and topsoil (FILL)	H.	2.28	4	SS	7			
		H		5	SS	2			
4		H		6	SS	5			
5			-	7	SS	9			
		Ħ	- - - -	8	SS	5			
6		H	-	9	SS	5			
7			00.40						
	Grey fine to medium SAND	<u>-17</u> -	7.29	10	ss	WH			
8	End of Borehole		95.55 8.23	11	55	4			<u>:]=</u> [
-10 -11 -12 -13					Koll		d Associates		Water level measured in borehole at about 3.8 metres below existing ground surface, August 27, 2014. Water level measured in standpipe at about 0.0 metres below existing ground surface, September 12, 2014.
	DEPTH SCALE: 1 to 75		C	ノ		laar eers	d Associates	LOGGED: DT	
	BORING METHOD: Power Auger			AU	JGER	TYP	E: 200 mm Hollow Stem	CHECKED: SD	

Γ

PR( CLI LO(	DJECT: Proposed Greely Commercial Co ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitcl	enter h Owe	REC		RD	OF	BOREHOLE BH11	-5114 PROJECT I DATE OF B SHEET 1 of	NUMB ORIN	ER: 140208 G: August 26, 2014
		100, 0	., omm	S۵	MPI	FS		DATOM.		
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	Түре	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 REM. SHEAR STRENGTH ° Cu, kPa ° 20 40 60 80 	DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		105.27							
_ _ _ _ _	Grey brown silty clay, trace to some sand, gravel and topsoil(FILL)	$\langle \rangle \rangle \langle \rangle$		1	SS	8				
1 		$\begin{pmatrix} \chi \\ \chi \\ \chi \\ \chi \\ \chi \\ \chi \end{pmatrix}$		2	SS	3				
2		/ /		3	SS	WH				
				4	SS	WH				
-		7 7 7		5	SS	WH				
4 		111		6	SS	WH				
5 5		////		7	SS	3				
6		/ / /		8	SS	WН				×
		× / /		9	SS	wн				Water observed in borehole at
- <b>7</b> - 7 	Grey fine to medium SAND End of Borehole	2	98.03 7.24 97.81 7.46	10	SS	5				metres below the existing ground surface,
										August 27, 2014
	DEPTH SCALE: 1 to 50 BORING METHOD: Power Auger	<u>.</u>	Œ		Koll Engin JGER		d Associates E: 200 mm Hollow Stem	LOGGED: DT CHECKED: SD		

CL LO PE	OJECT: Proposed Greely Commercial C IENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	enter ch Owe Drop, 0	ns Road .76mm	I				PROJECT N DATE OF BC SHEET 1 of 1 DATUM:	UMBI DRING	ER: 140208 5: August 27, 2014
	SOIL PROFILE			SA	MPL	ES		DYNAMIC CONE		
DEPTH SCALE (meters)	DESCRIPTION	TRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	× Cu, kPa × 20 40 60 80 <b>REM. SHEAR STRENGTH</b> ◦ Cu, kPa ◦ 20 40 60 80	PENETRATION TEST blows/300 mm	AUUITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	0	106 11							
-1 -2 -3 4 -5 -6 -7	Grey brown sandy, clayey silt, trace gravel and organics, rubber debris (FILL)	X + + + + + + + + + + + + + + + + + + +	100.01 6.10	1	SS SS	8				Borehole dry on August 27, 2014.
-										
-8	End of Borehole		97.89 8.22	3	SS	8				

PR CLI LO PEI	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitc NETRATION TEST HAMMER: 63.5kg, D	Center ch Owe Drop, 0	ens Road .76mm			0.	BOREHOLE BIIK	PROJECT DATE OF SHEET 1 DATUM:	NUME BORIN of 1	<b>BER:</b> 140208 I <b>G:</b> August 28, 2014
ALE	SOIL PROFILE	F		SA	MPL	ES E	UNDIST. SHEAR STRENGTH	DYNAMIC CONE PENETRATION	GĽ	
DEPTH SCA (meters)	DESCRIPTION	STRATA PLO	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3n	20         40         60         80           REM. SHEAR STRENGTH           °         Cu, kPa         °           20         40         60         80	TEST blows/300 mm 10 30 50 70 90	ADDITIONA LAB TESTIN	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface	$\sim$	110.68							
_	Grey brown SILTY SAND	$\uparrow \sim$								
2										Borehole dry on August 28, 2014.
5			105 50	1	SS	27				
	End of Borehole		5.18							
	DEPTH SCALE: 1 to 50		(K			laai	Associates			

PRO CLII LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mit IETRATION TEST HAMMER: 63.5kg, I	Center ch Owe Drop, 0	ens Roac .76mm	I				PROJECT NUM DATE OF BORII SHEET 1 of 1 DATUM:	BER: 140208 NG: August 28, 2014
	SOIL PROFILE			SA	MPL	ES		DYNAMIC CONE	
UEPTH SCALE (meters)	DESCRIPTION	TRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	x         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH         °         Cu, kPa         °           0         40         60         80	PENETRATION J 9 TEST VILS blows/300 mm LIGR 10 30 50 70 90 VE	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	0	110.20			_			
-0	Topsoil (FILL)	~~	110.30						
- 1	Red brown silty sand,some topsoil (FILL)		0.20						
	Grey brown silty clay (FILL)	#1#1#1#1#1#1#1#1#1#1#1#1	1.06						Borehole dry on August 28, 2014.
-5	End of Borehole		105.12 5.18	1	ss	5			
6									
8									
l I I	DEPTH SCALE: 1 to 50 BORING METHOD: Power Auger	_	Œ		Kol Engin JGER		d Associates :: 200 mm Hollow Stem	LOGGED: DT CHECKED: SD	1

			REC	CO	RD	OF	BOREHOLE BH1	5-5103		
PR CLI LO PE	DJECT: Proposed Greely Commercial Ce ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitcl NETRATION TEST HAMMER: 63.5kg. D	enter h Owe rop. 0	ens Road .76mm	I				PROJECT DATE OF SHEET 1 0 DATUM:	NUMB BORIN of 1	ER: 140208 G: August 28, 2014
	SOIL PROFILE	-1, -	-	SA	MPL	ES				
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 REM. SHEAR STRENGTH ° Cu, kPa ° 20 40 60 80	blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-0	Ground Surface	$\sim$	104.70							
E	Red brown silty sand some topsoil		0.00							
	(FILL)								_	
Ē			102.87							
2	Grey brown SILTY SAND		1.83							
3									_	Borehole dry on August 28, 2014.
4										
				1	SS	19				
5 	End of Borehole		99.52 5.18							
6										
- 										
_										
-										
-										
8										
-										
EI										
	DEPTH SCALE: 1 to 50	<u> </u>	(K		Koll Engin	laai	Associates	LOGGED: DT	<u> </u>	
	BORING METHOD: Power Auger			AL	JGER	TYP	: 200 mm Hollow Stem	CHECKED: SD	)	

			REC	COI	RD	OF	BOREHOLE BH16	-5101	
PRO CLI LOO PEI	DJECT: Proposed Greely Commercial Co ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mitc NETRATION TEST HAMMER: 63.5kg, D	enter h Owe rop, 0.	ns Road .76mm					PROJECT NUM DATE OF BORI SHEET 1 of 1 DATUM:	BER: 140208 NG: August 28, 2014
	SOIL PROFILE			SA	MPL	ES			
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH           ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH         ○         Cu, kPa         ○           20         40         60         80	blows/300 mm 10 30 50 70 90	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		105.00						
	Topsoil (FILL) Yellow brown silty sand, some gravel, cobbles and boulders, trace clay (possibly FILL)		(104 10						
	End of Borehole, refusal on large boulder		0.90						Borehole dry on August 28, 2014.
	DEPTH SCALE: 1 to 50 BORING METHOD: Power Auger		(K		Koll Engin		d Associates E: 200 mm Hollow Stem	LOGGED: DT CHECKED: SD	

			REC	COI	RD	OF	BOREHOLE	3H17-	-5119		
PR CLI LO PE	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, [	Center ch Owe Drop, 0	ns Road .76mm	l					PROJECT DATE OF E SHEET 1 of DATUM:	NUMB BORIN 1	<b>ER:</b> 140208 <b>G:</b> August 28, 2014
	SOIL PROFILE			SA	MPL	ES					
I SCALE eters)		PLOT	ELEV.	ER		s/0.3m	UNDIST. SHEAR STRE × Cu, kPa 20 40 60	80 1	PENETRATION TEST	IONAL STING	PIEZOMETER OR STANDPIPE
DEPTF (me	DESCRIPTION	STRATA	(M)	NUMB	ТҮРЕ	BLOWS	REM. SHEAR STREN           ○         Cu, kPa           20         40         60	<b>IGTH</b> 80	blows/300 mm 10 30 50 70 90	ADDIT LAB TE	INSTALLATION
	Ground Surface		105.69								
1	Grey brown silty clay, some sand, gravel, cobbles and topsoil with depth (FILL)	HHHHHH									
3		# # # # # #									
5	Grey brown fine to medium SAND,		<u>99.59</u> 6.10								
-7	trace to some gravel	•		1	SS	2					
				2	SS	2					
8	Fod of Dorobolo	•••	97.46	3	55	31					
9			0.20								Borehole dry, August 28, 2014. Water
10 11 11											level measured in standpipe at about 4.6 metres below existing ground surface, September 12, 2014
12											2017.
1	DEPTH SCALE: 1 to 75		(K		Koll	laai	d Associates		LOGGED: DT	II	
				AL	GER	L I TH			UNEUNED: SD		

			REC	CO	RD	OF	BOREHOLE BH18	-5107		
PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	enter h Owe Drop, 0	ens Roac .76mm	I				PROJECT DATE OF SHEET 1 0 DATUM:	NUMB BORIN of 1	BER: 140208 IG: August 28/29, 2014
	SOIL PROFILE			SA	MPL	ES				
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 REM. SHEAR STRENGTH ° Cu, kPa ° 20 40 60 80 - 40 60 80	DYNAMIC CONE PENETRATION TEST blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_0	Ground Surface		107.15							
	Grev brown silty clay (FILL)	Æ	0.00	1	ss	5				
-1		H				2				
				2		3				
2		H		3	SS	wн				
				4	SS	1				▼
3	Grev brown silty sand some gravel		104.00							-
	cobbles and boulders, trace clay and topsoil (FILL)			5	SS	9				
4	Grey brown fine to medium SAND, trace to some silt	1.	<u>,103.04</u> 4.11	6	SS	13				Water level
5				7	SS	17				borehole at about 5.7
				8	22	20				metres below existing ground
6						20				28, 2014.
	End of Borehole		100.45 6.70	9	SS	27				
-7										
8										
9										
10										
11										
Ē										
12										
Ē										
13										
			(K		Kol	laai	d Associates			
	DEPTH SCALE: 1 to 75			1	Engin	eers	<b>5</b> 000	LOGGED: DT		
	BORING METHOD: Power Auger			AU	IGEF	K TYP	E: 200 mm Hollow Stem	CHECKED: SD		

			REC	0	RD	OF	BOREH	OLE	BH19-	-5106		
PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	Center ch Owe Drop, 0	ns Road .76mm							PROJECT DATE OF I SHEET 1 0 DATUM:	NUMB BORIN f 1	<b>ER:</b> 140208 <b>G:</b> August 29, 2014
	SOIL PROFILE	-		SA	MPL	ES						
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	UNDIST. SH × C 20 40 REM. SHE ° C 20 40 20 40	EAR STR u, kPa 60 AR STRE cu, kPa 60 60	ENGTH 80 NGTH 80 0 80	DYNAMIC CONE           PENETRATION           TEST           blows/300 mm           10         30         50         70         90	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-0	Ground Surface		105.37									
=	Topsoil (FILL)	Æ	0.00									
2 3 4	Grey brown silty clay, some sand with depth (FILL)											Water observed in borehole at about 6.7 metres below existing ground surface, August 29, 2014.
7 8 9 10	Grey fine to mediumSAND		6.70	1	SS	3						
12	End of Borehole		93.34 12.03	2	SS	11						
=l	DEPTH SCALE: 1 to 75 BORING METHOD: Power Auger		(K	)	Kol Engin JGER		rd Associa E: 200 mm Holl	ites ow Stem		LOGGED: DT CHECKED: SD	<u> </u>	

Γ

PR CLI LO PE	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	enter ch Owe	REC		RD	OF	BOREHOLE BH20	-5110 PROJECT DATE OF I SHEET 1 c DATUM:	NUMB BORIN of 1	<b>ER:</b> 140208 <b>G:</b> August 29, 2014
	SOIL PROFILE			SA	MPL	ES				
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80 REM. SHEAR STRENGTH ° Cu, kPa ° 20 40 60 80	DYNAMIC CONE PENETRATION TEST blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		108 52							
_ 0		1	0.00							
	Grey brown silty clay (FILL)			1	SS	8				
1		H	-	2	SS	7				
2		H		3	ss	3				
		H		4	ss	2				
3		H		5	ss	3				
4	Grey brown to grey silty sand, trace		104.53 3.99	6	SS	11				
	to some clay and topsoil and wood (FILL)	7		7	SS	5				
5		///				6				
6		///								
7		7		9	SS	5				-
		/ /		10	SS	4				÷
8		2		11	SS	20				Water level
9		7		12	ss	5				borehole at about 7.1
	Grey fine to medium SAND, trace to	/	98.92 9.60	13	SS	3				existing ground surface, August
10	some gravel		98.01	14	ss	38				29, 2014.
_	End of Borehole	-	10.51							
11										
=										
_										
12										
Ē										
=										
13										
=										
			(P	5	Kall	0.00	d Accociator			
	DEPTH SCALE: 1 to 75		C	2	Engin	eers	u Associates	LOGGED: DT		
	BORING METHOD: Power Auger			AL	JGER		E: 200 mm Hollow Stem	CHECKED: SD		

RECORD OF BOREHOLE BH21-5109										
PRO CLI LOO PEN	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mito NETRATION TEST HAMMER: 63.5kg, D	enter h Owe	ns Road 76mm	I				PROJECT DATE OF SHEET 1 0 DATUM:	NUMB BORIN of 1	ER: 140208 G: August 26, 2014
	SOIL PROFILE			SA	MPL	ES				
DEPTH SCALE (meters)	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	NUMBER	ТҮРЕ	BLOWS/0.3m	UNDIST. SHEAR STRENGTH           ×         Cu, kPa         ×           20         40         60         80           REM. SHEAR STRENGTH         ∘         Cu, kPa         ∘           20         40         60         80	blows/300 mm	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-0	Ground Surface	~	107.19							
	Topsoil (FILL) Grey brown silty sand, some gravel, cobbles and boulders, trace clay and topsoil (FILL)		0.00	1	SS	13				
- - -1 -			105.97	2	ss	23				
_	Red brown silty sand (FILL)		105.67							
2	Grey brown silty clay (FILL)	HHH	1.52	3	SS	8			_	
			104.30	4	ss	21				Borehole dry on August 29,
	End of Borehole		2.09							2014.
	DEDTH SCALE. 1 to 50		(K	)	Kol	laai	d Associates			
			•	A1			E: 200 mm Hollow Stom			
	BORING METHOD: Power Auger     AUGER TYPE: 200 mm Hollow Stem     CHECKED: SD									

	RECORD OF BOREHOLE BH22-5112									
PRO CLI LOO PEM	DJECT: Proposed Greely Commercial C ENT: OTIS GROUP OF COMPANIES CATION: 5640 Bank Street and 701 Mite NETRATION TEST HAMMER:	Center ch Owe	ens Road					PROJECT DATE OF SHEET 1 c DATUM:	NUMB BORIN f 1	<b>ER:</b> 140208 <b>G:</b> August 28, 2014
	SOIL PROFILE			SA	MPL	ES		DYNAMIC CONF		
H SCALE neters)	DESCRIPTION	A PLOT	ELEV. DEPTH	BER	ш	/S/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80	PENETRATION TEST	TIONAL ESTING	PIEZOMETER OR STANDPIPE
DEPT (n		STRAT	(M)	MUN	ТҮГ	BLOW	REM. SHEAR STRENGTH           ○         Cu, kPa         ○           20         40         60         80	blows/300 mm	ADDI LAB T	
0	Ground Surface	$\sim$	104.45							
	Grev brown SILTY SAND trace	$\sim$	0.23							
-	gravel and cobbles with depth		103.71							
F,	End of Augerhole		0.74							
2									_	
-										
										Augerhole dry
3										2014.
-										
-										
Ē										
5										
-										
-										
6										
-										
7										
-										
8										
Εl										
			ſ	)	Kol	laai	d Associates	1		
	DEPTH SCALE: 1 to 50 LOGGED: DT									
	BORING METHOD: Hand Auger AUGER TYPE: Hand Auger CHECKED: SD									

#### TABLE I

#### RECORD OF TEST PITS GEOTECHNICAL INVESTIGATION PROPOSED GREELY COMMERCIAL CENTER 5640 BANK STREET AND 7041 MITCH OWENS DRIVE OSGOODE WARD, GREELY CITY OF OTTAWA, ONTARIO

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1 (near BH1-5123) (Elev. 105.53)	0.00 – 1.52	Grey brown sand, some gravel, topsoil concrete debris, vinyl siding, wood, clay large boulders (FILL)
	1.52 – 2.13	Grey brown SAND and GRAVEL, trace to some cobbles and boulders with depth
	2.13	End of test pit
Test pit dry, September 23, 2014.		
TP2 (near BH2-5122) (Elev. 105.24)	0.00 – 1.52	Grey brown sand, some gravel, topsoil concrete debris, shale, wood and large boulders (FILL)
	1.52 – 2.13	Grey brown SAND and GRAVEL, trace to some cobbles and boulders with depth
	2.13	End of test pit
Test pit dry, September 23, 2014.		

# TABLE I(continued)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
Nomber		
TP3 (west of BH4-5120) (Elev. 106.38)	0.00 – 3.35	Grey brown sand, some gravel, topsoil concrete debris, wire, wood, clay tile, asphaltic concrete and large boulders (FILL)
	3.35	End of test pit
Test pit dry, September 23, 2014.		
(Elev. 105.41)	0.00 – 2.89	Grey brown sand, some gravel, topsoil wood and large boulders (FILL)
	2.89 – 3.35	Grey brown SAND and GRAVEL, trace to some cobbles and boulders with depth
	3.35	End of test pit
Test pit dry, September 23, 2014.		



#### TABLE I

#### RECORD OF TEST PITS SUBSURFACE INVESTIGATION PROPOSED COMMERCIAL DEVELOPMENT BANK STREET AT MITCH OWENS ROAD CITY OF OTTAWA, ONTARIO

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1	0.0 - 0.6	Grey brown silty sand, some gravel and clay (FILL)
	0.6 - 0.8	TOPSOIL
	0.8 – 2.7	Grey brown silty sand, some gravel, cobbles and large boulders (GLACIAL TILL)
	2.7	End of test pit in glacial till
0.0 depth is about 1.2 metres above level ground at toe of slope	e level ground at toe of	slope and ended about 1.5 metres below

Test pit dry, April 24, 2014.

TP2	0.0 - 0.6	Grey brown silty sand, some gravel and clay and topsoil (FILL)
	0.6 – 1.8	Grey brown silty sand, some gravel, cobbles and large boulders (GLACIAL TILL)
	1.8	End of test pit in glacial till

0.0 depth is about 0.9 metres above level ground at toe of slope and ended about 0.9 metres below level ground at toe of slope

Test pit dry, April 24, 2014.

#### TABLE I (continued)

# **RECORD OF TEST PITS**

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP3	0.0 – 0.6	Grey brown sandy clay, some gravel and topsoil (FILL)
	0.6 – 2.3	Grey brown SILTY SAND, some gravel
	2.3 – 2.5	Grey brown silty sand, some gravel, cobbles and large boulders (GLACIAL TILL)
	2.5	End of test pit, refusal on large boulder

0.0 depth is about 1.3 metres above level ground at toe of slope and ended about 1.2 metres below level ground at toe of slope

Test pit dry, April 24, 2014.

TP4

0.0 – 1.0	Grey brown silty sand, some gravel and clay (FILL)
1.0 – 1.2	TOPSOIL
1.2 – 2.7	Grey brown silty sand, some gravel, cobbles and large boulders (GLACIAL TILL)
2.7	End of test pit in glacial till

0.0 depth is about 1.3 metres above level ground at toe of slope and ended about 1.4 metres below level ground at toe of slope

Test pit dry, April 24, 2014.









FIGURE 4



November 6, 2014

Attachment A Laboratory Test Results for Chemical Properties

# **EXOVA** ENVIRONMENTAL ONTARIO

**Certificate of Analysis** 



Client: Attention:	Kollaard Associates Inc. 210 Prescott St., Box 189 Kemptville, ON K0G 1J0 Mr. Dean Tataryn		Report Number: Date Submitted: Date Reported: Project: COC #:	1420324 2014-09-23 2014-09-30 140208 175683
PO#: Invoice to:	Kollaard Associates Inc.	Page 1 of 3	000 #.	110000

#### Dear Dean Tataryn:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL:

Lorna Wilson Laboratory Supervisor, Inorganics

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Exova (Ottawa) is certified and accredited for specific parameters by: CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is accredited for specific parameters by: SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

# **EXOVA** ENVIRONMENTAL ONTARIO

**Certificate of Analysis** 



Client:	Kollaard Associates Inc.			
	210 Prescott St., Box 189			
	Kemptville, ON			
	K0G 1J0			
Attention:	Mr. Dean Tataryn			
PO#:				
Invoice to:	Kollaard Associates Inc.			

Report Number:	1420324
Date Submitted:	2014-09-23
Date Reported:	2014-09-30
Project:	140208
COC #:	175683

				Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1135269 Soil 2014-09-22 BH1-5123
Group	Analyte	MRL	Units	Guideline	
Agri Soil	рН	2.0			8.0
General Chemistry	CI	0.002	%		<0.002
-	Electrical Conductivity	0.05	mS/cm		0.09
-	Resistivity	1	ohm-cm		11100
	SO4	0.01	%		<0.01

 Guideline =
 \* = Guideline Exceedence

 All analysis completed in Ottawa, Ontario (unless otherwise indicated by \*\* which indicates analysis was completed in Mississauga, Ontario).

 Results relate only to the parameters tested on the samples submitted.

 Methods references and/or additional QA/QC information available on request.

 146 Colonnade Rd. Unit 8, Ottawa, ON K2E 7Y1

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

Page 2 of 3

# **EXOVA** ENVIRONMENTAL ONTARIO

**Certificate of Analysis** 



Client:	Kollaard Associates Inc.
	210 Prescott St., Box 189
	Kemptville, ON
	K0G 1J0
Attention:	Mr. Dean Tataryn
PO#:	
Invoice to:	Kollaard Associates Inc.

Report Number:	1420324
Date Submitted:	2014-09-23
Date Reported:	2014-09-30
Project:	140208
COC #:	175683

#### QC Summary

	Analyte				Blank		QC % Rec	QC Limits
Run No	276786	Analysis Date	2014-	09-24	Method	С	CSA A23.2-4B	
CI					<0.002 %		108	90-110
Run No	276950	Analysis Date	2014-	09-26	Method	Со	nd-Soil	
Electrica	I Conductivity							85-115
рН								90-110
Run No	277139	Analysis Date	2014-	09-30	Method	Re	sistivity - soil	
Resistivit	ty							
SO4					<0.01 %			70-130

Page 3 of 3



November 6, 2014

Attachment B Laboratory Test Results for Physical Properties





Sieve Analysis LS 602 ASTM C136

ASTINICI				Client: Kollaard Associates Engineers File #140208											
1224100	Number:	Project		, File #140208	ciates Engineers	Kollaard Asso		Client:							
				Centre	ely Commercial	Proposed Gre		roject:							
					ates:	Soils / Aggreg	уре:	laterial 7							
						Fill/Granulars	Use:	roposed							
					')	BH5119 (BH17		ource:							
						SS3	lumber:	ample N							
						25'-27'	)epth:	ample D							
Brian Prevo	ested By:	T		i	ciates Engineers	Kollaard Asso	By:	ampled							
tember 15, 20	e Tested: Sep	Date			14	August 28, 20	npled:	Date Sam							
	ash Test Data	W													
611.3	Before Wash, (g):	nple Weight	Sar												
542.6	ht After Wash, (g):	ample Weig	S												
11.2	ssing No. 200, (g):	Percent Pa													
1			alysis	Sieve An											
	No Envi	nt	Perce	Weight	Siz										
ыоре		g	Passir	ed 🛛	Retair	ening	Sieve Op No.								
Maximum	Minimum		%		9	mm	No. Inches mm								
						150.0	6								
						106.0	4								
						76.2	3								
			100.0		0.0	53.0	2								
			90.8		56.2	26.5	1								
			78.8	3	129.	19.0	3/4								
			77.3	)	139.	16.0	5/8								
			76.2	3	1/2										
			75.7	3	3/8										
			72.1	3	170.	4.75	0.187								
	· · · · · · · · · · · · · · · · · · ·		8. I	and the second		- 4.75		+4							
			67.0	201.7		2.36	0.0937	8							
			60.9	2	239.	1.18	0.0469	16							
			51.2	3	298.	0.600	0.234	30							
			32.6	9	411.	0.300	0.0117	50							
			18.6	7	497.	0.150	0.0059	100							
			12.2	7	536.	0.075	0.0029	200							
10.0				7	541	Pan									
12.2	% Silt & Clay:	59.9	% Sand:	27.9	% Gravel:	f Sample:	sification of	Clas							



V:\01224\active\laboratory\_standing\_offers\2014 Laboratory Standing Offers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\[Wash Sieve, BH5119,xlsx]Cover

Stantec 2781 Lancaster Road, Suite 101 Ottawa ON, K1B 1A7

	PROJECT DETAILS	0	
Client:	Kollaard Associates Engineers, File #140208	Project No.:	122410003
Project:	Proposed Greely Commercial Centre	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates
Source:	BH5111 (BH6)	Date Sampled:	August 26, 2014
Sample No.:	SS3	Tested By:	Beth Frank
Sample Depth:	5'-7'	Date Tested:	September 9, 2014

A ION 2.750 0.978 24

HYDROMETER DETAILS	として
Volume of Bulb (V <sub>B</sub> ), (cm <sup>3</sup> )	63.0
Length of Bulb (L <sub>2</sub> ), (cm)	14,47
Length from '0' Reading to Top of Bulb (L1), (cm)	10.29
Scale Dimension (h <sub>*</sub> ), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm <sup>2</sup> )	27.2
Meniscus Correction (H <sub>m</sub> ), (g/L)	1.0

START TIME

7:00 AM

CALCULATION OF DRY SOIL N	ASS
Oven Dried Mass (W <sub>o</sub> ), (g)	34,22
Air Dried Mass (W <sub>a</sub> ), (g)	34.04
Hygroscopic Corr, Factor (F=W <sub>o</sub> /W <sub>a</sub> )	1.0053
Air Dried Mass in Analysis (M <sub>a</sub> ), (g)	51.67
Oven Dried Mass in Analysis (M <sub>o</sub> ), (g)	51.94
Percent Passing 2.0 mm Sieve (P10), (%)	57,69
Sample Represented (W), (g)	90.04

	a
	ā.
	0
	Ĭ
	Ĭ.
	<u>0</u>
	Ň
	2
	2
	ฉ
	2
	S
	S
	0
	Ť
-	S
2	<u>0</u> .
Š	S
-	

LS702 ASTM D422

27.49	Percent Passing Corrected (%)
47.7	Percent Passing No. 200 Sieve (%)
27,19	Sample Weight after Hydrometer and Wash (g)
51.94	Oven Dry Mass In Hydrometer Analysis (g)
	WASH TEST DATA

PERCENT LOSS IN SIEVE         Sample Weight Before Sieve (g)       1109.40         Sample Weight After Sieve (g)       1108.40         Percent Loss in Sieve (%)       0.09		
Sample Weight Before Sieve (g)         1109.40           Sample Weight After Sieve (g)         1108.40	0.09	Percent Loss in Sieve (%)
Sample Weight Before Sieve (g) 1109.40	1108.40	Sample Weight After Sieve (g)
PERCENT LOSS IN SIEVE	1109.40	Sample Weight Before Sieve (g)
		PERCENT LOSS IN SIEVE

				_																	
Note 1: (C + F) =	PAN	0.075	0.106	0.250	0.425	0.850	Total (C + F)	2.00	4.75	9.5	13,2	19.0	26.5	37.5	53.0	63.0	75.0	Sieve Size mm	SIEV	Percent Los	Sample Weight /
: Coarse + Fine	27.07	27.00	25.68	21.08	16.95	10.33	1108.40	469.4	355.5	227.2	154.9	58.6	46.0	0,0				Cum. Wt. Retained	E ANALYS	s in Sieve (%)	After Sieve (g)
U		27.70	29.17	34.28	38,86	46.22		57.7	68.0	79.5	86.0	94.7	95.9	100.0	100.0	100.0	100.0	Percent Passing	SIS	0.09	1108.40

V:101224/active\laboratory_standing_offers\2014 Laboratory Standing Offers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete		
standing_offers\2014 Laboratory Standing Offers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	V:\01224\active\laboratory	
offers\2014 Laboratory Standing Offers\10003 Kollaard Associates\Solls & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	_standing	
Laboratory Standing Offers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	offers\2014	
Standing Offers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	Laboratory	
)ffers\10003 Kollaard Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	Standing C	
rrd Associates\Soils & Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	)ffers\10003 Kollaa	
. Aaggregates\September 12, Sieve & Hyd., File #140208\Hydromete	ard Associates\Soils &	
12, Sieve & Hyd., File #140208\Hydromete	Aaggregates\September	
File #140208\Hydromete	12, Sieve & Hyd., I	k
9r.xlsx	File #140208\Hydrometer.xlsx	A STATE OF

				HYD	ROMETER A	NALYSIS	UI	3		1.1.1	
		Elapsed Time	щ	H°	Temperature	Corrected Reading	Percent Passing				Diameter
Date	Time	Т	Divisions	Divisions	T,	R = H <sub>a</sub> - H <sub>c</sub>	σ	F	η	~	D
		Mins	g/L	9/L	°C	g/L	%	cm	Poise		mm
09-Sep-14	7:01 AM	1	23,5	3,5	23,0	20,0	21 73	12.56941	9.39251	0.012818	0.04545
09-Sep-14	7:02 AM	2	23.0	3.5	23.0	19.5	21.19	12.64691	9.39251	0.012818	0.03223
09-Sep-14	7:05 AM	5	21.5	3.5	23.0	18.0	19.56	12.87941	9.39251	0.012818	0.02057
09-Sep-14	7:15 AM	15	18.0	3.5	23.0	14.5	15,76	13.42191	9.39251	0.012818	0.01213
09-Sep-14	7:30 AM	30	14.5	3,5	22.5	11.0	11.95	13.96441	9.50295	0.012894	0.00880
09-Sep-14	8:00 AM	60	12.5	3.5	22.5	9.0	9.78	14.27441	9.50295	0.012894	0.00629
09-Sep-14	11:10 AM	250	10.0	3.5	21.5	6.5	7.06	14.66191	9.73081	0.013047	0.00316
10-Sep-14	7:00 AM	1440	8.0	3,5	21.5	4.5	4.89	14.97191	9.73081	0.013047	0.00133
Remarks:							Reviewed By:	Brian	Re	rest	
							Date:	Scotor	ber 17	12014	
Vivot and and in ollabor	aton, standing offers	NOD4 4 1 aborators	Chanding Office	~140000 221222	d Accordance Colla	8 Apparenter Conton	abor 10 Cinus 9 Liv		091Ludenmoto		



November 6, 2014

Attachment C Water Well Records

Ontario Ministry of the Environment	Well	Tag No. (Place Sticker a	and/or Print Below)	Regulatio	n 903 Ontario	Well R Water Res	Record
Well Owner's Information		<u> </u>		]		ye	<u> </u>
First Name Last Name Or	ganization		E-mail Address	110		Well (	Constructed
Mailing Address (Street Number/Name)	15	Municipality	Province	HC 109	ers.com	by We	erea codel
3338 Dufferin St		Taronto	ON	MAAS	A4416	2489	2181313
Well Location		1 10.01110	I	1.10/10	<u>              -</u>		<u>AU99</u>
Address of Well Location (Street Number/Name)		Township		Lot	Conces	sion	
County/District/Municipality	EET				Province	Postal	Code
CITY OF OTTAWA (F	ZMOC)	GREELY			Ontario	K 4	PIOIATI
UTM Coordinates Zone Easting North	ning	Municipal Plan and Subl	ot Number		Other		
NAD 8 3 1 0 9 4 7 5 5 50	13714		1 1 1 1 1 1				
General Colour Most Common Material		c <b>ora</b> <i>(see instructions on the</i> )ther Materials	Back of this form)	ral Description	1	_ Dep	th ( <i>m/ft</i> )
			by and sol	2		From	
OKET CLAUCESTIC	SIL	JORGANICS	Uter wrat	сл-		0.0m	0.1m
skey chay	SIT/S	AND/GRAVEL	HU			0.2m	1.0m
GREY CHAY SAND	STONE	GRAVEL /CLAY	E NA	NVE		TiDn	10.0 m
		•					
Annular Sp	ace		F	Results of We	ell Yield Testi	na	1
Depth Set at ( <i>m/ft</i> ) Type of Sealan	it Used	Volume Placed	After test of well yield,	water was:	Draw Dowr		covery
From To (Material and T	ype)	(march)	Clear and sand fr	ee	( <i>min</i> ) ( <i>m/ft</i> )	evel Time   \ ) ( <i>min</i> )	Water Level (m/ft)
0 18 bentonite	*	4.5 ++	If pumping discontinue	d, give reason:	Static		100
18 30 Sand		244°			1	1	
			Pump intake set at (n	₁/ft)			
					2		
Method of Construction	Well L	lse	Pumping rate (I/min / 0	GPM)	3	/ 3	
Cable Tool Diamond Public	Comm	nercial 🗌 Not used	Duration of numping		4	4	
Rotary (Conventional)     Jetting     Domes     Rotary (Reverse)     Driving     Livestr	stic 🗌 Munic	ipal Dewatering	hrs + m	nin	5	5	
Boring	on Coolin	g & Air Conditioning	Final water level end of	f pumping (m/ft)	10	10	
☐ Air percussion ☐ Industr ☐ Other. specify ☐ Other	ial specify				45	45	
Construction Record - Casing		Status of Well	If flowing give rate (I/m	nin / GPM)	- 10	15	
Inside Open Hole OR Material Wall	Depth (m(ft))	Water Supply	Recommended pump	depth (m/ft)	20	20	·····
<i>(cm/in)</i> (Galvanized, Fibreglass, Thickness ( <i>cm/in</i> ) Concrete, Plastic, Steel) ( <i>cm/in</i> )	From To	Replacement Well			25	25	
2"	0' 70'	Recharge Well	Recommended pump (I/min / GPM)	rate	30	30	
pastic		Dewatering Well			40	40	*****
		Monitoring Hole	well production (I/min	/ GPM)	50	50	
		(Construction)	Disinfected?	· · · · ·			
		Abandoned, Insufficient Supply	Yes No		60	60	
Construction Record - Screen	Donth (m(ff))	Abandoned, Poor	Please provide a man t	Map of We	Il Location	e back	
Diameter (cm/in) (Plastic, Galvanized, Steel) Slot No.	From To	Abandoned, other,		selett ienetting		o buon.	
2.2." (main)	20' 20'	specify					
doc plastic 10	0 20	Other, specify					
The second s	and the second						
Water Details		Hole Diameter					
( <i>m/ft</i> ) Gas Other specify	ntested De From	To (cmm)					
Vater found at Depth Kind of Water: Fresh	ntested 🖒	30' 7"					
( <i>m/ft</i> ) Gas Other, specify							
Vater found at Depth Kind of Water: Fresh	ntested						
(m/m)Gas  Other, specify	 						
usiness Name of Well Contractor	nnician informa	ell Contractor's Licence No.					
Henderson Drilling Inc		7 4 8 8					
usiness Address (Street Number/Name)	M	unicipality	Comments:				
2200 Eracey Side Koad RR#	FS Tibory	Lakeshore	See at	tache	d draw	nul	
Intario NIDIALI Dhack h	nall Address /	monterio	Well owner's Date Pa	ckage Deliverer	Min	istry Lise	Only
us.Telephone No. (inc. area code) Name of Well Tech	nician (Last Name	First Name)	information package		Audit No.		<u></u>
51/19 350 714913 Henderso	n, Rob		delivered Date Wo	Y Y M M E	<u> 1</u> 의 <b>z</b>	138	652
rell rechnician's Licence No.  Signature of Technician ar	nd/or Contractor Da	ate Submitted		D. laule	14 am	n . n .	0.040
506E (2007/12) © Queen's Printer for Ontario, 2007	Ø	Ministry's Conv		<u>n 14 14 14</u>	KeceWad	<u>ria</u>	<u>4013 -</u>

012 Prescott #3 18 T 455 183 140 metres such of Mikh ovens Rd #1 18 T 454755 of Mitch Queno of Prescett Mitch Ovens Rd. × Telsed 5+72 m Vacant Lot #2 18T 454856 **8**#2 of old Prescott 296 metres continuest 46 metres south of Mitch Owans Rd. Tay # A122239 Ø Contraction of the local division of the loc 11-くい Pg 2 of 2 audit # ≥ 138652 Stree Sand. APR 1 8 2013

An and the second seco	Contario	/linistry of he Environment	Well Tag#: A1280	<b>172</b> <i>it Below)</i>	Regulation	903 C	<b>W</b> Intario Wa	ell R ter Res	ecor
Bill Owner Information         Eastview Sand & Grave Limeted           Box 13D, R.R. #1         Greek         <	easurements recorded in:	Metric      Mimperial					Page_		of
Answer         Description         Stand & Gravel Limited         Construction         Constructi	/ell Owner's Informatio	on /							<u></u>
Dig Addition (Detron the notachiner)     Dig Addition (Detron the notachiner)     Dig Addition (Detron the A	'st Name	Eastview S	Sand & Gravel Limited	E-mail Address	ian So	al a	Dret		Constructed
BOX TBUL KEYK #1     CYC BIOL     <	ailing Address (Street Numb	er/Name)	Municipality	Province	Postal Code	4.6.15	Telephone I	lo. (inc.	area code)
International state         International state         International state         PH. 1         Conservational state           26393 Bank Streed         Control State         Contro State         Control State	BOX 190. K.K.	F1	Greeiy		<u>  K4P</u>	<u>c M1</u>			
5639 Bank Streed         Orgoode         PIL 1         5           Ottavia         Contaction         Co	dress of Well Location (Stre	et Number/Name)	Township		Lot		Concession	1	
Classes_crasses_lin	5639 Bank Stre	eet <mark>seesse suurinteetteesse</mark>	Osgoode	a de la companya de La companya de la comp	P/L 1	Dravin	5	Destal	Codo
Contract Scale Scale     Other       Contract Scale Scale     Contract Scale Scale       Contract Scale Sc	ounty/District/Municipality	Materia and a second	City/Town/Village			Onta	<sub>ce</sub> ario	Postal	Code
Number All       44552531       50141226         Interestication       Other Destination       General Description       provide of the second of the network of the second of the second of the network of the second of t	M Coordinates Zone Easti	ng Northing	Municipal Plan and Suble	ot Number		Other		1 1 1	
Mail and perfortion method perfortion method with the method of the m	NAD 8 3 18	155253 50141:	26	· · · · · · · · · · · · · · · · · · ·					
Sand & Gravel     D     45       Grey     Umestore     48       White     Sand School     Strold       Sand School     Strold     Immestore       White     Sand School     Strold       Sand School     Strold     Strold       White     Sand School     Strold       Sand School     Strold     Strold       White     Sand School     Strold       Sand School     Sand School     Strold       White     Sand School     Strold       Sand School     Sand School     Strold       White     Sand School     Strold       Sand School     Sand School     Strold       White     Sand School     Strold       Sand School     Strold     Strold       Sand School     Strold <td>eneral Colour Most</td> <td>Common Material</td> <td>Other Materials</td> <td>Gene</td> <td>ral Description</td> <td></td> <td></td> <td>Dep</td> <td>th (<i>m</i></td>	eneral Colour Most	Common Material	Other Materials	Gene	ral Description			Dep	th ( <i>m</i>
Grey         Limestone         49         196           White         Sand Shore         Sind Shore         Limestone         144         198           White         Sand Shore         Sind Shore         Limestone         144         198         142         124           White         Sand Shore         Sind Shore         Sind Shore         Sind Shore         146         187           White         Sand Shore         Sind Shore         Sind Shore         Sind Shore         142         200           White         Sand Shore         Sind Shore         Sind Shore         Sind Shore         142         200           Amplate Space         Ange of texture Hule         Unrestone         Innestone         142         200           Amplate Space         Ange of texture Hule         Unrestone         110         110         122         200           Amplate Space         Ange of texture Hule         Unrestone         110		Sand & Gravel	Soulders		de com			0	48
While         Sand Stack         Cruy         Limestone         156         164           While         Sand Stack         Limestone         191         192         192         192         192         192         192         192         192         200 <sup>+</sup> While         Sand Stack         Limestone         193         192         200 <sup>+</sup> 192         200 <sup>+</sup> While         Sand Stack         Limestone         192         200 <sup>+</sup> 192         200 <sup>+</sup> While         Sand Stack         Limestone         192         200 <sup>+</sup> 192         200 <sup>+</sup> While         Sand Stack         Limestone         192         200 <sup>+</sup> 192         200 <sup>+</sup> Limestone         Limestone         Limestone         192         200 <sup>+</sup> 192         200 <sup>+</sup> 192         200 <sup>+</sup> Limestone         Limestone         Limestone         192         200 <sup>+</sup> 192	Grev	Limestone	en el composition de la composition de			y wana arafi	neperiore generation	48	156
White     Sand Share     Care Linestone     164     161       White     Sand Share     Linestone     181     182       White     Sand Share     Linestone     181     182       White     Sand Share     Linestone     182     200 <sup>2</sup> White     Sand Share     Linestone     182     200 <sup>2</sup> White     Annuar Space     Linestone     182     200 <sup>2</sup> White     Annuar Space     Linestone     182     200 <sup>2</sup> White     Annuar Space     186     182     200 <sup>2</sup> Construction     Image and Types     186     182     200 <sup>2</sup> 2 <sup>2</sup> S2     Nearcement     186     182     200 <sup>2</sup> 2 <sup>3</sup> S2     Nearcement     186     182     200 <sup>2</sup> 2 <sup>4</sup> S3     Nearcement     186     200 <sup>2</sup> 200 <sup>2</sup> 2 <sup>4</sup> S3     Nearcement     186     200 <sup>2</sup> 200 <sup>2</sup> 2 <sup>4</sup> S3     S3     S3     S3     S3       2 <sup>4</sup> S3     S6     S3     S6     S3     S6       2 <sup>4</sup> S5     S6     S3     S6     S3     S6       2 <sup>4</sup> S6     S3     S6     S6 <t< td=""><td>White</td><td>Sand stand</td><td>WISCOU Limestor</td><td>neter a contraction</td><td>an de son setter y dy hyra synaddia</td><td></td><td>Navatara ara</td><td>156 '</td><td>164</td></t<>	White	Sand stand	WISCOU Limestor	neter a contraction	an de son setter y dy hyra synaddia		Navatara ara	156 '	164
White         Sand Shore         Limestare         181/         182/         200           White         Sand Shore         Second Shore         Second Shore         182/	White	Sandsta	Limestor	e internet	ana ana (China a	a da antara a Antara antara a	ripe on a Shifteen (Cod	164 '	181
White         Sand Shm         Sand Shm <t< td=""><td>White</td><td>Sandsford</td><td>Wilcon, Limeston</td><td>ne station and showing</td><td>en ar Angelain</td><td>Na j</td><td>ing and in the</td><td>181 (</td><td>192</td></t<>	White	Sandsford	Wilcon, Limeston	ne station and showing	en ar Angelain	Na j	ing and in the	181 (	192
Annotation Space       Values Flored         Our first of Commental and Type of General Commental and Type of General Commental and Type of General Commental and Type of Commental Commental and Type of Commental	White	SandStore	WGrey Limestor		an a	nteoriji in	ana ang	192	2001
Recultor of Well Vield Testing         December of an any of Bealant Used (MCD)       Volume Placed (MCD)       Daw Doom (Placed Colspan="2">December (MCD)         Open of Bealant Used (MCD)       Model Control (MCD)       Daw Doom (Placed Colspan="2">December (MCD)         21       0       Bistophile Sturry       37.8         Method of Construction       Used Control (MCD)       Model Control (MCD)									· · · · ·
Instrument       Instrument <th></th> <th>Annular Space</th> <th>Volume Placed</th> <th>After test of well yield, v</th> <th>Results of We</th> <th>II Yiel</th> <th>d Testing aw Down</th> <th>R</th> <th>ecovery</th>		Annular Space	Volume Placed	After test of well yield, v	Results of We	II Yiel	d Testing aw Down	R	ecovery
2         52         Near comment         3         42.8         58           2         D         Bendonite starry         37.8         Bornerstarry         37.8           Method of Construction         Prade         Construction         3         43.4         80.6           Method of Construction         Proving activity (Drivertical)         Proving activity (Drivertical)         3         53.7         3         55.7           Method of Construction         Proving activity (Drivertical)         Proving activity (Drivertical)         10         67.1         4         41         4         41           Note set of the Construction activity (Drivertical)         Proving activity (Drivertical)         Monices         Proving activity (Drivertical)         5         56.0         3	From To	(Material and Type)	(m³@)	Clear and sand fr	ree	Time ( <i>min</i> )	Water Leve	I Time	Water Leve (m/ft)
2'       0       Bentoniks sturry       37.8         Mathingt of Construction       Pumping rate (Antri Antri	27 52 N	eaticement	18.0 · · · · · · · · · · · · · · · · · · ·	If pumping discontinue	d, give reason:	Static	34.4	4	80.6
Method of Construction       Well Use         Construction       During intak set at /c@       2       48       2       50         Method of Construction       During intak set at /c@       3       53.7       3       45         Convertional       During intak set at /c@       3       53.7       3       45         Convertional       During intak set at /c@       3       53.7       3       45         Convertional       During intak set at /c@       3       53.7       3       45         Convertional       During intak set at /c@       3       53.7       3       45         Convertional       During intak set at /c@       10       67.8       10       34         Charles peeds       Test tell       10       67.8       10       34         Convertional (Convertional)       Convertional (Convertional)       10       67.8       10       34         Test tell       Convertional (Convertional)       Depth (m?)       Power peeds       10       67.8       10       73.2       20       34         Test tell       Convertional       Depth (m?)       Developing Wethod       20       75.3       34       40       77.9       50       34 <t< td=""><td>2'Bi</td><td>entonite slurry</td><td>37.8</td><td></td><td></td><td></td><td>42.8</td><td></td><td>58.0</td></t<>	2'Bi	entonite slurry	37.8				42.8		58.0
Mathad of Construction     Well Use       Amathad of Construction     Purping rate ( <i>Mini</i> ( <i>Construction</i> )       Being     Purping rate ( <i>Mini</i> ( <i>Construction</i> ) <td></td> <td></td> <td></td> <td>Pump intalle set at (n</td> <td>Ð</td> <td>2</td> <td>18</td> <td>2</td> <td>50 /</td>				Pump intalle set at (n	Ð	2	18	2	50 /
Method of Construction       Well Use         Cate Tool       Public       Commercel       Not used         Reary (Convention)       Determore       Commercel       Not used         Reary (Convention)       Determore       S 60.6       S 38         Reary (Convention)       Determore       S 60.6       S 38         Reary (Convention)       Determore       Monitoring       S 60.6       S 38         Reary (Revense)       Determore       Monitoring       S 60.6       S 38         Restrict Revension       Determore       Monitoring       S 60.6       S 38         Restrict Revension       Determore       S 70.5       S 43         Restrict Revension       Determore       Restrict Revension       S 70.5       S 43         Restrict Revension       Determore       Restrict Revension       S 70.5       S 43         Restrict Revension       S 50.6       S 70.5       S 70.5       S 70.5 <td></td> <td></td> <td></td> <td>180 March 180</td> <td>-</td> <td>3</td> <td>50 7</td> <td>3</td> <td>AE 1</td>				180 March 180	-	3	50 7	3	AE 1
Catele Tool       Demond       Catele Tool       Demond       Connectual       Not used         Reauy (Convention)       Determined       Devention       Connectual       Devention       Status of pumping       1       5       Status of pumping         Reauy (Convention)       Devention       Connectual       Devention       Connectual       Not used         Presussion       Devention       Connectual       Devention       Status of Pumping       1       6       Status       Status       Not used         Status of Weill Connectors       Devention       Connectors       Resourcement Weil       1       6       Status of Weill       Status of Weill       0       7.3.2       20       7.3.2       20       3.3.4         Presussion       Connectors       Presussion       Presussion       Presussion       Status of Weill       Connectors       3.0       7.5       3.0       3.4         Pression       Status       Status       Status       Connectors       Status       Connectors       Status       Status       2.0       7.5       3.0       3.4         Pression       Status       Status       Status       Connectors       Status       Status       Status       Status       Status	Method of Construct	ion	Well Use	Pumping rate (I/min /	Sem)	300 S	03.7	5	40.
Construction Record - Cosing & Air Conditioning         4 his + 0, min         5         58.6         5         38           Pred watery (freevests)         Draging         Instruction Record - Casing & Air Conditioning         1 his + 0, min         5         70.6         70.9         10         40.7         10         40.7         10         40.7         10         40.7         10         40.7         10         40.7         10         40.7         10         40.7         10         67.9         10         40.7         10         67.9         10         40.7         10         40.7         70.5         15         34           Pred water for	Cable Tool D	amond Public	Commercial Not used	Duration of pumping	in the second	4	57.1	4	41.(
Borng         Orgging         Impaired         Cooling & Air Cenditioning         10         67.9         10         34.           Other.specify         Construction Record - Casing         Status of Well         If Rowgo give rate ( <i>Imm / GPM</i> )         15         70.5         15         34.           Image Consense (Imm / GPM)         Other.specify         Other.specify         Image Consense (Imm / GPM)         15         70.5         15         34.           Image Consense (Imm / GPM)         Other.specify         Other.specify         Other.specify         Image Consense (Imm / GPM)         10         67.9         10         34.           Image Consense (Imm / GPM)         Value (Imm / GPM)         Other.specify         Other.specify         Image Consense (Imm / GPM)         15         70.5         15         34.           Image Consense (Imm / GPM)         Image Consense (	Rotary (Conventional)	riving Livestock	Test Hole Monitoring	<u>1</u> hrs + <u>0</u> n	nin	5	59.6	5	38.(
Conter, specify       If how a gene of how a specify         It made target Construction Record - Casing target Construction Record - Casing Construction Record - Casing Construction Record - Casing Construction Record - Casing Construction Record - Streen Construction	Boring LD	igging Irrigation Industrial	Cooling & Air Conditioning	80.6	r pumping ( <i>ma</i>	10	67.9	10	34.4
Construction Record - Casing       Status of Well         Inded       Open Hole CR Material (Caskanzed, Floregies, (cm/n)       Depth (m/n)         Steel       18       42       62'         Inde       Open Hole CR Material (Caskanzed, Floregies, (cm/n)       The charge Well (Caskanzed, Floregies, (cm/n)       From       To         Inde       62'       200'       Recharge Well (Construction Record - Screen       Devating Vell (Construction Record - Screen       Mage of Well Location         Water Details       Hole Diameter       Construction Record - Screen       Deph (m/n)       Devating Vell (Construction Record - Screen       Mage of Well Contractor         Water Details       Hole Diameter       From       To       Construction       Mage of Well Contractor         118       (mo) Gas       Other, specif/       Scresh       Municipality       <	Other, specify	Other, specify		If flowing give rate (I/r	nin / GPM)	15	70.5	15	34.0
Market Plastic, Steel       Theicheas       From       To       Replacement Well         15/6       Open Hole       198       +2'       62'       Dewatering Well         15/6       Open Hole       62'       200'       Dewatering Well         15/6       Open Hole       62'       200'       Dewatering Well         16/6       Open Hole       62'       0'       0'       75'       30'         10       Construction Record - Screen       Depth (m/t)       Deandoned, other, specify       No       90'       80'       90'       80'       90'       80'       90'       80'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'       90'	Inside Open Hole OR Ma	ion Record - Casing terial Wall Depth	(m/ft) Water Supply	Recommended pump	o depth (ng/h)	20	73.2	20	34.4
**       Steel       188       +2       62       I lest role       Recharge Well       Recharge	Diameter (Galvanized, Fibreg	plass, Thickness Steel) (cm/in) From	To Replacement Well	140 ( ()	2+1P-logen	25	74	25	34.4
Steer <th< td=""><td>9 Ctarl</td><td>198' 47'</td><td>Recharge Well</td><td>Recommended pump</td><td>o rate</td><td>30</td><td>75</td><td>30</td><td>34.4</td></th<>	9 Ctarl	198' 47'	Recharge Well	Recommended pump	o rate	30	75	30	34.4
Web production (min / 200)       Sol / 78 / 50 / 34         Construction Record - Screen       Depth (m/t)       Attention         Duisde (construction)       Abandoned, poor wider Quality       Abandoned, other, specify       Sol / 78 / 50 / 34         Duisde (construction)       Abandoned, other, specify       Abandoned, other, specify       Map of Well Location         Water Quality       Abandoned, other, specify       Other, specify       Map of Well Location         Water Quality       Abandoned, other, specify       Other, specify       Map of Well Location         Water Quality       Abandoned, other, specify       Other, specify       Map of Well Location         Well Contractor specify       Other, specify       Other, specify       Map of Well Location         Well Contractor and Well Technician Information       Well Contractor's Licence No       Ministry Use Only         Sinses Name Well Contractor and Well Technician (Last Name, First Name)       Hills       Comments:         Sinses Address (Street Number/Name)       Business E-mail Address       Ministry Use Only         Nincervice No.       Name of Well Technician (Last Name, First Name)       Date York Completed       20 / 20 / 20 / 20 / 20 / 20 / 20 / 20 /			Dewatering Well	20	10500	40	77	40	34.4
Atternation       Atternation         Construction Record - Screen       Insufficient Suppl         Abandoned, insufficient Suppl       Abandoned, other, specify         Dataside (rwin)       Bot No.         Water Datability       Depth (m/til)         Abandoned, other, specify       Dother, specify         Water Datability       Depth (m/til)         Abandoned, other, specify       Depth (m/til)         B1 (mother Specify)       Depth (m/til)         B1 (mother Specify)       Depth (m/til)         B1 (mother Specify)       Bandoned, other, specify         B1 (mother Specify)       Bandoned, other, specify         B1 (mother Specify)       Bandoned, other, specify         B1 (mother Specify)       Business Amme of Well Contractor         B1 (mother Specify)       Business E-mail Address         B1 (mother Specify)       Business B-mail Address         B1 (mother Specify)       Business B-mail Address         B1 (mother Specing) <t< td=""><td>Open Hole</td><td>04</td><td>Monitoring Hole</td><td>20</td><td></td><td>50</td><td>79</td><td>50</td><td>34.4</td></t<>	Open Hole	04	Monitoring Hole	20		50	79	50	34.4
Abandoned, Insufficient Supply Insu			Alteration (Construction)	Disinfected?		60	od e	<sup>4</sup> 60	sí.
Construction Record - Screen         Deskide hameter       Material (Plasic, Galvanized, Steel       Depth (m/t) From       Depth (m/t) (m/t)       Depth (m/t) (m/t)       Plasadoned, other, specify         Water Details       Hole Diameter         iter found at Depth       Kind of Water:       Fresh       Depth (m/t)       Diameter         164 (m@)       Gas       Other, specify       Depth (m/t)       Diameter         iter found at Depth       Kind of Water:       Fresh       Presh       Depth (m/t)         181 (m@)       Gas       Other, specify       Depth (m/t)       Diameter         iter found at Depth       Kind of Water:       Fresh       Presh       Bess Provide a map below following instructors on the back.         Mile found at Depth       Kind of Water:       Fresh       Depth (m/t)       Diameter         integrade       Other, specify       Bess Provide a map below following instructors on the back.       Mile for the specify         Well Contractor and Well Technician Information       Bess Provide a map below following instructors       Mile for the specify         Siness Name of Well Contractor       Mile for the specify       Mile for the specify       Mile for the specify         Vince       Postal Code       Name of Well Technician (Last Name, First Name)       Mile for the specify<			Abandoned, Insufficient Supply	Vres No	Man of M		u.uu	1 1	
Matterial (m/m)       Water Details       From       To       Abandoned, other, specify         Other, specify       Other, specify       Other, specify         Iter found at Depth Kind of Water:       Fresh Wintested       Depth (m/th)       Diameter         164 (m@)       Gas       Other, specify       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Fresh Wintested       Iter found at Depth Kind of Water:       Iter found at Depth Kind of Water:       Fresh Water:       Iter found at Depth Kind of Water:       Fresh Water:       Iter found at Depth K	Outside Unitside	tion Record - Screen Depth	( <i>m/ft</i> ) Abandoned, Poor Water Quality	Please provide a map	below following	instruct	ions on the l	back.	-t
Water Details       Hole Diameter         tter found at Depth Kind of Water:       Fresh Wintested         164 (m@)       Gas         Other, specify       0         184 (m@)       Gas         Other, specify       0         181 (m@)       Gas         Other, specify       0         183 (m@)       Gas         Other, specify       0         184 (m@)       Gas         Other, specify       0         183 (m@)       Gas         Other, specify       62         184 (m@)       Gas         Other, specify       62         183 (m@)       Gas         Other, specify       62         184 (m@)       Gas         Other, specify       62         183 (m@)       0         Municipality       0         Siness Name of Well Contractor       1119         Nunce       Municipality         Richmond       112         Nince       None         ON       KQA 220         Business E-mail Address         Nince       Name of Well Contractor         112 HP - 10 GPM set @ 140 ft         112 HP - 10 GPM set @ 1	Diameter (Plastic, Galvanized,	Steel) Slot No. From	To Abandoned, other,						18
Water Details       Hole Diameter         ther found at Depth Kind of Water:       Fresh Vintested       Depth (m/th)         164 (m)       Gas       Other, specify         181 (m)       Gas       Other, specify         183 (m)       Gas       Other, specify         184 (m)       Gas       Other, specify         184 (m)       Gas       Other, specify         184 (m)       Gas       Other, specify         185 (m)       Gas       Other, specify         186 (m)       Gas       Other, specify         187 (m)       Gas       Other, specify         188 (m)       Municipality         Richmond       Municipality         Richmond       Municipality         Richmond       Municipality         188 (m)       Hanna, Jeremy         188 (c00702)       Oureens brown for Othac 2000 <td></td> <td></td> <td></td> <td></td> <td>^ -</td> <td></td> <td>D</td> <td>0</td> <td>Ø</td>					^ -		D	0	Ø
Water Details       Hole Diameter         ater found at Depth       Wind of Water:       Fresh       Untested       Depth (m/n)       Diameter         164       (m@)       Cas       Other, specify       0       From       To       (cm.S)         181       (n@)       Cas       Other, specify       0       From       62       6''       6			Other, specify	Mite	h Due	ms	fee	ð	
ater found at Depth       Kind of Water:       Fresh       Depth (m/ft)       Diameter         164. (m@)       Gas       Other, specify       Image: Fresh	Wat	er Details	Hole Diameter			K			
164 (m@) Gas       Other, specify         181 (m@) Gas       Other, specify         182 (m@) Gas       Other, specify         183 (m@) Gas       Other, specify         184 (m@) Gas       Other, specify         187 (m@) Gas       Other, specify         188 (m@) Gas       Other, specify         189 (m@) Gas       Other, specify         180 (m@) Gas       Other, specify         181 (m) Gas       Other, specify         181 (m) Gas       Other, specify         181 (m) Gas       No         181 (m) Gas       Business E-mail Address         0N       KQA 220         181 (m) Gas       Business E-mail Address         0N (m. c. area code)       Name of Well Technician (Last Name, First Name)         18138832170       Hanna, Jeremy         18138832170       Hanna, Jeremy         18128382170       Hanna, Jeremy	ater found at Depth Kind of	Water: Fresh Watested	Depth ( <i>m/ft</i> ) Diameter From To ( <i>cm</i> /c)			1	1.5		
181       (m@) Gas       Other, specify       0       62       5 </td <td>164 (m Gas Oth</td> <td>er, specify</td> <td>FF FF "</td> <td></td> <td></td> <td></td> <td>10-</td> <td>• . • ·</td> <td>d</td>	164 (m Gas Oth	er, specify	FF FF "				10-	• . • ·	d
ater found at Depth       Kind of Water:       Fresh       <	181 (m@ Gas 0th	er, specify	FT 62 15/			1	V	- 	15
Well Contractor and Well Technician Information         siness Name of Well Contractor         Air Rock Drilling Co. Ltd.         1119         siness Address (Street Number/Name)         0659 Franktown Road, RR#1         Wince         ON       K0A 220         Bisness E-mail Address         air-rock@sympatico.ca         s. Telephone No. (inc. area code)         Name of Well Technician (Last Name, First Name)         B138382170         II Technician's Licence No.         Signature of Technician and/or Contractor Date Submitted         Y Y Y Y M M 1         Y Y Y Y M M 2         B1383822170         II School         Weil contractor Protection Ontare 2007	ater found at Depth Kind o	f Water: Fresh Vuntested		n en	Ċ	X) <	<u></u>	- 1	> 10
Well Contractor         Well Contractor's Licence No.         Air Rock Drilling Co. Ltd.       1119         siness Address (Street Number/Name)       Municipality         0659 Franktown Road, RR#1       Municipality         wince       Postal Code       Business E-mail Address         ON       K0A/2Z0       Business E-mail Address         S. Telephone No. (inc. area code)       Name of Well Technician (Last Name, First Name)       Date Package Delivered       Munistry Use Only         B138382170       Hanna, Jeremy       Municipality       Date Work Completed       Munistry Use Only         IT Echnician's Licence No.       Signature of Technician and/or Contractor       Date Suppristed       OS 30       Date Work Completed       JUN 2 9 20         0       Part Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	(m(tt)) Gas Oth	er, specity	n Information			,	$\partial \infty$	• ·	10
Air Rock Drilling Co. Ltd.       1119         siness Address (Street Number/Name)       Municipality         6659 Franktown Road, RR#1       Municipality         wince       Postal Code         No       K0A 2Z0         S. Telephone No. (inc. area code)       Name of Well Technician (Last Name, First Name)         B138382170       Hanna, Jeremy         II Technician's Licence No.       Signature of Technician and/or Contractor         Date Submitted       57.70         II Technician's Licence No.       Signature of Technician and/or Contractor         Date Submitted       Yes         No       Yes     <	usiness Name of Well Contra	ctor	Well Contractor's Licence No.	1 100 Att					*
Ministry Use Only         Ministry Use Only <t< td=""><td>Air Rock Drilling Co</td><td>Ltd</td><td>1119 Municipality</td><td>Comments:</td><td></td><td></td><td></td><td></td><td>j (</td></t<>	Air Rock Drilling Co	Ltd	1119 Municipality	Comments:					j (
Postal Code       Business E-mail Address         ON       K0A 220       Business E-mail Address         air-rock@sympatico.ca         s. Telephone No. (inc. area code)       Name of Well Technician (Last Name, First Name)         B138382170       Hanna, Jeremy         II Technician's Licence No.       Signature of Technician and/or Contractor       Date Submitted       Date Submitted       Date Work Completed         No       Yes       Date Work Completed       JUN 2 9 20         AFE (2007/12)       Queen's Finter for Ontario, 2007       Ministry's Coopy	usiness Address (Street Num 6659 Franktown Ro	idenname) ad, RR#1	Richmond	1/2 HP - 10	GPM set @	2 1 4 0	ft		
N       KUA 240       air-rock@sympatico.ca         s.Telephone No. (inc. area code)       Name of Well Technician (Last Name, First Name)       Date Package Delivered         6138382170       Hanna, Jeremy         II Technician's Licence No.       Signat/re of Technician and/or Contractor Date Submitted       533         II Second       Audit No.       2012       Audit No.         Audit No.       JUN 2 9 20         AFE (2007/12)       Ouege's Protect for Ontario 2007       Ministry 250	rovince Postal C	ode Business E-mail Add	Iress						a Only
B138382170       Hanna, Jeremy         II Technician's Licence No.       Signature of Technician and/or Contractor Date Submitted OF 31         II Technician's Licence No.       Signature of Technician and/or Contractor Date Submitted OF 31         II Second Contractor Date Submitted OF 32       No         V Y Y Y M M 32       No         V Y Y Y M M 32       No         Second Contractor Date Submitted OF 32       No         V Y Y Y M M 32       No         Second Contractor Date Submitted OF 32       No         V Y Y Y M M 32       No         Second Contractor Date Submitted OF 32       No         V Y Y Y M M 32       No         Second Contractor Date Submitted OF 32       No         V Y Y Y M M 32       No         Second Contractor Date Submitted OF 32       No         Second Contractor Submitted OF 32       No <t< td=""><td></td><td>240 air-roc</td><td>ast Name First Name)</td><td>I vveil owner's Date F</td><td>-ackage Delivere</td><td>a</td><td>Audit No.</td><td></td><td></td></t<>		240 air-roc	ast Name First Name)	I vveil owner's Date F	-ackage Delivere	a	Audit No.		
I Technician's Licence No. Signature of Technician and/or Contractor Date Submitted 05 37 No Y 2012 05 01 Received JUN 2 9 20	6138382170	Hanna, Jerems	ngangangan ng pantanan ng pananan ng pananan Panangangan ng panganganganganganganganganganganganganga	delivered Date V	2012 0 5 Nork Completed	008	z 1	28	560
E (2007/12) © Queen's Printer for Ontario, 2007	all Technician's Licence No. Sig	natúre of Technician and/or Co	ontractor Date Submitted 0531		2012 0 5	01		UN 2	9 201
	120294	tor Optaria 2007				<u> </u>	neseivea	nangu Steinith	

Ministry's Copy

	Irio the Er	vironment	<b>`</b>		A128	3073		Regulatio	n 903 (	Ontario Wat	er Re	sources A
easurements r	ecorded in:	Vletric 🕅	)mperial			en de drag h				Page_	1001747011-075	of
/ell Owner's st Name	Information	.ast Name /	Organizatio	n			E-mail Address	0.1			Weil	Constructe
ailing Addross (	Street Number/No	Ea	stview	Sand 8	Grave	Limited	Canadia	n 2011	P	Telephone N	hogh	el Owner
Box 19	0. R.R. # 1			na a segura da tara da	Gre	ely	ON	K4P	1N5		ю. (лю	
ell Location								1		Canada		
Idress of Well L 5639 Bi	ocation (Street Nu ank Street	mber/Name)	fra anna adhraichte	e fisikan er er	Township OSO	aoode		P/L	1	Concession 5		
ounty/District/M	unicipality			(	City/Town/V	/illage		t franceizaire incorrected	Provir	nce	Posta	I Code
Ottawa M Coordinates	-Carleton Zone ,Easting	ı No	orthing	ing dia ang di Ang dia ang dia	Gre Municipal P	Plan and Sublo	ot Number	gete <sup>1</sup> e generationen T	Other			
NAD 8 3	18 455	253	50138	59	020103400745550100755597						national second	
<b>/erburden an</b> eneral Colour	d Bedrock Materi Most Comr	als/Abando non Material	onment Sea	aling Reco Otl	<b>ord</b> <i>(see ins</i> ner Materia	<i>tructions on the</i> Ils	back of this form) Gener	al Descriptior	<u></u> า	<u> </u>	De	oth ( <i>n@)</i>
		Glav		<u></u>		Boulders				1924 - Anna State and Anna	<u>n</u>	16'
		Sand	& Grave	4		Boulders			en e	nan in the second	16	48'
Grey		Lime	stone	al a construction of				Marakaya Inga	Japan Santana	and the second second	48 '	170
Grey	, and the second se Second second	Lime	stone	Alush	ite	Sand -	200	en er	Giganggas	aatoon oo oo	170	171
Grey		Lime	stone v	Juli	te	Sand St	sie	t: Mejsteristiggenering			171	178
Grey		Lime	stone V	alut	ite	Sand St	ore.			an a	178	190
	ann an air ann an ann ann an ann an ann an ann an			1.20				fatter i server en s				
		*****										
	_	Annular	Space				F	lesults of W	ell Yiel	Id Testing		
Depth Set at ( <i>n</i> From T	Ø	Type of Sea (Material an	alant Used ad <i>Type)</i>		Volun (/	ne Placed	Clear and sand fr	vater was: 'ee	Time	Water Level	Time	Water Le
0 1 5(	) / Neat o	ement			. 1	0.9	Other, specify	Not teste	( <i>min</i> ) Static	(m/ft)	(min) 4	(m/ft)
0 / 0	' Bentor	nite slurry		inggalanan na Addalaga Naja	3	3.6		a, give reason.	Level	20.2		04.8
						And here	3 8		1 Stephen	303	1996 B 1997	- 44
						n Miner Breek	Pump intake set at /r	<b>(</b> A)				
						n 1794 e general	Pump intake set at (n 180	ØP)	2	40.6	2	39
Method o	f Construction			Well Us	 ;e		Pump intake set at ( <i>n</i>	AP Emp	2	40.6	2	39 36
Method o	f Construction	I Pul	blic	Well Us	ie rcial	Not used	Pump intake set at (n 180 Pumping rate (1/min / 20 Duration of pumping	AP SEMP	2 3 4	40.6 44.4 46.7	2 3 4	39 36 34
Method o Cable Tool Rotary (Conven Rotary (Reverse	f Construction		blic mestic estock	Well Us	se incial [ al [ ile [	Not used Dewatering Monitoring	Pump intake set at ( <i>n</i> <b>180</b> Pumping rate ( <i>I/min</i> / <b>0</b> <b>20</b> Duration of pumping thrs + 0 m	AAD SEAD hin	2 3 4 5	40.6 44.4 46.7 48.5	2 3 4 5	39 36 34 33
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion	f Construction	I Pul Do Liv	blic mestic estock gation lustrial	Well Us Comme Municip Test Ho Cooling	ie rcial [ al [ le [ & Air Condi	Not used Dewatering Monitoring itioning	Pump intake set at (n 180 Pumping rate (I/min / 20 Duration of pumping hrs + 0 m Final water level end of 64 8	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	2 3 4 5 10	40.8 44.4 46.7 48.5 54	2 3 4 5 10	39 36 34 33 30
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, <i>specify</i>	f Construction	I Pul Doi Livi Irrig Indt	blic mestic estock gation lustrial her, <i>specify</i> _	Well Us Comme Municip Test Hc Cooling	ie rcial [ al [ le [ & Air Condi	Not used Dewatering Monitoring itioning	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 n Final water level end of 64.8 If flowing give rate (l/n	AFF) SEAP nin f pumping (m/ft) nin / GPM)	2 3 4 5 10 15	40.6 44.4 46.7 48.5 54 56	2 3 4 5 10 15	39 36 34 33 30 27
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify	f Construction	I Pul Doi Livi Irrig Ott ecord - Cas	blic mestic estock gation iustrial ner, <i>specify</i> _ <b>sing</b> Depth	Well Us Comme Municip Test Hc Cooling (m/ft)	rcial [ al [ le [ & Air Condi	Not used Dewatering Monitoring itioning	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 4 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	2 3 4 5 10 15 20	40.6 44.4 46.7 48.5 54 56 57.9	2 3 4 5 10 15 20	39 36 34 33 30 27 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, <i>specify</i> Inside Ope iameter (Gal comm) Con	f Construction	Pul Do Livi I livi I livi I livi I livi I livi I livi Cott Ott ecord - Cas Vall Thickness (cm/in)	blic mestic estock gation lustrial her, <i>specify</i> <b>Sing</b> Depth From	Well Us Comme Municip Test Hc Cooling (m/ft) To	se rcial [ al [ & Air Condi Statu Water Repla	Not used Dewatering Monitoring itioning itioning itioning r Supply accement Well	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/n Recommended pump	Image: Apple of the second sec	2 3 4 5 10 15 20	40.6 44.4 48.7 48.5 54 56 57.9 58.8	2 3 4 5 10 15 20 25	39 36 34 33 30 27 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, <i>specify</i> Inside iameter <i>comp</i>	f Construction	I Pul Do Livi Irrig Oth ecord - Cas Wall Thickness (cm/in)	blic mestic estock gation lustrial her, <i>specify</i> _ <b>sing</b> Depth From	Well Us Comme Municip Test Hc Cooling (m/ft) To BD	ie rrcial [ al [ le [ & Air Condi Statu Water Repla Test H	Not used Dewatering Monitoring itioning itioning ss of Well r Supply acement Well Hole arge, Well	Pump intake set at (n 180 Pumping rate (l/min /4 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 644)	نظب) EMP in pumping ( <i>m/ti</i> ) in / <i>GPM</i> ) depth ( <i>m</i> E) Frate	2 3 4 5 10 15 20 20 30	40.6 44.4 46.7 48.5 54 56 57.9 58.8 58.8 59.7	2 3 4 5 10 15 20 25 30	39 36 34 33 30 27 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter iameter iameter iameter iameter iameter	f Construction	I Pul Y Doi Livi I Irrig I Ind Ott ecord - Cas Wall Thickness (cm/in)	blic mestic estock gation lustrial her, <i>specify</i> _ sing Deptr From +2 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60	se rcial [ al [ le [ & Air Condi Statu Water Repla Test H Recha Dewa Obser	Not used Dewatering Monitoring itioning itionin	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / Recommended pump (l/min / Recommended pump (l/min / Recommended pump (l/min / Recommended pump (l/min / Recommended pump (l/min / Recommended pump	€ EMP hin f pumping (m/t) hin / GPM) depth (m@) hin / GPM) depth (m@)	2 3 4 5 10 15 20 20 30 40	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5	2 3 4 5 10 15 20 25 30 40	39 36 34 33 30 27 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, <i>specify</i> Inside Ope ameter Cont It St 1516 Ope	f Construction  itional)  Diamono  tional)  Diting  Driving  Digging  Construction R  rn Hole OR Material vanized, Fibreglass, crete, Plastic, Steel)  cel  cel	Pul Doo Livi Iniq Iniq Cott ecord - Cas Wall Thickness (cm/in)	blic mestic estock gation lustrial her, <i>specify</i> <b></b> <b></b> <b></b> <b></b> From +2 / 60 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60           190	se rcial [ ał [ le [ & Air Condi Statu Water Repla Repla Dewa Obser Obser Monito Altera	Not used Dewatering Monitoring itioning itioning itioning so of Well r Supply acement Well Hole arge Well ttering Well rvation and/or oring Hole tion	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 69M) 20 Well production (l/min 20	Image: selection of the se	2 3 4 5 10 15 20 30 40 50	40.6 44.4 48.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2	2 3 4 5 10 15 20 25 30 40 50	39 36 34 33 30 27 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, specify Dther, specify Con Con (Gal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal Con (Cal (Cal (Cal (Cal (Cal (Cal (Cal (Cal	f Construction	I Pul Doi Live Irrig Oth ecord - Cas Wall Thickness (cm/in)	blic mestic estock gation lustrial her, <i>specify</i> _ <b>sing</b> Depth From +2 / 60 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60 '           190 '	se rrcial [ al ] le [ & Air Condi Statu Water Repla Water Repla Obser Monito Altera (Cons Abago	Not used Dewatering Monitoring itioning itioning itioning so of Well r Supply acement Well Hole arge Well tering Well rvation and/or oring Hole ation struction) doned	Pump intake set at (n 180 Pumping rate (l/min /4 20 Duration of pumping hrs + 0 m Final water level end of 64.8 If flowing give rate (l/n Recommended pump (l/min / 6PM) 20 Well production (l/min 20 Disinfected? XYes No	(هی) EMP in pumping (m/ħ) nin / GPM) depth (m@) Yate	2 3 4 5 10 15 20 30 40 50 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.8	2 3 4 5 10 15 20 25 30 40 50 (* 60	39 36 34 33 30 27 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, specify Con Con Con Con Con Con Con Con Con Con	f Construction  itional)  Diamono  tional)  Diting  Dirving  Digging  Construction R  rn Hole OR Material  vanized, Fibreglass, crete, Plastic, Steel)  cel  construction R  Construction R	I Pul Livi Livi I Irrig I Ind Ott ecord - Cas Wall Thickness (cm/in) .188	blic mestic estock gation lustrial her, <i>specify</i> _ sing Deptr From +2 / 60 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60           190	se rrcial [ al [ le [ & Air Condi Statu Water Repla Dewa Dewa Obser Monito Altera (Cons Abano Insuffi	Not used Dewatering Monitoring Monitoring itioning ition iticing itioning iticing iticig	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / GPM) 20 Well production (l/min 20 Disinfected? VYes No	<pre>Æ₽</pre> SEAP nin f pumping (m/t) nin / GPM) depth (mÆP) SEEP / CEM Map of W	2 3 4 5 10 15 20 20 30 40 50 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation	2 3 4 5 10 15 20 25 30 40 50 (* 60	39 36 34 33 30 27 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, specify Inside Conter Conter It St It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter Conter It St Ope Conter It St Ope It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter It St Ope Conter It St Ope It St It St	f Construction  itional)  Diamono tional)  Diting Dirving Digging  Construction R  n Hole OR Material  Construction R  Attrial	Pul Doo Livi Init ecord - Cas Wall Thickness (cm/in) . 188	blic mestic estock gation lustrial ner, <i>specify</i> Depth From +2 / 60 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60           190	se rcial [ al [ le [ & Air Condi Statu Water Repla Repla Repla Dewa Dewa Dewa Obser Monit Abanc water Abanc	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning ition is of Well r Supply acement Well Hole arge Well rvation and/or oring Hole ation struction) doned, icient Supply doned, Poor r Quality doned, other	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 n Final water level end of 64.8 If flowing give rate (l/m Recommended pump 140 Recommended pump (l/min / GeM) 20 Well production (l/min 20 Disinfected? XYes No	Image: Application of the second state of the second st	2 3 4 5 10 15 20 20 25 30 40 50 60 60	40.6 44.4 48.7 48.5 54 56 57.9 58.8 59.7 81.5 63.2 64.9 cation	2 3 4 5 10 15 20 25 30 40 50 40 50 (* 60	39 36 34 30 27 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, specify Dther, specify Con (Gal Con (1) 10 10 10 10 10 10 10 10 10 10 10 10 10	f Construction  ional)  Diamono  j Jetting  Dirving  Digging  Construction R  an Hole OR Material vanized, Fibreglass, crete, Plastic, Steel)  cel  Construction R  Material ic, Galvanized, Steel)	Pull Pull Pull Pol Pol Prince Pol Pol Pol Pol Pol Pol Pol Pol Pol Pol	blic mestic estock gation lustrial her, <i>specify</i> From +2 60 /	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60 '           190 '           (m/ft)           To	se rrcial [ al ] le [ & Air Condi Statu Water Repla Water Repla Obser Monito Abano (Cons Abano Insuffi Abano Specifi	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning itioning itioning ition itition ition	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping hrs + 0 n Final water level end of 64.8 If flowing give rate (l/n Recommended pump (l/min / 64) 20 Well production (l/min 20 Well production (l/min 20 Disinfected? OYes No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 <b>ell Loc</b>	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the ba	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, specify Con Con Con Con Con Con Con Con Con Con	f Construction  itional)  Diamono  tional)  Dition  Digging  Construction R  m Hole OR Material  construction R  Material  ic, Galvanized, Steel)	ecord - Scre	blic mestic estock gation lustrial her, <i>specify</i> _ sing Depth From +2 / 60 /	Well Us           Comme           Municip           Test Hc           Cooling           n (m/ft)           To           60           190           n (m/ft)           To	se rrcial [ al [ le [ & Air Condi Statu Water Repla Becha Dewa Obser Monito Altera (Cons Abano msuffi Abano Water Cons Obser Monito Cons Obser Monito Cons Obser Monito Obser Monito Obser Monito Obser Monito Obser Obser Monito Obser Obser Obser Monito Obser Obser Monito Obser Obser Obser Obser Obser Obser Monito Obser	Not used Dewatering Monitoring Monitoring Monitoring itioning  soft Well r Supply acement Well Hole arge Well tration and/or oring Hole ation struction) doned, ficient Supply doned, Poor r Quality doned, other, fy ; specify	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 6PM) 20 Well production (l/min 20 Disinfected? XYes No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 <b>ell Loc</b>	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the back	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Dther, <i>specify</i> (Gal Conter (Gal Conter (Cal (Cal (Cal) (Cal (Cal) (Ca	f Construction  itional)  Diamono  tional)  Diting  Driving  Digging  Construction R  rn Hole OR Material  construction R  Material  ic, Galvanized, Steel)	ecord - Scre	blic mestic estock gation lustrial her, <i>specify</i> <b></b> <b></b> <b></b> <b>From</b> <b>+2</b> <b>60</b> <b>/</b> <b>From</b> <b></b> <b>Constant</b>	Well Us           Comme           Municip           Test Hc           Cooling           (m/ft)           To           60           190           n (m/ft)           To	se rrcial [ al ] le [ & Air Condi Statu Vater Repla Repla Bewa Dewa Obser Monto Altera (Cons Abano specifi Other	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning ition is of Well r Supply acement Well Hole arge Well thering Well rvation and/or oring Hole ation struction) doned, poor r Quality doned, other, fy ; specify	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 n Final water level end of 64.8 If flowing give rate (l/m Recommended pump 140 Recommended pump (l/min / EM) 20 Well production (l/min 20 Disinfected? SYes No		2 3 4 5 10 15 20 30 40 50 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the back	2 3 4 5 10 15 20 25 30 40 50 (* 60	39 36 34 33 30 27 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside ameter cm(p) Con (Gal Con (Gal Con (I 1516 O Dutside lameter cm/in) (Plast	f Construction  ional)  Jetting  Diamono  ional)  Jetting  Driving  Digging  Construction R  n Hole OR Material vanized, Fibreglass, crete, Plastic, Steel)  cel  Construction R  Material ic, Galvanized, Steel)  Water De	ecord - Scre	blic mestic estock gation lustrial her, <i>specify</i> From +2 / 60 / From	Well Us         Comme         Municip         Test Hc         Cooling         (m/ft)         To         60         190         (m/ft)         To         60         190         To         Der	se  rcial al al al al Air Condi  Statu  Kair Condi  Statu  Air Condi  Abanc (Cons (C	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning r Supply acement Well Hole arge Well tering Well tering Well vation and/or oring Hole ation struction) doned, icient Supply doned, Poor r Quality doned, other, fy ; specify	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 64.9 Well production (l/min 20 Well production (l/min 20 Disinfected? XYes No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 60 <b>ell Loc</b>	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the base cation	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter cm(in) Qutside iameter cm/in) (Plast (Plast (Plast (Plast (Convent)) (Plast (Plast) (Plast (Convent)) (Plast (Convent) (Plast) (Convent) (Plast) (Conven)	f Construction         ional)       Jetting         j       Driving         ional)       Jetting         ional)       Jetting         ional)       Jetting         ional)       Driving         ional       Digging         Construction R         wanized, Fibreglass,         crete, Plastic, Steel)         cel         construction R         Material         ic, Galvanized, Steel)         Water Der         water Der         water Der         ichn Kind of Wate         ichn Kind of Wate	ecord - Scre	blic mestic estock gation lustrial her, <i>specify</i> _ sing Depth From +2 / 60 / een Depth From	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           To           BD           To           BD           To           BD           To           BD           To           From	se rrcial [ al [ le [ & Air Condi Statu Water Repla Bewa Dewa Dewa Obser Monite Abane Insuffi Abane Specifi Other to (m/ft) To	Not used Dewatering Monitoring Monitoring itioning Iss of Well r Supply acement Well Hole arge Well tering Well tration and/or oring Hole ation struction) doned, ficient Supply doned, Poor r Quality doned, other, fy r, specify	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 69/9) Well production (l/min 20 Disinfected? XOYes No Please provide a map	AP EAP in f pumping (m/t) inin / GPM) depth (mAP) idepth (mAP) idepth (mAP) Map of W below following HOL C Rec	2 3 4 5 10 15 20 30 40 50 60 60 60 <b>ell Loc</b>	40.6 44.4 48.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the back	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter cm(m) Convention It St Optime Car Car Car Car Car Car Car Car Car Car	f Construction         itional)       Jetting         j       Driving         j       Driving         j       Driving         j       Driving         in Hole OR Material         vanized, Fibreglass, crete, Plastic, Steel)         cel         cel         construction R         Material         ic, Galvanized, Steel)         Water De         epth         Kind of Wate         iegeth         Kind of Wate	ecord - Cas Vali Thickness (cm/in) ecord - Cas Vali Thickness (cm/in) ecord - Scre Slot No. tails r:Fresh [ cc/fy	blic mestic estock gation lustrial her, <i>specify</i>	Well Us         Comme         Municip         Test Hc         Cooling         (m/ft)         To         60         190         n (m/ft)         To         B0         190         From         Dep         From         State	se rrcial [ al ] al ]	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning itioning itioning Hole arge Well itering Well vation and/or oring Hole attring truction) doned, Poor r Quality doned, Poor r Quality doned, other, fy ; specify itient Diameter (cm/in) f <b>6</b>	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump 140 Recommended pump (l/min / 600) Well production (l/min 20 Disinfected? XYes No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the basis 55	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter Con Inside iameter Con Inside iameter Con Inside iameter Con Inside iameter Con Inside iameter Con Inside iameter Con Inside iameter Con Inside Inside Inside iameter Con Inside In	f Construction         ional)       Jetting         Diamond         ional)       Jetting         Driving       Digging         Construction R         In Hole OR Material         varized, Fibreglass, crete, Plastic, Steel)         cel         construction R         Material         ic, Galvanized, Steel)         Water Der         repth         Kind of Wate         Gas       Other, spe         epth       Kind of Wate         Gas       Other, spe         epth       Kind of Wate	ecord - Scre Slot No.	blic mestic estock gation lustrial her, <i>specify</i> <b>From</b> +2 60 // 60 // From Pepth From	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           To           Dep From           Per           From	se rrcial [ al [ le [ & Air Condi Statu Water Repla Berla Cons Abanc Cons Abanc Cons Abanc Specifi Abanc Specifi Cons Abanc Cons Abanc Specifi Cons Abanc Cons Cons Abanc Cons Abanc Cons Cons Cons Abanc Cons Cons Abanc Cons	Not used Dewatering Monitoring itioning itioning itioning itioning struction doned, ficient Supply doned, Poor r Quality doned, Poor r Quality doned, other, fy ; specify	Pumpi intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 64.9 20 Well production (l/min 20 Well production (l/min 20 Disinfected? No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the base MS	2 3 4 5 10 15 20 25 30 40 50 40 50 (* 60	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside Con Inside Insi	f Construction         ional)       Jetting         j Jetting         ional)       Jetting         ional)       Jetting         ional)       Driving         ional       Digging         Construction R         In Hole OR Material         Construction R         Material         ic, Galvanized, Steel)         Water Dereit         Dereit         Water Dereit         Water Dereit         Dereit         Water	ecord - Scre Slot No.	blic mestic estock gation lustrial her, specify _ sing Depth From +2 / 60 / een Depth From	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           To           From           From           Game           Municip           To           BO           H           Dep           From           Game	se rrcial [ al ] le [ & Air Condi Statu Water Repla Dewa Obser Monite Altera (Cons Abanc Insuffi Abanc Water Cons Other Cons C	Not used Dewatering Monitoring itioning it	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / CEM) 20 Well production (l/min 20 Disinfected? XYes No Please provide a map	AP EAP in f pumping (m/t) depth (mD) idepth (mD) id	2 3 4 5 10 15 20 30 40 50 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 cation tions on the basis 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 64.9 59.7 64.9 59.7 64.9 59.7 64.9 59.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 64.9 50.7 70.0 70.0 70.0 70.0	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter (Gal Con (I1 St (Gal Con (I1 St (Gal Con (Cal (Cal Con (Cal Con (Cal (Cal (Cal (Cal (Cal (Cal (Cal (Cal	f Construction         ional)       Jetting         j Diamono         ional)       Jetting         j Driving       Digging         Construction R         in Hole OR Material         vanized, Fibreglass, crete, Plastic, Steel)         cel         construction R         Material         ic, Galvanized, Steel)         Water Defepth         Kind of Wate         Gas       Other, spe         epth       Kind of Wate         Gas       Other, spe         epth       Kind of Wate         Gas       Other, spe         velt       Contractor	ecord - Cas Wall Thickness (cm/in) ecord - Cas Wall Thickness (cm/in) .188 ecord - Scre Slot No. Slot No.	blic mestic estock gation lustrial her, <i>specify</i>	Well Us           Comme           Municip           Test Hc           Cooling           n (m/ft)           To           60           190           n (m/ft)           To           Boy           Participation           No           Dep           From           Boy           Image: State	ie rrcial [ al ] al ]	Not used Dewatering Monitoring itioning Is of Well r Supply acement Well Hole arge Well thering Well rvation and/or oring Hole tition struction) doned, poor r Quality doned, other, fy r, specify teter Diameter Com/in) C D D S Loganza No	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (/min / 64.9 Well production (l/min 20 Well production (l/min 20 Disinfected? XYes No Please provide a map		2 3 4 5 10 15 20 30 40 50 60 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.8 cation tions on the basis 55 55 57.9 58.8 59.7 61.5 63.2 64.8 53.2 64.8 54 55 55 55 55 55 55 55 55 55 55 55 55 57.9 58.8 59.7 61.5 63.2 64.8 54 55 57	2 3 4 5 10 15 20 25 30 40 50 60 60	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter (cm) Dutside iameter (cm/in) (Plast iter found at D 171 (m) iter found at D 178 (m) iter found at D 178 (m)	f Construction         ional)       jetting         ional       jetting         iona	ecord - Scre Slot No. Slot No. Slot No. Slot No. Calls r: Fresh [ coffy r:	blic mestic estock gation lustrial her, specify	Well Us       Comme       Municip       Test Hc       Cooling       To       60       190       190       To       Participation       Image: State of the state o	ie rrcial [ al ] le [ & Air Condi Statu Vater Repla Bela Dewa Dobser Monita Aband Insuffi Aband Jobser Monita Cons C	Not used Dewatering Monitoring Monitoring itioning Is of Well r Supply acement Well Hole arge Well tration and/or oring Hole ation struction) doned, ficient Supply doned, Poor r Quality doned, other, fy r, specify reter Diameter (cm/in) f Stic/le	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / GPM) Disinfected? 20 Well production (l/min 20 Disinfected? 20 Please provide a map	AP EAP in pumping (m/t) depth (mAP) depth (mAP) AP AP AP AP AP AP AP AP AP AP	2 3 4 5 10 15 20 20 40 50 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.8 59.7 61.5 63.2 64.8 59.7 61.5 63.2 64.8 59.7 61.5 63.2 64.8 59.7 64.5 50.7 64.8 50.7 50.7 50.7 63.2 64.8 50.7 50.7 50.7 63.2 64.8 50.7 50.7 50.7 64.8 50.7 50.7 50.7 60.5 50.7 60.5	2 3 4 5 10 15 20 25 30 40 50 (* 60)	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter cm(p) Con (Cal Cal Cal Cal Cal Cal Cal Cal Cal Cal	f Construction         Diamono         Diamono         Digging         Driving         Digging         Construction R         nHole OR Material         vanized, Fibreglass,         crete, Plastic, Steel)         cel         Construction R         Material         c, Galvanized, Steel)         Water De         epth Kind of Wate         Gas Other, spe         epth Kind of Wate         f Well Contractor         f Well Cont	ecord - Cas Wall Thickness (cm/in) ecord - Cas Wall Thickness (cm/in) ecord - Scre Slot No. Ecord - Scre Ecord - Scre Slot No. Ecord - Scre Slot No. Ecord - Scre Slot No. Ecord - Scre Slot No. Ecord - Scre Ecord - Scre Slot No. Ecord - Scre Ecord - Scre Slot No. Ecord - Scre Slot No. Ecord - Scre Ecord - Sc	blic mestic estock gation lustrial her, <i>specify</i>	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           To           From           Provide           Image: Second Se	ie rrcial [ al ] al ]	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning ition iss of Well r Supply acement Well Hole arge Well ttering Well rvation and/or oring Hole ation struction) doned, Poor r Quality doned, other, fy r, specify  reter Diameter Cam/in) f Supply Supply Cameter Cam/in) f Supply Cameter	Pumpintake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / GAA) Well production (l/min 20 Disinfected? XOYes No Please provide a map Mich Comments:		2 3 4 5 10 15 20 30 40 50 60 60 60 7 60 60 60	40.6 $44.4$ $46.7$ $48.5$ $54$ $56$ $57.9$ $58.8$ $59.7$ $61.5$ $63.2$ $64.8$ $54$ $53.2$ $64.8$ $53.2$ $64.8$ $53.2$ $64.8$ $53.2$ $53.2$ $64.8$ $53.2$	2 3 4 5 10 15 20 25 30 40 50 (* 60) ack.	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter (cm) Convention (Converted iameter (cm) Converted (Converted (Converted (Converted) (Conv		ecord - Scre Slot No.	blic mestic estock gation lustrial her, <i>specify</i> <b>5ing</b> Depth From +2 / 60 / 60 / From	Well Us           Comme           Municip           Test Hc           Cooling           120'           190'           190'           Dep           From           From           Similaria           Www.           Minicip           To           60'           190'	se  rrcial al a	Not used Dewatering Monitoring Monitoring itioning soft Well r Supply accement Well Hole arge Well traing Well traing Well traing Well traing Well traing Vell traing Vell traing to and/or oring Hole ation struction) doned, ficient Supply doned, Poor r Quality doned, other, fy r, specify teter Diameter Com/in) Diameter Com/in) C Diameter C D	Pumpintake set at (n 180 Pumping rate (l/min / 20 Duration of pumping <u>hrs</u> + <u>0</u> m Final water level end of 84.8 If flowing give rate (l/m Recommended pump (l/min / GPA) Well production (l/min 20 Well production (l/min 20 Well production (l/min 20 Please provide a map McC SYes No Please provide a map	A A A A A A A A A A A A A A A A A A A	2 3 4 5 10 15 20 30 40 50 60 60 60 60 60 60 60 60 60 60 60 7 60 60 60 60 60 60 60 60 60 60 60 60 60	$ \begin{array}{c} 40.6 \\ 44.4 \\ 46.7 \\ 48.5 \\ 54 \\ 56 \\ 57.9 \\ 58.8 \\ 59.7 \\ 61.5 \\ 63.2 \\ 64.9 \\ 59.7 \\ 61.5 \\ 63.2 \\ 64.9 \\ 59.7 \\ 61.5 \\ 63.2 \\ 64.9 \\ 59.7 \\ 61.5 \\ 63.2 \\ 64.9 \\ 59.7 \\ 61.5 \\ 63.2 \\ 64.9 \\ 50.2 \\ 50.2 \\ 64.9 \\ 50.2 \\ 64.9 \\ 50.2 $	2 3 4 5 10 15 20 25 30 40 50 (* 60 ** 60	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter (cm/in) Dutside iameter (cm/in) (Plast iter found at D 171 (m) iter found at D 171 (m) iter found at D 178 (m) iter found at D 178 (m) iter found at D 178 (m) iter found at D 178 (m)	f Construction         ional)       Jetting         j Diamono         ional)       Jetting         j Driving       Digging         Construction R         in Hole OR Material         cel         construction R         Material         ic, Galvanized, Steel)         Water Der         eeth         Kind of Wate         Gas       Other, spe         epth       Kind of Wate         Gas       Other, spe         epth       Kind of Wate         Gas       Other, spe         Postal Code       KQA         KQA       ZQD	ecord - Cas Wall Thickness (cm/in) ecord - Cas Wall Thickness (cm/in) ecord - Scre Slot No. falls r: Fresh [ scify r: Fresh [ scify] r: Fresh	blic mestic estock gation lustrial her, specify	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           To           From           Dep           From           Minicip           To           B0           190           To           So           Image: So of the second se	se rcial [ al ] al ]	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning itioning itioning ition iss of Well r Supply acement Well Hole arge, Well tatering Well rvation and/or oring Hole ation struction) doned, Poor r Quality doned, Poor r Quality doned, other, fy r, specify  teter Diameter Cm/in) f f S IS/A	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 64.9 Well production (l/min 20 Disinfected? XOYes No Please provide a map Ni Please provide a map Ni Comments: 1/2 HP - 10 ( Well owner's Date P		2 3 4 5 10 15 20 30 40 50 60 60 60 60 60 60 60	40.6 44.4 46.7 48.5 54 58 59.7 61.5 63.2 64.9 58.8 59.7 61.5 63.2 64.9 58.5 7 7 61.5 63.2 64.9 58.5 7 7 61.5 63.2 64.9 58.5 7 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	2 3 4 5 10 15 20 25 30 40 50 (* 60 * 60	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o Cable Tool Rotary (Conven Rotary (Reverse Boring Air percussion Other, specify Inside iameter Con (I 11116 Ope (Gal Con (I 1116 (I 1116) (I 1116 (I 1116) (I 1116 (I 1116) (I 1116 (I 1116) (I 1116) (I 1116)	f Construction         ional)       Jetting         j Diamond         ional)       Jetting         j Driving       Digging         Construction R         in Hole OR Material         vanized, Fibreglass, crete, Plastic, Steel)         cel         construction R         Material         ic, Galvanized, Steel)         Water De         eepth         Kind of Wate         Gas       Other, spe         eepth       Kind of Wate         Gas       Other, spe         epth       Constructor         Vall Contractor       Vall Contractor         valing Co. Ltd.       Street Number/Na         Ktown Road, R       Postal Code         KQA 220	ecord - Cas Wall Thickness (cm/in) ecord - Cas Wall Thickness (cm/in) ecord - Scre Slot No. Slot No. Slot No. Fresh [ porfy r: Fresh [ porfy] r: Fresh [ po	blic mestic estock gation lustrial her, <i>specify</i> <b>From</b> +2 60  60  From Deptr From Comparison From Comparison From Comparison	Well Us           Comme           Municip           Test Hc           Cooling           To           60           190           190           From           From           Base           Wu           Municip           To           BO           To           BO           To           BO           To           BO           No           To           BO           No           Municip           To           BO           No           Municip           To           BO           No           Second           Municip           Second           Municip	se rrcial [ al ] al ]	Not used Dewatering Monitoring itioning itioning itioning itioning itioning itioning itioning itioning ition and/or oring Hole arge Well vation and/or oring Hole arge Well vationa arge Well vationa arge Well vationa arge Well vationa arge W	Pump intake set at (n 180 Pumping rate (l/min / 20 Duration of pumping 1 hrs + 0 m Final water level end of 64.8 If flowing give rate (l/m Recommended pump (l/min / 64.9 20 Well production (l/min 20 Well production (l/min 20 Disinfected? 20 Well production (l/min 20 Please provide a map M ( Comments: 1/2 HP - 10 ( Well owner's Date P information package A 2 Well owner's Date P		2 3 4 5 10 15 20 30 40 50 60 60 60 60 60 60 60 60 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 58.8 59.7 81.5 63.2 64.9 58.5 7 7 63.2 64.9 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 6 7 7 7 6 7 7 6 7 7 7 6 7 7 7 6 7 7 7 7 6 7	2 3 4 5 10 15 20 25 30 40 50 (60 60 (60) (60) (60) (7) (60) (7) (60) (7) (60) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26
Method o         Cable Tool         Rotary (Conven         Rotary (Reverse         Bair percussion         Data (Reverse         Coning         Air percussion         Data (Gal         Con         Inside ameter         cm(i)         Inside ameter         Con         Inside ameter         Inside ameter         Con         Inside ameter         Inses Address         Bi	f Construction         ional)       jetting         ional)       jetting         in Hole OR Material         vanized, Fibreglass,         crete, Plastic, Steel)         cel         construction R         Material         ic, Galvanized, Steel)         waterial         id, Gas         Other, spe         eepth         Kind of Wate         Gas         Other, spe         well Contractor         valied, Road, R         Vell Contractor         valied, ZZO         in, Gas Cother, spe         epth         Kind of Wate         Gas         Other, spe         ing Co. Ltd.         ing Co. Signature	ecord - Scre Slot No. Slot Slot Slot Slot Slot Slot Slot Slot	blic mestic estock gation lustrial her, specify	Well Us           Comme           Municip           Test Hc           Cooling           1201           1901           1901           No           1901           To           60           1901           To           Boy           In (m/ft)           To           Boy           Boy           In Informal           Wo           Mu	se  rcial al al al ble contractor	Not used Dewatering Monitoring Monitoring itioning Is of Well r Supply acement Well Hole arge Well tration and/or oring Hole ation struction) doned, for tr Quality doned, other, fy r, specify	Pumpintake set at ( <i>m</i> <b>180</b> Pumping rate ( <i>l/min</i> / <b>20</b> Duration of pumping <b>1</b> hrs + <b>0</b> m Final water level end of <b>64.8</b> If flowing give rate ( <i>l/m</i> Recommended pump ( <i>l/min</i> / <b>6</b> <b>20</b> Well production ( <i>l/min</i> <b>20</b> Well production ( <i>l/min</i> <b>20</b> Disinfected? <b>20</b> Well production ( <i>l/min</i> <b>20</b> Disinfected? <b>20</b> Well production ( <i>l/min</i> <b>20</b> Disinfected? <b>10</b> Corres No Please provide a map <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>11</b> <b>1</b>		2 3 4 5 10 15 20 40 50 60 60 60 60 60 60 60 60 60 60 60 60 60	40.6 44.4 46.7 48.5 54 56 57.9 58.8 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 59.7 61.5 63.2 64.9 57.9 58.8 64.9 64.9 64.9 7 64.9 7 64.9 7 64.9 7 64.9 7 64.5 6 64.9 7 64.9 7 64.5 6 64.9 7 64.9 7 64.9 7 64.5 6 64.9 7 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6	2 3 4 5 10 15 20 25 30 40 50 (* 60 ***********************************	39 36 34 33 30 27 26 26 26 26 26 26 26 26 26 26 26 26 26

2012<sup>eu</sup> 0 5 31 □ No Y Y Y M M D D Re Ministry's Copy