Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

PRELIMINARY HYDROGEOLOGICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
WALDEMAR DEVELOPMENT
TOWNSHIP OF AMARANTH

Prepared For: Sarah Properties Ltd. Developments
2 Prince Edward Road
Woodstock, Ontario
N4V 1G7

Attention: Walter Broos

File No. 13-13-3198-6
April 16, 2015

Terraprobe Inc.

Greater Toronto
11 Indell Lane
Brampton, Ontario L6T 3L1
(905) 796-2650 Fax: 796-2250

Hamilton – Niagara
903 Barton Street, Unit 22
Stoney Creek, Ontario L8E
(905) 643-7560 Fax: 643-7559

Central Ontario
220 Bayview Drive, Unit 25
Barrie, Ontario L4N 4Y8
(705) 739-8355 Fax: 739-8369

Northern Ontario
1012 Kelly Lake Rd., Unit 1
Sudbury, Ontario P3E 5P4
(705) 670-0460 Fax: 670-0558

www.terraprobe.ca

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1.0 INTRODUCTION

1.1 Project Description

Terraprobe was retained by Sarah Properties Limited to conduct a hydrogeological investigation for the property identified at 1 Evans Ave and 9 Mill Street, Township Amaranth. The purpose of this investigation was to assess the hydrogeologic conditions with respect to development of the property with a residential subdivision.

The property is situated on the west side of the Village of Waldemar to the north of Highway 9, as seen in Figure 1. The property is an irregular parcel comprising a total of 35.02 ha. The site is currently open and rolling agricultural land, as seen in Figure 2. It is bounded to the north by a former railway alignment and current rail trail and to the east by existing estate residential development. The lands to the south and west are currently used for agricultural purposes.

It is proposed to develop the property with approximately 334 single family residential homes, as seen in Figure 3. The site will be serviced with internal municipal roadways, and municipal water supply. Sewage disposal will be accomplished through a communal sewage system with surface disposal.

The Village of Waldemar is currently serviced with a municipal water supply. The supply is obtained from a number of wells, completed within the Village area to the east of the Grand River. It is proposed to extend the current municipal system to provide piped water to the proposed development. There are currently discussions underway with Township of Amaranth to discuss the requirements for extending the system.

There are currently no communal sewage facilities in the Village of Waldemar. The proposed development will be serviced with a communal system with surface discharge. The proposed sewage system will likely comprise of the following components:

- An internal system of sewage collection through a combination of gravity sewers and pumping stations.
- A sewage treatment plant
- Surface discharge, ultimately to the Grand River.

The ownership of the sewage and water systems will be determined through future discussions with the Township of Amaranth. However, it is expected that the ownership of the sewage system may be through a condominium arrangement or by the Township of Amaranth, while the water system may be owned and operated by the Municipality.

1.2 Summary of Work Program

In summary, the work program included the following:

- Review of available geologic and topographic mapping for the site and surrounding area.
- Review of Ministry of Environmental (MOE) well records and the results of subsurface investigations which Terraprobe has conducted in the immediate area and the Village of Waldemar.
- Review of well head protection studies, hydrogeologic studies, source water studies and watershed studies by Grand River Conservation and the Township of Amaranth.
- Review and identification of known areas of natural significance in the vicinity of the site. This will include water bodies, drainage features, ESA's, ANSI's, and similar published information regarding natural features.
- A detailed site inspection to assess hydrogeologic features and surface drainage on the site and surrounding areas.
- A review of meteorological data to assess local climate and water balance
- A review of existing studies completed for the site and the adjacent sites, including previous subsurface investigations.
- The excavation of 10 test pits to depths of approximately 3 m.
- Drilling of 23 boreholes, to depths of 3 m to 12 m. Monitoring wells were installed at each of the boreholes to permit the monitoring of shallow ground water levels and ground water quality.
- Assessment of soil saturated hydraulic conductivity through grain size analysis and well response tests in the monitoring wells.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Location and Description

The site occupies Part of Lots 1, 2, and 3, Concession 10, in the Township of Amaranth (County of Dufferin). It is located on the west side of the Village of Waldemar, and north of Highway 9 as shown on the Site Location Plan (Figure 1). The property is irregular parcel comprising a total of 35.02 ha. The site is currently open and rolling agricultural land (Figure 2). It is bounded to the north by a former railway alignment and current rail trail and to the east by existing estate residential development. The lands to the south and west are currently used for agricultural purposes.

2.2 Regional Physiography and Drainage

The site is situated near the boundary of two physiographic regions known as the Stratford Till Plain and the Hillsburg Sandhills (Figure 4). The Stratford Plain is a clay plain, generally consisting of a brown calcareous silty clay till. It is an area of ground moraine with several terminal moraines and is a product of the Huron Ice Lobe. The Hillsburgh Sandhills are characterized by rolling topography and sandy materials.

2.3 Site Topography and Drainage

The site generally slopes down to the north and east with a maximum topographic relief of approximately 28 m. The highest elevation of the property is near the south-western corner of the property. The lowest elevation of the property is situated at the north-east, near the rail trail. The site ground surface elevation is approximately 476 m to 458 m above mean sea level (Figure 2).

There are no permanent water courses found on the site. There is an existing storm water management pond and storm sewer located immediately downstream of the site. This was constructed as part of the existing community that is adjacent to the east side of the site. There are several drainage swales that feed the SWM basin, however these were dry at the time of the site inspection. The site is situated within the watershed of the Grand River. The main channel of the Grand River is found approximately 200 m to north and east of the site.

2.4 Climate

The site is situated in a climatic region known as the Dundalk Upland. The following climate data was obtained from Environment Canada publications. This information presents average climate data for the period of 1950-1980 (Brown et al., 1980):

- Mean annual frost free period……...115 days
- Mean annual precipitation……860 mm
- Annual water surplus……330 mm
- Mean annual evapotranspiration……530 mm

It is noted that the climate conditions and water balance above are generalized only; however, this information is sufficient for a preliminary assessment of the current infiltration conditions at the site for development purposes.

2.5 Regional Geology and Hydrogeology

Based on published geological information for the general area, the near surface soil on the northern portion of the subject property generally consists of Pleistocene age sediments, predominantly Late Wisconsinan glaciofluvial deposits consisting of gravel and sand. The near surface soil on the southern portion of the subject property generally consists of Pleistocene age sediments, predominantly Late Wisconsinan Tavistock Till consisting of silt to clayey silt till. The surficial geology map of the area is shown on the accompanying Figure 4.

Beneath the sequence of overburden deposits is bedrock of the Guelph Formation. The Guelph Formation consists of brown or tan dolostone. The bedrock geology map of the area is provided as Figure 5. Geologic mapping indicates that the depth of overburden in the vicinity of the subject property is between 20 and 30 m.

A review of well records for the area indicates that most wells obtain water from the underling dolostone bedrock. The dolostone bedrock is a regional aquifer and forms the most important aquifer or water supply zone in the area.

2.6 Ground Water Resources

The records for the wells within approximately 1 km of the site were reviewed to determine the nature of local ground water resources and water use. Based on this review, the following is a summary of local well records.

Total number of wells……..……49

Number of wells completed in the bedrock……40

Number of wells completed in the overburden…….……9

Depth Ranges:

Less than 15m…….……..….4

15 m to 30 m……...……12

Greater than 30 m……...…….30

Water Use:

Domestic or Stock……..……...……48

Unknown……..……..1

The locations of these wells have been plotted on the accompanying Figures 6. Geologic cross-sections have been prepared using the well data, and is presented in Figure 7 and 8.

In summary, the information indicates that the majority of the local wells and greater than 15 m in depth and draw water from the underlying bedrock, and most are used for domestic supply purposes.

3.0 RESULTS OF SITE INVESTIGATION

Details of the subsurface conditions encountered at the site are summarized below, and are also presented on the accompanying borehole and test pit logs presented in Appendix A and B, respectively. The borehole and test pit locations at the subject property are shown on the accompanying Figure 9. It should be noted that the soil conditions are determined at the test pit and borehole locations only, and may vary at other locations.

3.1 Stratigraphic Conditions

The soil conditions at the site were investigated by means of test pits and borehole between January and April, 2014. The test pits provided information regarding shallow soil and ground water conditions to depths of up to 3 m. Boreholes provided additional information regarding subsurface conditions to depths up to 12 m. Two geologic cross-sections were prepared using the borehole data. These cross sections are presented in Figures 10 and 11.

A more complete description of each of the hydrostratigraphic units encountered in the vicinity of the site is provided in this section of the report. Select grain size distribution curves for the following stratigraphy can be seen in Appendix A.

In summary, the site is covered by a layer of topsoil, underlain by glacial till. In the majority of the property, the topsoil is underlain by clayey silt till. At a small area in the northern portion of the property, sand and gravel deposits were encountered directly beneath the topsoil layer and extend to the depth of investigation. Sand deposits also encountered at depth in two boreholes.

Bedrock was not encountered during the investigation.

3.1.1 Sand and Gravel Deposits

Sand to sand and gravel deposits were encountered across sections of the northern portion of the property (Test Pits 2, 3, 4, and 5), and Boreholes 1 and 7 at the south west section of the site. These sand deposits were encountered below the topsoil at the test pits (2, 3, 4, and 5) in the northern section of the site. Sand and gravel was encountered in BH1 at depths of 7.6 m to 10.7, within the till unit. A similar sand unit was encountered from 2.7 to 4.6 m in Borehole 7. These boreholes both terminated in the till deposits.

3.1.2 Glacial Till

Glacial soils were encountered in all boreholes throughout the site. The glacial till soils were encountered immediately underlying the topsoil and continued to the completed depths. The glacial till had a clayey silt to silty sand matrix with trace to some gravel. Cobbles were at occasionally present within the till.

3.2 Ground Water Levels and Gradients

The depth to ground water has been measured several times in the monitoring wells on the property. The water levels in the monitoring wells installed on the development site were measured on several occasions between February and October 24, 2014. The data is presented in Appendix F.

The groundwater elevations are plotted on the accompanying Figure 10, 11 and 12.

The water elevation date data generally indicates the following:

- It is interpreted that the groundwater flow directions are primarily the north and east towards the Grand River.
- The shallow ground water flow direction follows surface topography

The ground water level measurements were taken over a period of time to assess seasonal variations. As noted in Appendix F, there are seasonal variations in water levels.

Generally, the ground water levels rise during the wet periods of the year (spring and fall) and drop during the summer months.

Vertical gradients were measured at five locations. Generally, there is a downward gradient across the site, consistent with ground water recharge.

3.3 Ground Water Quality

3.3.1 Overburden

Ground water monitoring wells installed on the property were sampled during the 2014/15 investigation for three sampling events. All of these monitoring wells were completed in the overburden materials. Complete laboratory results are provided in Appendix E.

The nitrate concentrations in the monitoring wells installed on the subject property are summarized in the following table below:

	Units	MW1D	MW3S	MW6	MW8	MW9	MW11D	MW12	MW16
Total Ammonia-N	mg/L	0.12	<0.050	0.053	<0.050	<0.050	0.12	<0.050	<0.050
Total Kjeldahl Nitrogen (TKN)	mg/L	3.9	0.41	19	3.1	1.6	1.0	<2.0	12
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<0.10	0.14	0.32	2.67	0.17	<0.10	1.61	3.42
Nitrate + Nitrite	mg/L	<0.10	0.14	0.32	2.67	0.17	<0.10	1.61	3.42

The nitrogen (Ammonia, TKN, Nitrite, Nitrite, and Nitrate) levels on the subject property are low. The average nitrate levels at the property are less than 1.1 mg/L at all locations, well below the Ontario Drinking Water Standard (ODWS) of 10 mg/L.

3.4 Description of Municipal Wells

3.4.1 Location and Water Use

The Village of Waldemar is currently serviced with three municipal wells. The status of the municipal wells has been the subject of several studies conducted on behalf of the Township of Amaranth. Most recently, and additional well (PW-3) was installed. A number of studies were conducted by R.J. Burnside and Associates Limited with respect to these wells, as noted below:

- "*Report on Construction and Testing of PW3/02, Waldemar, Ontario*" (R.J. Burnside & Associates Limited, 2003).
- "*Township of Amaranth, GUDI Study for PW3/02, Waldemar, Ontario*" (R.J. Burnside &Associates Limited, 2003).

In summary, these reports provide information on the hydrogeologic setting in the vicinity of the wells, and the status of the wells with respect to GUDI (Groundwater Under the Direct Influence of Surface Water) criteria.

Many homes within Waldemar are supplied with piped water obtained from three municipal wells. These municipal wells identified as PW-1, PW-2, and PW-3 are all located greater than 500m from the site, on the east side of the Grand River. The Permit to Take Water for PW-1 and PW-2 allows pumping rates of 5.7 L/s and 4.5 L/s, respectively (R.J. Burnside & Associates Limited, 2003). A Permit to Take Water was made for PW-3 for 5.3 L/s.

3.4.2 Hydrostratigraphic Conditions

Review of the well records for the municipal wells indicates that the subsurface conditions encountered at the wells can be divided into three hydrostratigraphic units: clayey till, sand and gravel, and bedrock. Each of these units is discussed individually below.

3.4.2.1 Clayey Till

The well records indicate that clayey materials were encountered at the surface at each of the well locations. This layer extended to depths ranging from 7 m to 24m below surface and contains sand, gravel, and cobbles; therefore this is likely a till deposit with a clay matrix.

The hydraulic conductivity of this layer is estimated to be approximately 10^{-8} to 10^{-10} m/s. Because of the low permeability of this soil type, this unit acts as a significant confining layer. It provides geologic isolation to the aquifer from the ground surface.

3.4.2.2 Sand and Gravel Deposits

The well record for PW-1 indicates that a deposit of sand and gravel was encountered at a depth of 7 m below ground surface. This deposit extended for 8 m to the dolostone bedrock. This deposit was not noted in any other municipal wells and is likely of limited extent.

3.4.2.3 Bedrock

Dolostone bedrock underlies the clayey glacial till materials in PW-2, PW-3 and the sand and gravel deposit in PW-1. The dolostone was noted to be fractured on the well records and was logged to depths ranging from 76 m to 106 m. This unit is the primary aquifer in the area.

3.4.3 Water Levels and Capture Zones

The static water level in the three municipal wells is 8 m, 15 m, and 5 m below ground surface for PW-1, PW-2, and PW-3, respectively.

The ten year capture zone for municipal wells extends approximately 2.8 km east of PW-1 and is approximately 700 m in width, as shown on Figure 13. The proposed subdivision lies outside the municipal wells capture zone.

3.4.4 GUDI Status of Municipal Wells

The study was conducted by R.J. Burnside Associates Limited (2003) to assess the GUDI status of PW3. The results of the study indicate that the well is not considered to be under the direct influence of surface water infiltration.

3.5 Hydraulic Conductivity Testing

Single well response testing was conducted on select monitoring wells to assess the saturated hydraulic conductivity throughout the site. Results from these tests are provided in the accompanying Appendix C. A summary of the results from the rising head tests are provided below. All of the wells are completed in the clay silt till strata.

Well ID	Saturated Hydraulic Conductivity (m/s
MW1D	2.4E-08
MW3S	2.6E-09
MW6	6.9E-08
MW8	6.7E-09
MW9	4.0E-09
MW11D	1.1E-08
MW12	5.5E-08
MW16	4.8E-09

The hydraulic conductivity ranged from 5.5 x10-^{8} to 2.6 x10^{-9} m/s, with geometric mean of 1 x10^{-8} m/s, consistent with clayey silt till.

4.0 DISCUSSIONS AND ANALYSIS

The following discussion and recommendations are based on the data used for this study. These recommendations are presented for the purposes of assessing the feasibility of developing the proposed subdivision site. It is noted that further engineering will be required during the final design and construction of the development.

4.1 Summary of Hydrogeological Features of the Site

The principal hydrogeologic features of the site were used as a guide to assess the possible impact of the development on the local ground water system. This information was then used to assess the expected impact of the development on ground water recharge and quality.

The principal hydrogeological features of the site include the following:

- The majority of the site is characterized by deposits of low permeability glacial till. Higher permeability sand and gravel is found beneath a small section of the northern portion of the sites beneath the topsoil, and at depth within the till at two boreholes at the south of the site.

- From a regional perspective, the site and surrounding areas are generally characterized by surficial deposits of low permeability glacial till which overlies bedrock at depths of over 20 m. The overburden and glacial till are not significant water bearing units or aquifers. The underlying bedrock is an important regional aquifer and supplies the local municipal wells.

- It is interpreted that the development site is situated primarily in an area of ground water recharge. The site is situated on the north and east side of a local height of land. Shallow groundwater flow is directed northeastward towards the Grand River.

4.2 Water Supply

The proposed subdivision will comprise 336 lots. Based on the number of lots, an assumption of 4 people per lot, and an average domestic usage of 450 L per day/per person, the average domestic water usage required for the development is 605 m^3/day.

Similarly the 2 hour peak demand is based on 3.75 L/min per person, yielding a peak usage of 5 m^3/min for the development.

These water demand figures are preliminary. The actual domestic consumption will generally be lower, since the population is typically less than 4 persons per household. Production wells in the area, use the fractured dolostone, which a regional aquifer. This aquifer is capable of providing adequate supply for the

subdivision, however further studies will be needed to confirm the requirements for the expansion of the municipal system to acknowledge the water demand.

4.3 Proposed Sewage System Design

The proposed development will have a gravity fed sanitary system that will convey raw sewage from each lot to a single treatment facility on the southeast side of the development. Certain areas were gravity fed is not possible, pumping stations will be used to covey sewage to the treatment facility.

The treatment facility will then allow for discharge of treated sewage to the adjacent Grand River. The sewage collection, treatment, and discharge activities will not affect local ground water conditions.

4.3.1 Impact on Local Private Wells

Review of MOE water well records indicate that the local wells in the area are mostly completed in the bedrock, with several completed in the overburden. As noted above, there is a significant confining layer which separates the bedrock from the surface. Therefore, the water quality in the bedrock wells is not likely going to impacted by the proposed development.

A door-to-door well survey must be completed to confirm the details of the local wells. If needed, is the proposed to provide any local residents who have a shallow well in the overburden materials with a municipal water which will be servicing the proposed development.

4.4 Impact of Development on Water Balance

4.4.1 Water Balance for Existing Conditions

A preliminary water balance model for the site was prepared to assess the distribution of rainfall, runoff and infiltration for existing (pre-development) conditions. The model is based on the climate data presented in Section 2.4 of this report. The Thornwaite Method was used to calculate the relative balance between rainfall, evaporation and evapotranspiration in the shallow soil zone. Based on this calculation, a conceptual model of ground water flow and water balance was developed. The water balance calculations are provided in Appendix D.

In summary, the total ground water recharge component for the area is about 165 mm/a (Appendix D). This recharge was determined using MOE Table 2 and Table 3 approach in the Technical Information Requirements for Land Development Applications (1995).

4.4.2 Water Balance for Post Development Conditions

The post-development water balance model that was prepared (Appendix D) is based on a residential development of 336 lots, or the 35 hectares development area.

As noted above, development of the site will result in a reduction of evaporation and direct infiltration, and an increase in runoff. The additional runoff can be used as a resource to enhance infiltration and restore infiltration to pre-development levels or higher. There several ways to introduce the runoff including but not limited to; soak away pits, swales, or overland flow. Roof runoff is suitable for this purpose since it is generally clean and free of sediment. To restore infiltration rates to pre-development levels, the equivalent to infiltration of approximately 33% of the runoff from rood areas.

4.4.3 Proposed Mitigation Measures

The primary hydrogeological function at the site is the maintenance of recharge rates. In particular, the sandy layers in the northern portion of the property should be maintained, as this area may provide enhanced ground water baseflow to the Grand River, situated to the north and east of the site. Therefore, the primary design considerations will be:

- Maintenance of the ground recharge rates. The recharge rates should occur over a broad diffuse area to match existing conditions.
- Maintenance of the more permeable layers in the northern portion, and in particular, the maintenance of any groundwater flow within this area.

Based on the site conditions, there are a number of storm water management techniques which are available to maintain ground water recharge rates. The use of 33% of roof top runoof will allow for a total infiltration of 57,784 m^3, equal to the pre development site infiltration.

In the northern portion of the site property, which is underlain with more permeable deposits, best management measures for maintaining infiltration should be considered. In this area, roof leaders could be discharged to surface and/or infiltration facilities.

The overall continuity of the ground water flow at the site should be maintained. The continuity if the higher permeable layers should be maintained to ensure that the pathway of ground water is not disrupted. In addition, house basements and underground services should not inadvertently drain ground water from such a zone.

Generally, the ground water pathways can be maintained through the following means:

- The proposed side grading plan should respect the continuity if the permeable layers in the northern portion of the property. Site grading in these areas should be conducted so that the zone is not truncated. Also, areas of surficial sand should be covered with materials of like or greater permeability.

- The excavation of underground services across permeable layers may interrupt ground water flow. Trench backfilling operations should be carried out with materials that are similar to the materials that have been excavated. In particular, sand zones must not be truncated by backfilling of trench using lower permeability material. The continuity of permeable zones can be ensured by providing a thin layer of permeable material such as sand and gravel, across the entire width of the trench.

- The bedding materials for underground services may serve as a subdrain to collect and convey ground water away from existing ground water transmission zones. This effect can be mitigated by the provision of trench plugs to cutoff granular bedding at all manhole locations.

As part of the final design, proposed site grading, drainage, and servicing plans should be reviewed by a qualified Hydrogeologist. The review should specifically address the requirements to maintain zones of groundwater transmission, as noted above.

5.0 SUMMMARY AND CONCLUSIONS

The results of the study indicate that the hydrogeologic features in the vicinity of the site can be characterized as follows:

- Most of the site is characterized by deposits of low permeability glacial till. The glacial till provides a significant protection to the local ground water resource.

- There is a municipal well system which services Waldemar. The well system obtains water from the underlying amabel dolomite which is a regional aquifer system.

- There are no significant natural features, such as water courses or wetland found on or directly adjacent to the site. The nearest significant natural feature is the Grande River found approximately 200 m to the north and east of the site.

It is concluded that the development will not cause a significant impact to local hydrogeologic conditions. In particular, the following is noted:

- The site does not provide for significant local ground water discharge to natural features or the Grande River. The Grande River generally obtains discharge from the underlying bedrock strata.

- Treated sewage generated at the development will be discharged in to the surface water and not the ground water.

- Ground water recharge and infiltration rates on the property can be maintained through conventional storm water management techniques. This includes infiltration of roof run off.

The following additional studies and/or supporting information required as the design and approvals of the development proceeds:

- Additional studies must be conducted to confirm the requirements for provision of additional water from the existing Municipal well system, to supply the proposed development. This may include assessment of additional water takings and/or provision of storage with respect to existing wells, and/or drilling of additional supply wells to augment water supply.

- A detailed water balance must be conducted as part of final design of the subdivision. Based on this water balance, the final design of appropriate storm water management measures (such as soak away pits, or other infiltration measures) must be provided in order to maintain overall ground water infiltrations rates.

- The final grading and servicing plan for the development must be reviewed to ensure basement, underground services do not intercept and/or cause dewatering of the isolated sand layers found on the property.

- A door-to-door survey should be conducted to identify any remaining private wells within approximately 250 m of the site. If necessary, provisions can be made for providing deeper wells and/or connection to the Municipal system if it appears the wells may be affected by the proposed development. Current information suggests that surrounding wells will not affected by the proposed development.

We trust this report meets with your requirements. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Terraprobe Inc.

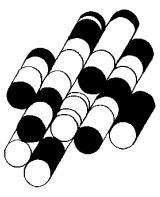
PROFESSIONAL GEOSCIENTIST
CHRISTOPHER RYAN SMITH
PRACTISING MEMBER
1950
4/16/15
ONTARIO

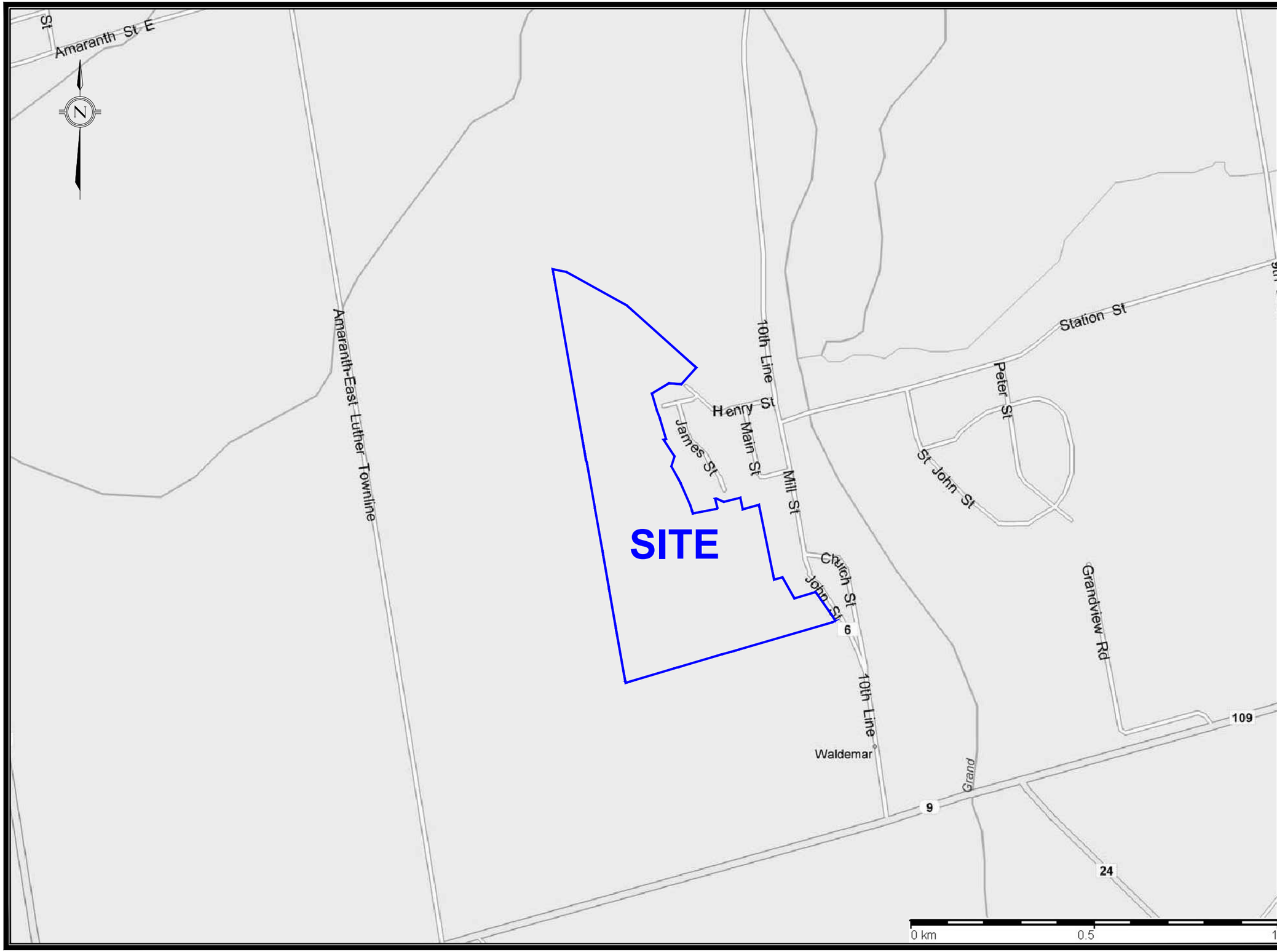
Ryan Smith, M.Sc., P.Geo.
Project Manager

Paul Bowen, P.Eng., P.Geo., QP_{RA}
Principal

FIGURES

TERRAPROBE INC.





Terraprobe Inc.

Consulting Geotechnical & Environmental Engineering
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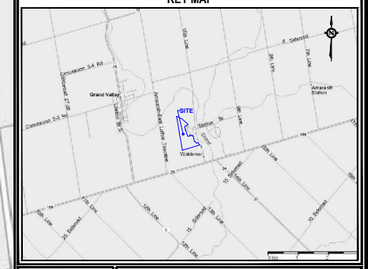
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



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REFERENCE:

Microsoft Streets & Trips 2013

NOTES:

LEGEND:

Property Boundary

PROJECT TITLE:

Hydrogeological Investigation

SITE LOCATION:

Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:

SITE LOCATION PLAN

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
As Shown	1
DATE:	
January 2014	

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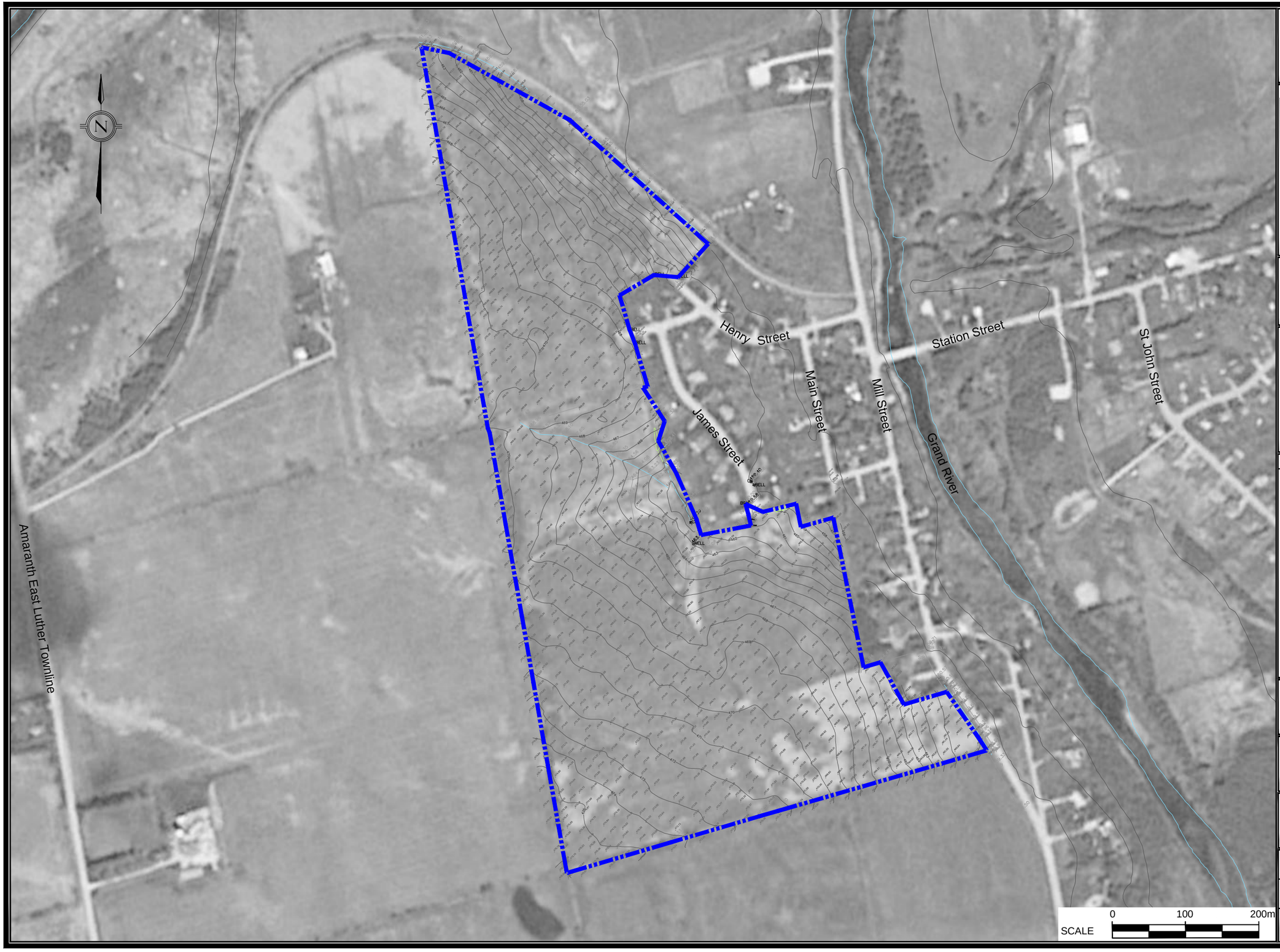

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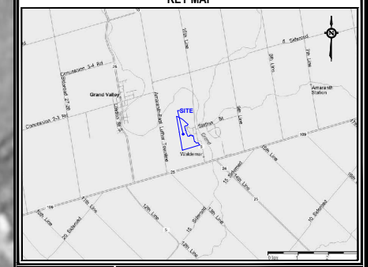

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LEGEND:

	Property Boundary

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
REGIONAL TOPOGRAPHY

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DATE: January 2014	

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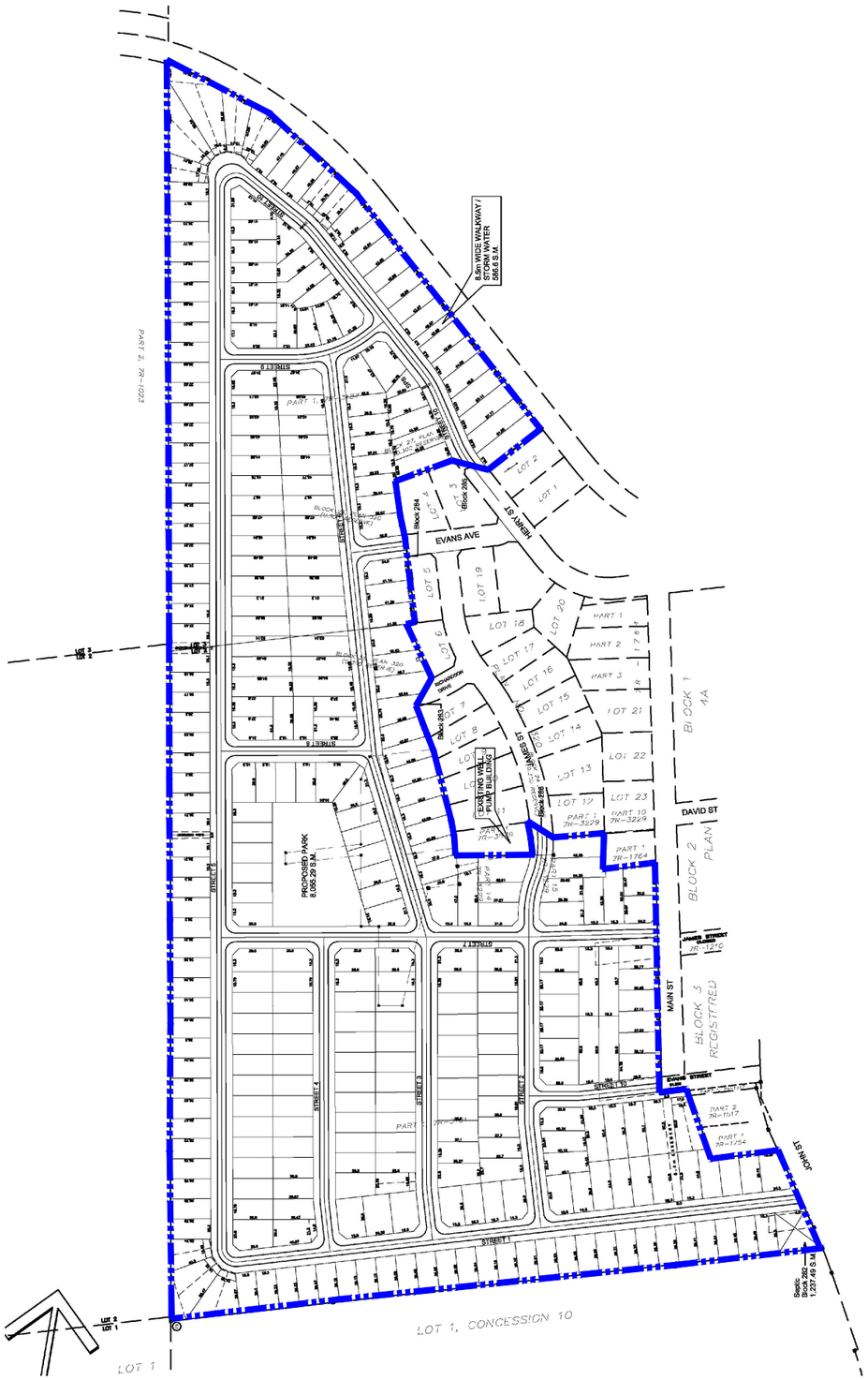

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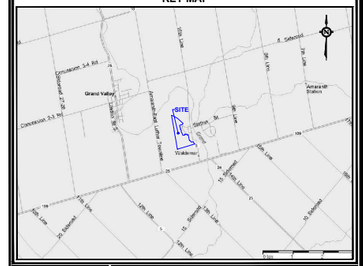
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:
SARAH PROPERTIES LTD.
Proposed Residential Development
1 Evans Avenue & 9 Mill Street
drawing No.: DP-1
date: March 25, 2015

NOTES:

LEGEND:

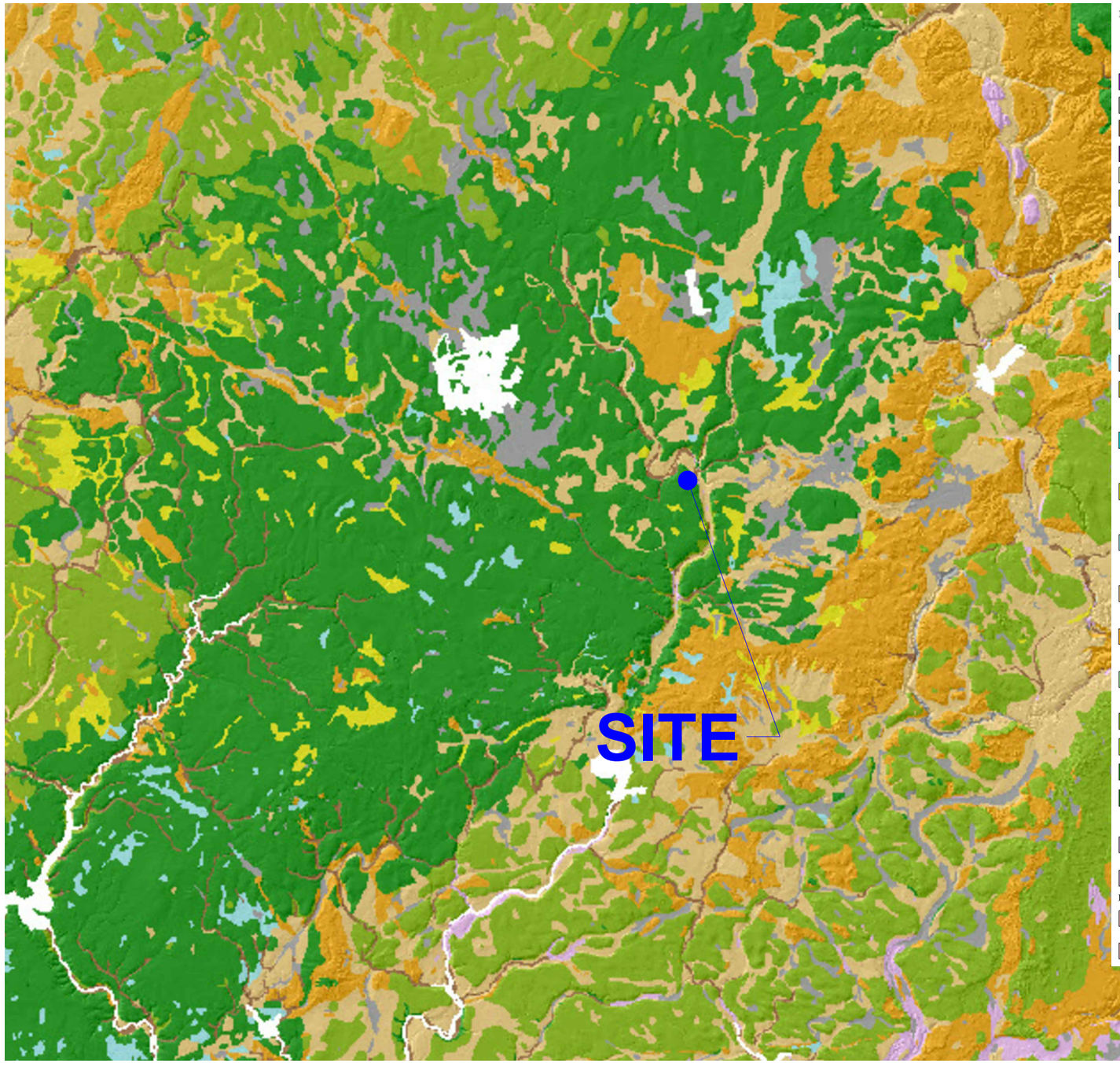
Property Boundary

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
PROPOSED SITE PLAN

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE: As Shown	**FIGURE NO.:** 3
DATE: February 2015	



Legend

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT

- 21 **Man-made deposits:** fill, sewage lagoon, landfill, urban development
- 20 **Organic Deposits:** peat, muck, marl
- 19 **Modern alluvial deposits:** clay, silt, sand, gravel, may contain organic remains
- 18 **Colluvial deposits:** boulders, scree, talus, undifferentiated landslide materials
- 17 **Eolian deposits:** fine to very fine sand and silt
- 16 **Coarse-textured marine deposits:** sand, gravel, minor silt and clay
  - 16a Deltaic deposits
  - 16b Littoral deposits
  - 16c Foreshore and basinal deposits
- 15 **Fine-textured marine deposits:** silt and clay, minor sand and gravel
- 14 **Coarse-textured lacustrine deposits:** sand, gravel, minor silt and clay
  - 14a Deltaic deposit
  - 14b Littoral deposits
  - 14c Foreshore and basinal deposits
- 13 **Fine-textured lacustrine deposits:** silt and clay, minor sand and gravel

PLEISTOCENE

- 12 **Older alluvial deposits:** clay, silt, sand, gravel, may contain organic remains
- 11 **Coarse-textured glaciomarine deposits:** sand, gravel, minor silt and clay
  - 11a Deltaic deposits
  - 11b Littoral deposits
  - 11c Foreshore and basinal deposits
- 10 **Fine-textured glaciomarine deposits:** silt and clay, minor sand and gravel
  - 10a Massive to well laminated
  - 10b Interbedded silt and clay and gritty, pebbly flow till and rainout deposits
- 9 **Coarse-textured glaciolacustrine deposits:** sand, gravel, minor silt and clay
  - 9a Deltaic deposits
  - 9b Littoral deposits
  - 9c Foreshore and basinal deposits
- 8 **Fine-textured glaciolacustrine deposits:** silt and clay, minor sand and gravel
  - 8a Massive to well laminated
  - 8b Interbedded silt and clay and gritty, pebbly flow till and rainout deposits
- 7 **Glaciofluvial deposits:** river deposits and delta topset facies
  - 7a Sandy deposits
  - 7b Gravelly deposits
- 6 **Ice-contact stratified deposits:** sand and gravel, minor silt, clay and till
  - 6a In moraines, eskers, kames and crevasse fills
  - 6b In subaquatic fans
- 5a **Till:** Silty sand to sand-textured till on Precambrian terrain
  - 5a Silty sand to sand-textured till on Precambrian terrain
- 5b 5b Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain
- 5c 5c Stony, sandy silt to silty sand-textured till on Paleozoic terrain
- 5d 5d Clay to silt-textured till (derived from glaciolacustrine deposits or shale)
- 5e 5e Undifferentiated older tills, may include stratified deposits

PALEOZOIC

- 4 **Bedrock-drift complex in Paleozoic terrain:**
  - 4a Primarily till cover
  - 4b Primarily stratified drift cover
- 3 **Paleozoic bedrock**

PRECAMBRIAN

- 2 **Bedrock-drift complex in Precambrian terrain:**
  - 2a Primarily till cover
  - 2b Primarily stratified drift cover
- 1 **Precambrian bedrock**

SYMBOLS

- Clay pit (active or inactive)
- Peat and muck pit
- Location of quarry
- Sand or gravel pit;
- Tailings
- Stoss and lee feature; crag and tail
- Delta, glaciolacustrine
- Drumlin or drumlinoid ridges
- Dune
- Glacial fluting
- Fossil locality
- Geotechnical or stratigraphic borehole not reaching bedrock
- Kame
- Solution weathering feature
- Kettle
- Outcrop
- Observed pebble orientation in till
- Reservoir
- Roches moutonee
- Sample site
- Small landslide scar
- Glacial striae; direction of ice movement known
- Glacial striae; direction of ice movement unknown
- Talus
- Area of sand dune
- Area of former lake bed
- Area of ribbed moraine or till ridges transverse to ice flow
- Area of scabland
- Beach ridges and near shore bars
- Shore bluff or scarp
- Crevasse filling
- Crests of large sand dune (eolian)
- Trend of moraine crest
- Bedrock scarp or escarpment
- Esker; direction of flow known
- Esker; direction of flow unknown
- Meltwater channel; inferred direction of flow
- Meltwater channel; direction of flow unknown
- Iceberg keel mark
- Ice-contact slope
- Clint and gryke topography
- Linear feature observed on aerial photograph
- Crest of megaripple
- Meltwater flow; inferred direction of flow
- Meltwater flow; direction of flow unknown
- Mapable edge of quarry or pit
- Minor moraine
- Bedrock pressure release ridge
- Ribbed or rogen moraine
- Edge of a mapable landslide scar
- Slump block, margin
- Abandoned meltwater channel or river channel; terrace escarpment
- Area of landslide scar
- Area of hummocky topography
- Area of moraine with no hummocky topography

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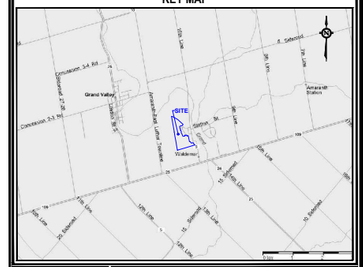
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:
The Ontario Geological Survey - 2003
Surficial Geology of Southern Ontario

NOTES:

LEGEND:

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
SURFICIAL GEOLOGY

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
NTS	4
DATE:	
January 2014	

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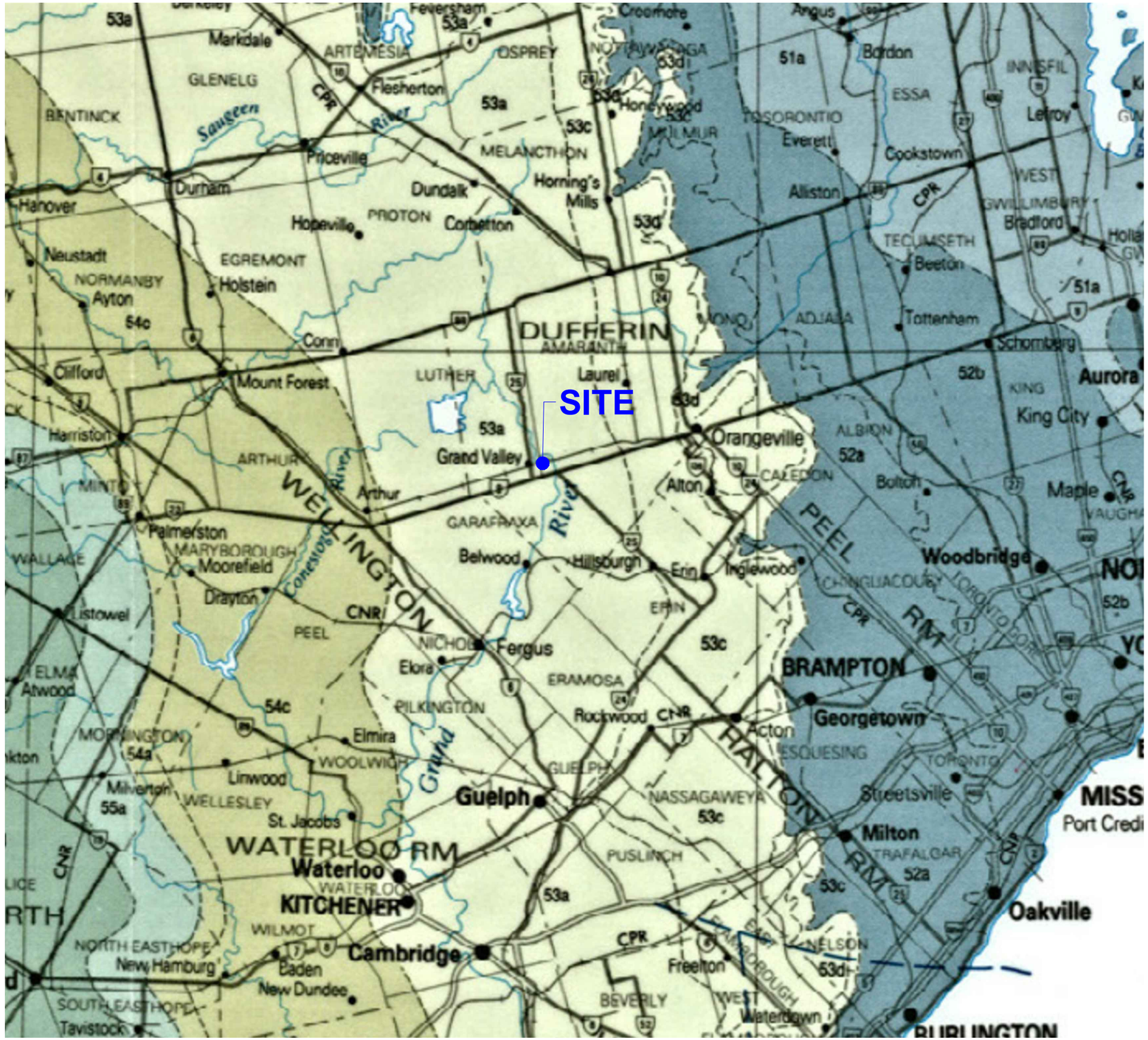

SILURIAN

UPPER SILURIAN

54 **Limestone, dolostone, shale, sandstone, gypsum, salt**
- 54a Bass Islands Fm.
- 54b Bertie Fm.
- 54c Salina Fm.
- 54d Kenogami River Fm. (Upper Silurian to Lower Devonian)

MIDDLE AND LOWER SILURIAN

53 **Sandstone, shale, dolostone, siltstone**
- 53a Guelph Fm.
- 53b Lockport Fm.
- 53c Amabel Fm.
- 53d Clinton Gp.; Cataract Gp.
- 53e Thornloe Fm.; Earlton Fm.
- 53f Wabi Gp.
- 53g Attawapiskat Fm.
- 53h Ekwan River Fm.
- 53i Severn River Fm.

ORDOVICIAN

UPPER ORDOVICIAN

52 **Shale, limestone, dolostone, siltstone**
- 52a Queenston Fm.
- 52b Georgian Bay Fm.; Blue Mountain Fm.; Billings Fm.; Collingwood Mb.; Eastview Mb.
- 52c Liskeard Gp.
- 52d Red Head Rapids Fm.
- 52e Churchill River Gp.
- 52f Bad Cache Rapids Gp.

MIDDLE ORDOVICIAN

51 **Limestone, dolostone, shale, arkose, sandstone**
- 51a Ottawa Gp.; Simcoe Gp.; Shadow Lake Fm.
- 51b Chazy Gp., Rockcliffe Fm.

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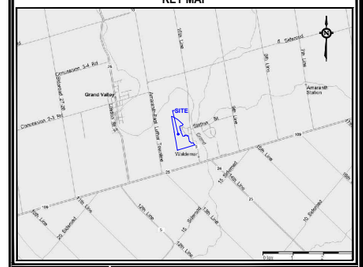
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:
Ministry of Northern Development and Mines
MAP 2544
Bedrock Geology of Ontario
Southern Sheet

NOTES:

LEGEND:

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
REGIONAL BEDROCK GEOLOGY

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE: NTS	**FIGURE NO.:** 5
DATE: January 2014	

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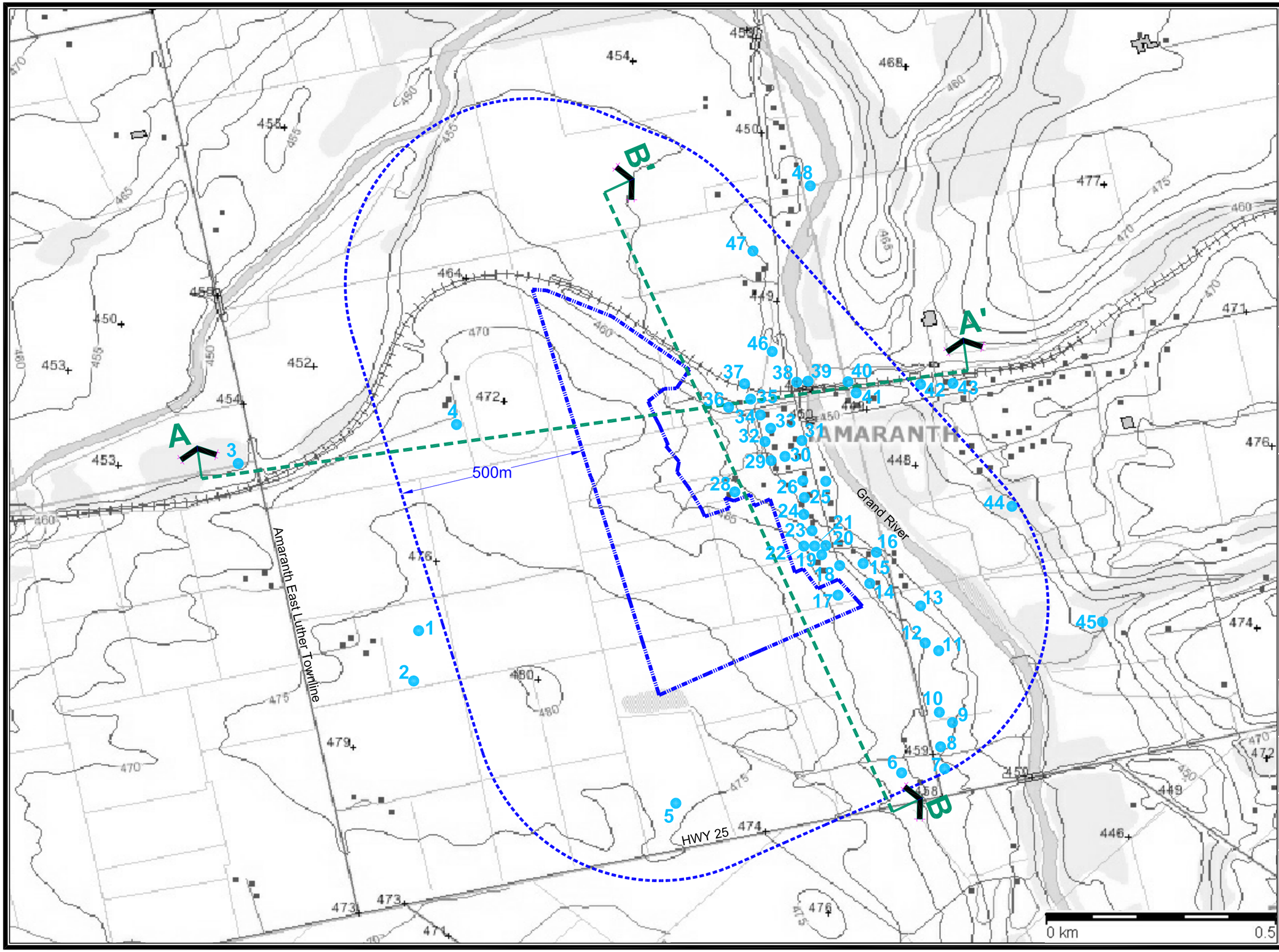

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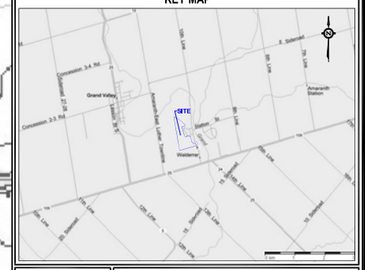
Construction Materials, Inspection & Testing

11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

Ontario Base Map

NOTES:

LEGEND:

- Property Boundary
- Study Area
- MOE Well Record Location
- Approximate Section Location

PROJECT TITLE:

Hydrogeological Investigation

SITE LOCATION:

Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:

MOE WELL LOCATION PLAN

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE: As Shown	**FIGURE NO.:** 6
DATE: January 2014	

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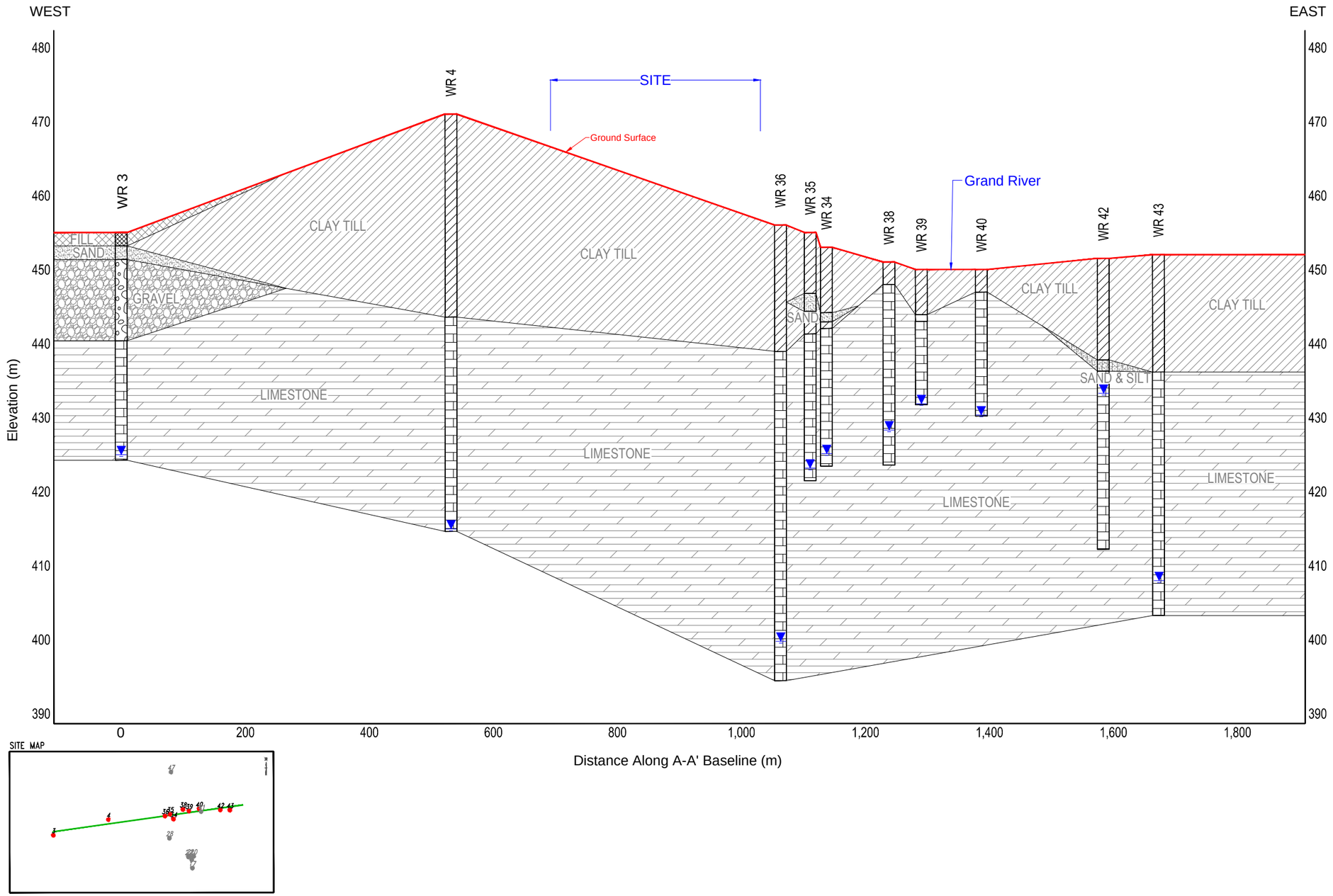
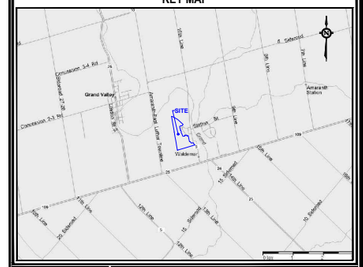
CROSS SECTION A-A'



SITE MAP

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

NOTES:

LEGEND:

- Fill
- Sand
- Clay Till
- Sand and Silt
- Gravel
- Limestone
- Stabilized water level, most recent

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
CROSS SECTION A-A'

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE: As Shown	**FIGURE NO.:** 7
DATE: January 2014	

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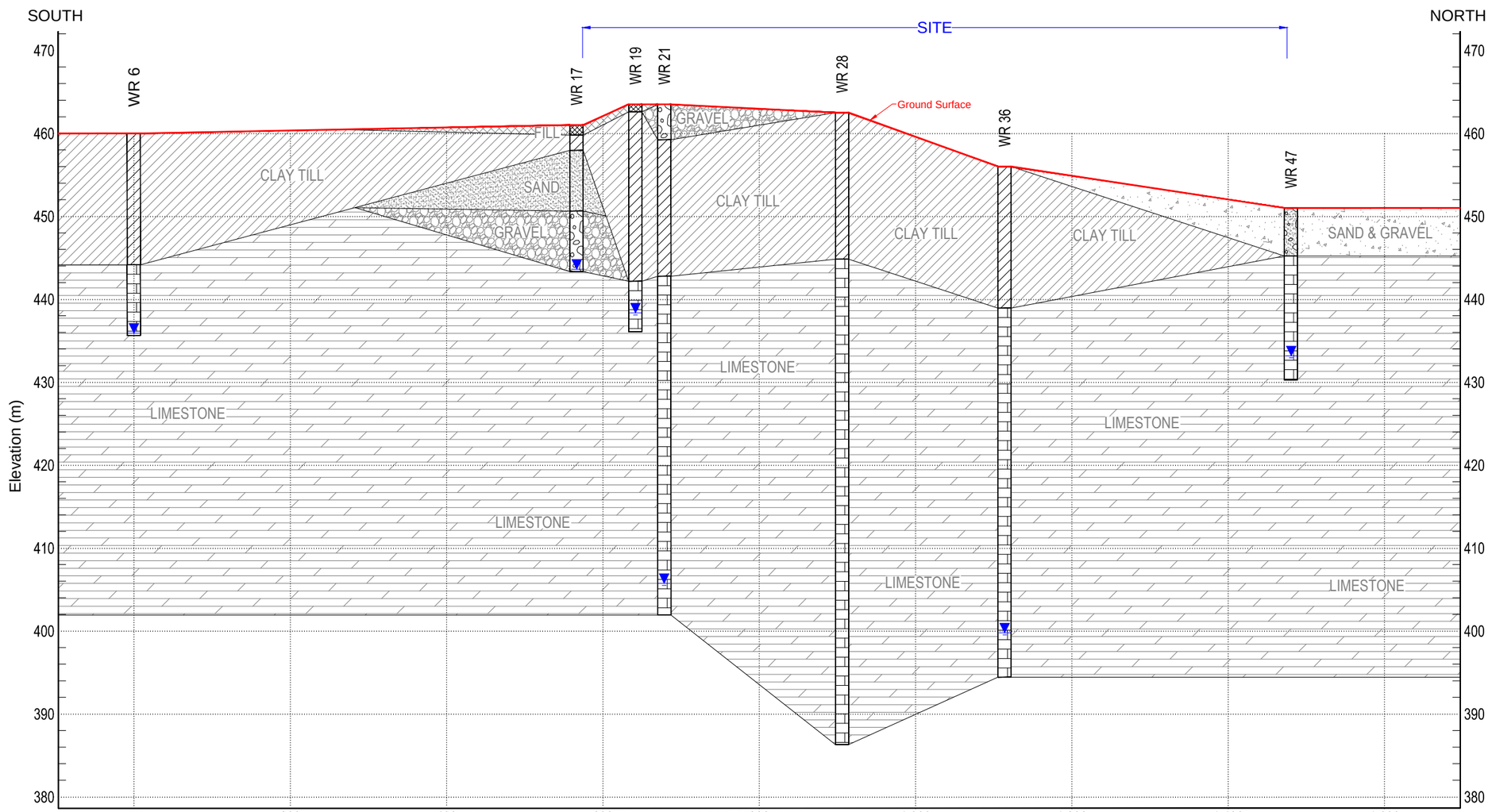
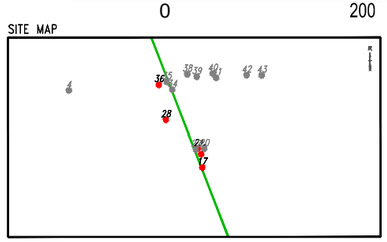
CROSS SECTION B-B'

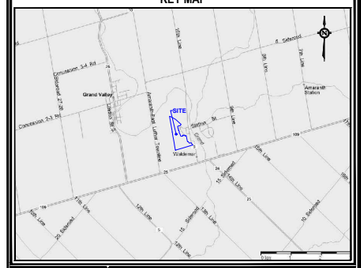


SITE MAP



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

NOTES:

LEGEND:

- Fill
- Sand
- Clay Till
- Sand and Gravel
- Gravel
- Limestone
- Stabilized water level, most recent

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
CROSS SECTION B-B'

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
As Shown	8
DATE:	
January 2014	

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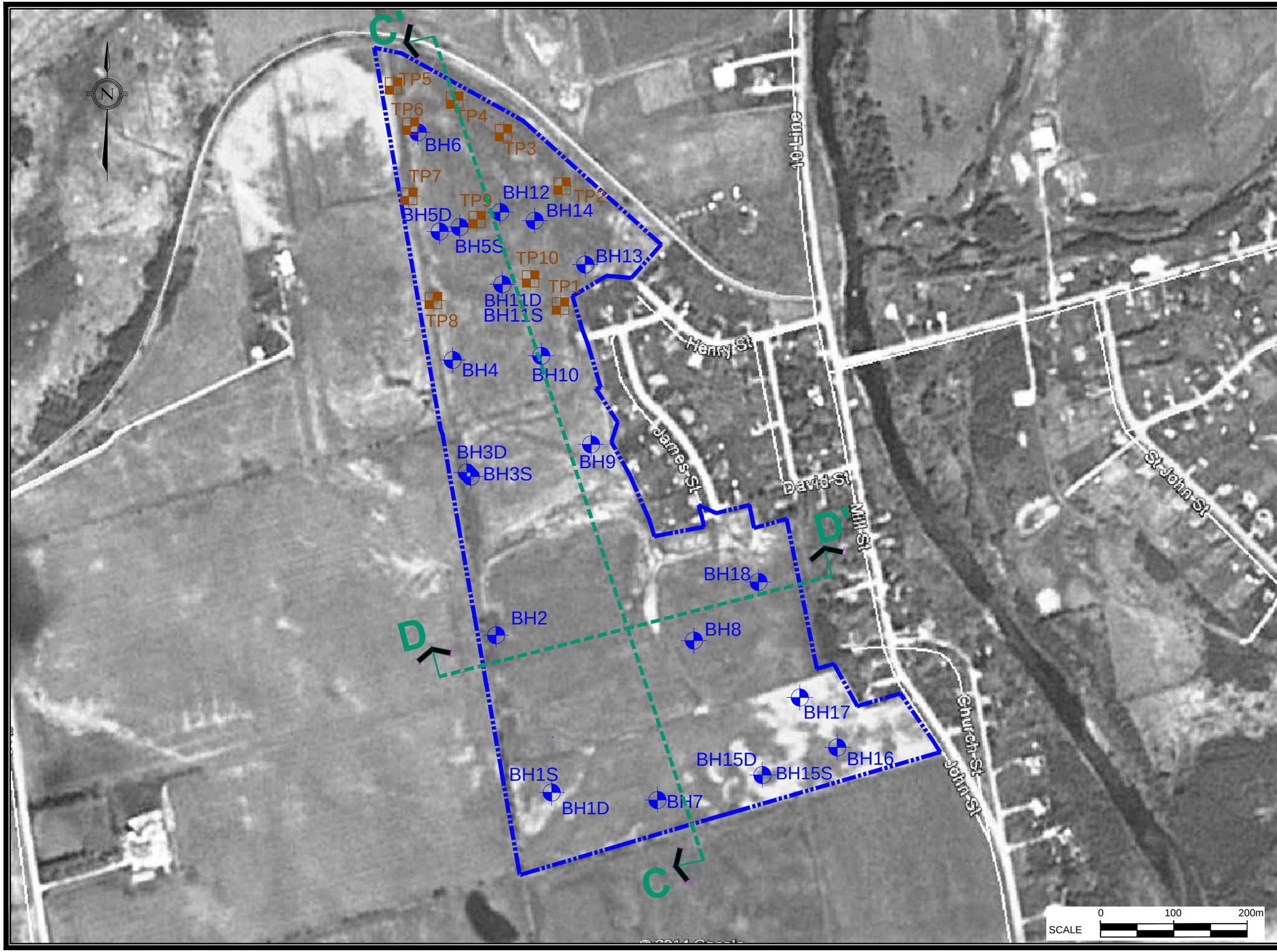
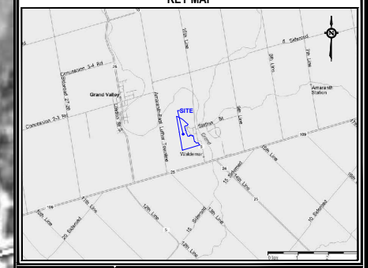


Terraprobe Inc.

Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing

11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

Google Earth - 2013

NOTES:

LEGEND:

- Borehole Location
- Test Pit Location
- Cross Section Location

PROJECT TITLE:

Hydrogeological Investigation

SITE LOCATION:

Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:

BOREHOLE AND TEST PIT
LOCATION PLAN

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
As Shown	9
DATE:	
June 2014	

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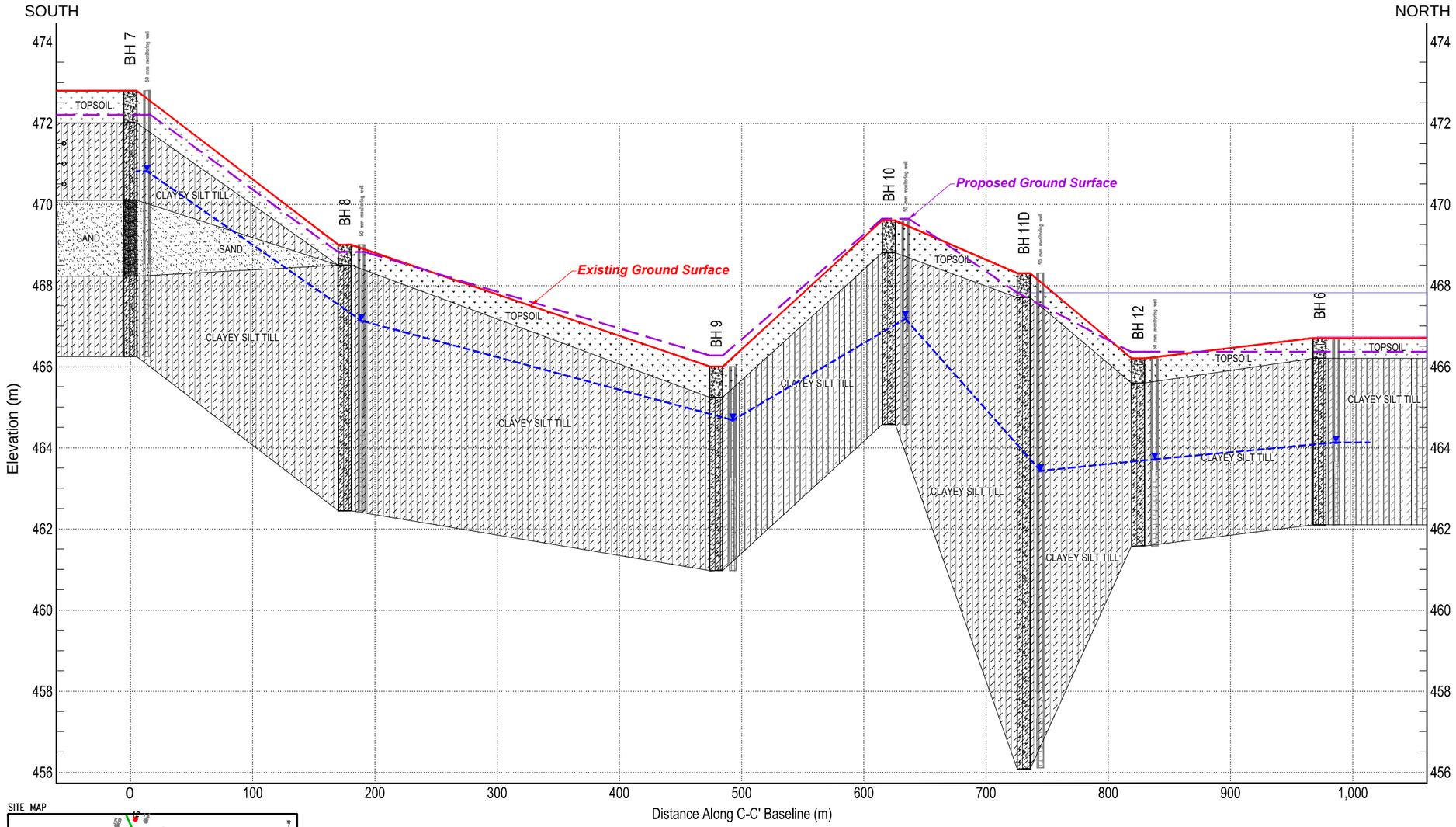
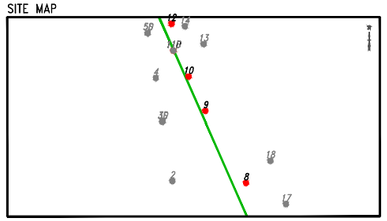
CROSS SECTION C-C'

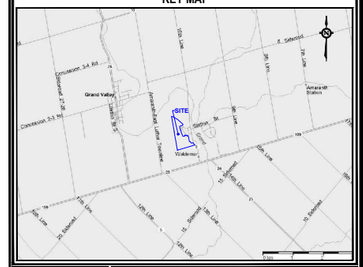


SITE MAP



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

NOTES:

LEGEND:

- Topsoil
- Sand
- Clayey Silt Till
- Stabilized water level, (March 23, 2015)
- Proposed Ground Surface
- Exisiting Ground Surface

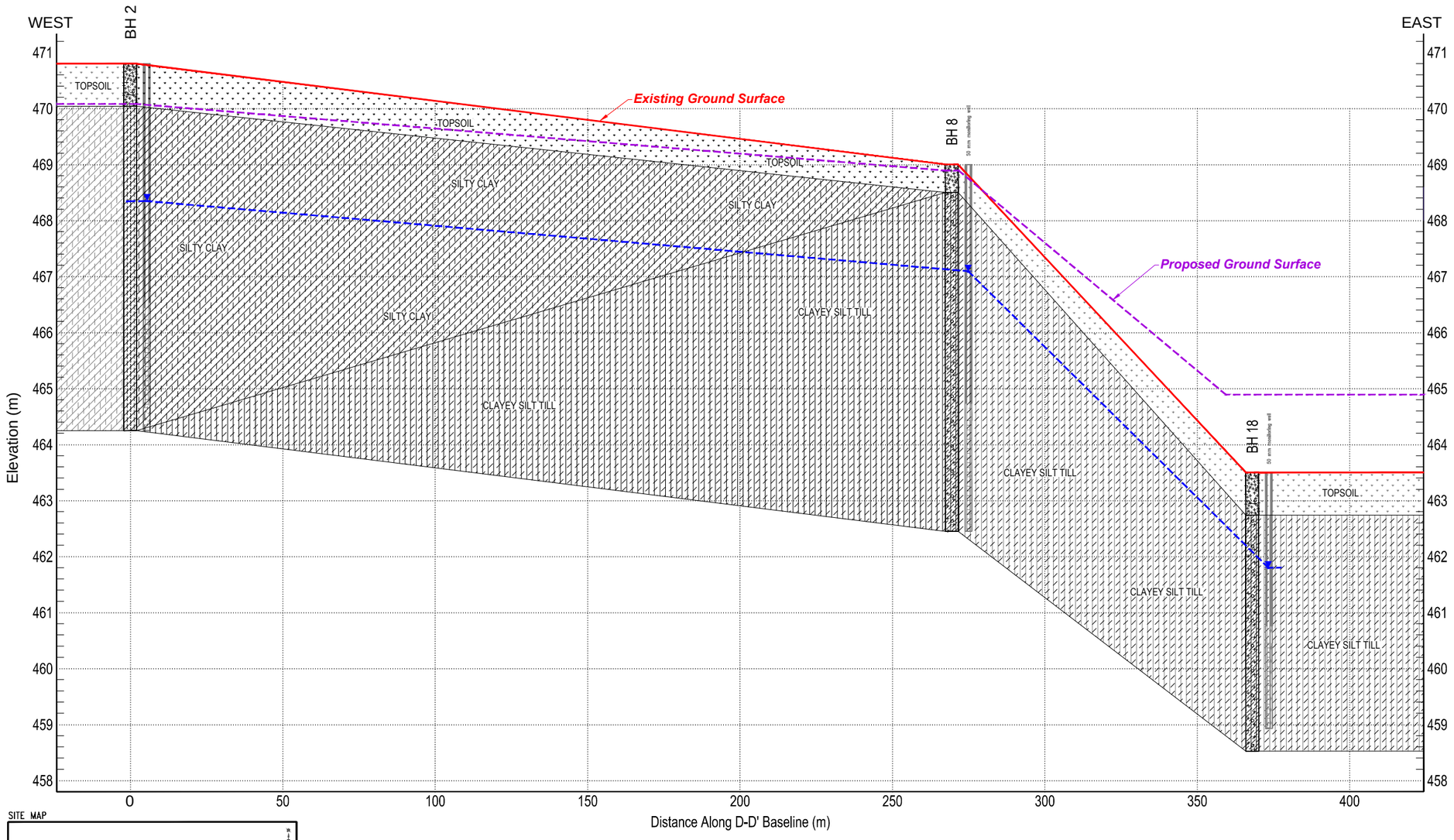
PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

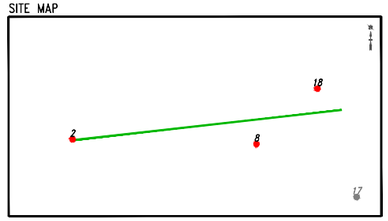
FIGURE TITLE:
CROSS SECTION C-C'

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE: As Shown	**FIGURE NO.:** 10
DATE: June 2014	

CROSS SECTION D-D'

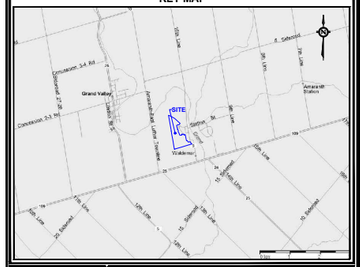


SITE MAP



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:

NOTES:

LEGEND:

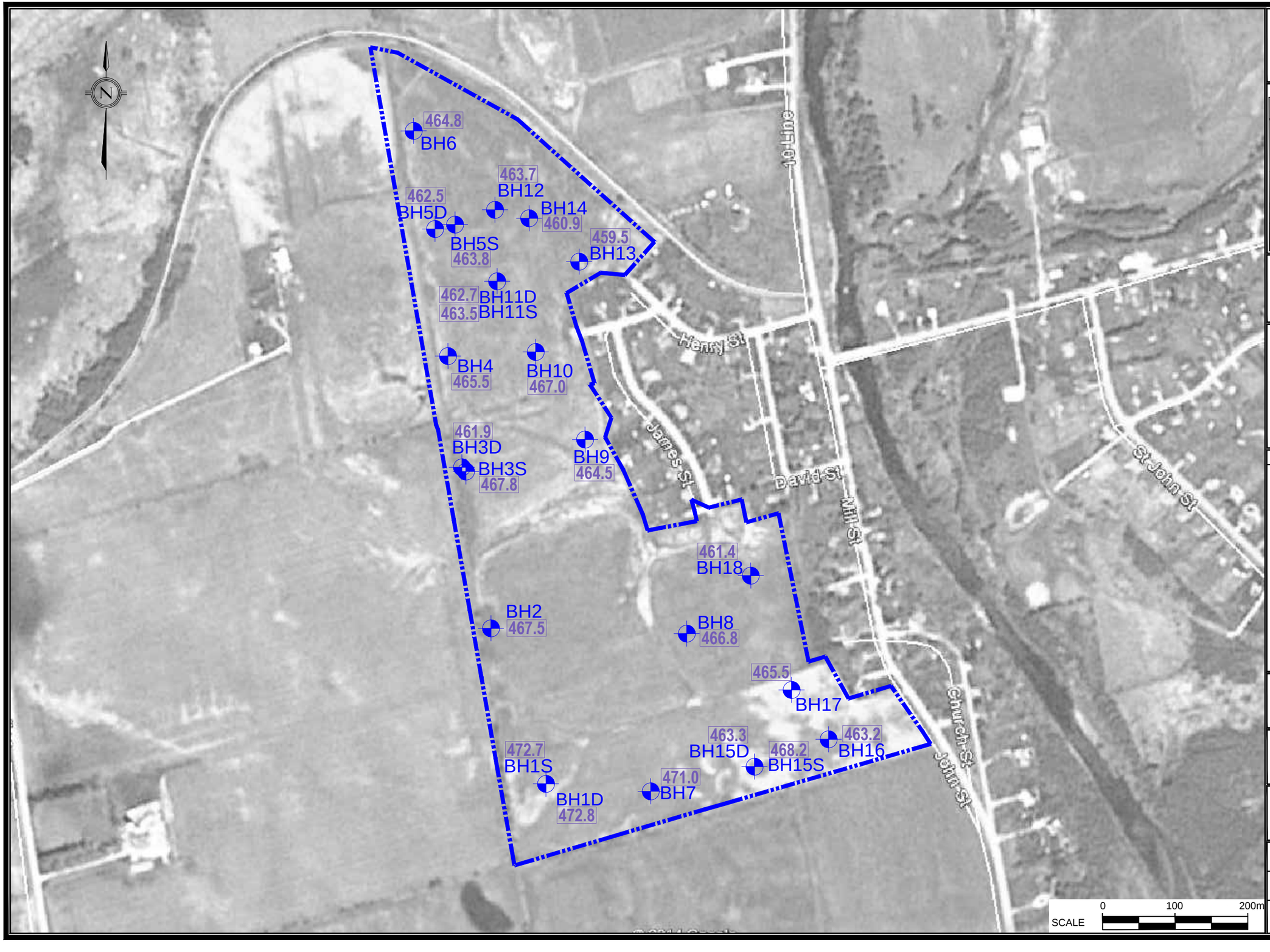
- Topsoil
- Silty Clay
- Clayey Silt Till
- Stabilized water level, (March 23, 2015)
- Proposed Ground Surface
- Exisiting Ground Surface

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

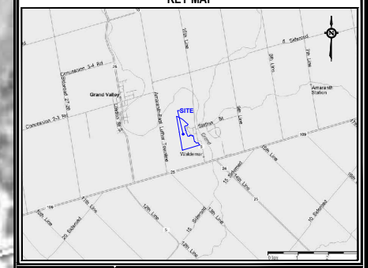
FIGURE TITLE:
CROSS SECTION D-D'

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
As Shown	11
DATE:	
June 2014	



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:
Google Earth - 2013

NOTES:

LEGEND:

	Property Boundary
	Borehole Location
466.8	Ground Water Elevation (masl), Oct.24, 2014

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

FIGURE TITLE:
GROUND WATER ELEVATIONS

REV NO.: 0	**FILE NO.:** 13-13-3198-6
SCALE: As Shown	**FIGURE NO.:** 12
DATE: June 2014	

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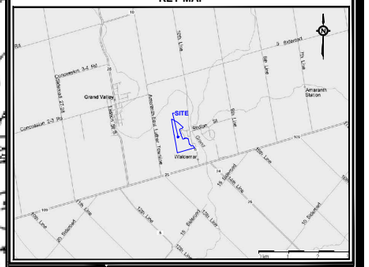
Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

KEY MAP



REFERENCE:
TOWNSHIP OF AMARANTH
PW3/02 GUDI STUDY
BURNSIDE
DATE: AUGUST 2003

NOTES:

LEGEND:

MUNICIPAL WELL LOCATION

PROJECT TITLE:
Hydrogeological Investigation

SITE LOCATION:
Waldemar Developments
Township of Amaranth, Ontario

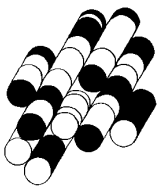
FIGURE TITLE:
CAPTURE ZONE FOR
THE WALDEMAR HEIGHTS WELLS

REV NO.:	FILE NO.:
0	13-13-3198-6
SCALE:	**FIGURE NO.:**
As Shown	13
DATE:	
June 2014	

SITE
ACCHIONE WELL
PW-1
PW-2
PW-3
10 YEAR CAPTURE ZONE
WILLOW CREEK
GRAND RIVER
SCALE 0 100 200 300 400m

APPENDIX A

TERRAPROBE INC.



LOG OF BOREHOLE 1D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 2

Position : E: 557124, N: 4859399 (UTM 17T)
Elevation Datum : Geodetic
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	9
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	26
1				3	SS	40
2				4	SS	44
		...becomes grey		5	SS	43
3						
4				6	SS	46
5						
6				7	SS	44
7						
	7.6	**GRAVEL AND SAND**, some silt, dense, grey, wet		8	SS	29
8						
9				9	SS	68
10						

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

(continued next page)

LOG OF BOREHOLE 1D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 2 of 2

Position : E: 557124, N: 4859399 (UTM 17T)
Elevation Datum : Geodetic
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description (continued)	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
		GRAVEL AND SAND, some silt, dense, grey, wet *(continued)*					
11	10.7	**CLAYEY SILT**, trace sand, trace gravel, very dense, grey, moist and wet		10	SS	50 / 100mm	
12	12.2	**END OF BOREHOLE**		11	SS	50 / 50mm	

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
Unconfined Field Vane
Pocket Penetrometer Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 3.0 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 1S

Client : Sarah Properties Ltd Developments

Project : Waldemar Development

Location : Township of Amaranth, Ontario

Project No.: 13-13-3198

Date started : April 29, 2014

Sheet No. : 1 of 1

Position : E: 557124, N: 4859399 (UTM 17T)

Elevation Datum : Geodetic

Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	9
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	26
1				3	SS	40
2				4	SS	44
		...becomes grey		5	SS	43
3						
4						
	4.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 2

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557049, N: 4859627 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	5
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, wet (GLACIAL TILL)		2	SS	16
1				3	SS	31
2				4	SS	41
		...becomes grey		5	SS	40
3						
4				6	SS	38
5						
6				7	SS	34
	6.6	**END OF BOREHOLE**				

Unstabilized water level measured at 4.6 m below ground surface; borehole was open upon completion of drilling.

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

LOG OF BOREHOLE 3D

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 2

Position : E: 557013, N: 4859848 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, loose, dark brown, moist (TOPSOIL)		1	SS	37
	0.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	10
1				3	SS	6
2				4	SS	7
3				5	SS	33
4						
	4.6	**CLAYEY SILT**, trace sand, trace gravel, very stiff, grey, moist (GLACIAL TILL)		6	SS	27
5						
6				7	SS	40
7						
8				8	SS	18
9				9	SS	100 / 150mm
10						

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
Unconfined
Pocket Penetrometer
Field Vane
Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

(continued next page)

LOG OF BOREHOLE 3D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 2 of 2

Position : E: 557013, N: 4859848 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		(continued)				
		CLAYEY SILT, trace sand, trace gravel, very stiff, grey, moist (GLACIAL TILL) *(continued)*				
11				10	SS	92 / 275mm
12				11	SS	50 / 125mm
	12.3	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)
Mar 11, 2014	9.0

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 3S

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557012, N: 4859846 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	37
	0.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	10
1				3	SS	6
2				4	SS	7
3				5	SS	33
4	4.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)
Mar 11, 2014	dry

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 4

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 556988, N: 4860008 (UTM 17T)
Elevation Datum : Geodetic

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	GROUND SURFACE				
	CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	86
0.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	25
			3	SS	32
	...becomes grey		4	SS	53
			5	SS	44
			6	SS	48
			7	SS	32
6.6	**END OF BOREHOLE**				

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)
Mar 11, 2014	dry

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 5D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 556958, N: 4860174 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	19
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	15
1				3	SS	16
2				4	SS	21
3				5	SS	52
4		...becomes grey ,wet		6	SS	47
5						
6				7	SS	50 / 100mm
	6.2	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
Unconfined Field Vane
Pocket Penetrometer Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 5S

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 556958, N: 4860174 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	19
1	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	15
				3	SS	16
2				4	SS	21
3				5	SS	52
4	4.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 6

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

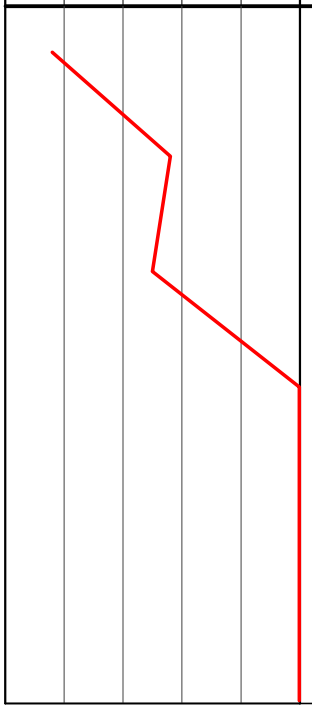
Position : E: 556934, N: 4860321 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	8
	0.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, wet (GLACIAL TILL)		2	SS	28
1				3	SS	25
2				4	SS	78
3				5	SS	50 / 75mm
4	4.6	**END OF BOREHOLE** Auger refusal		6	SS	50 / 25mm

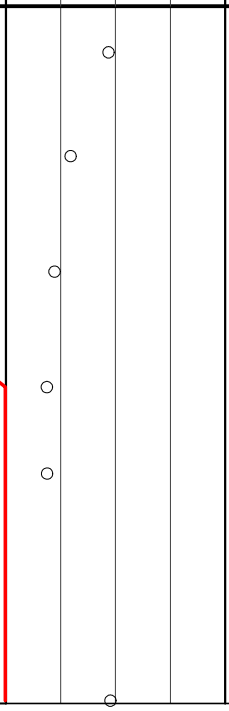
Borehole was dry and open upon completion of drilling.

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
Unconfined
Pocket Penetrometer
Field Vane
Lab Vane
40 80 120 160

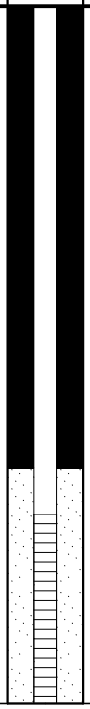


Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30



Headspace Vapour

Instrument Details



Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

LOG OF BOREHOLE 7

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557275, N: 4859408 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	17
1	0.8	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	22
				3	SS	37
2		...becomes grey		4	SS	38
	2.7	**SAND**, trace silt, very stiff, grey, wet		5	SS	29
3						
4						
	4.6	**CLAYEY SILT**, trace sand, trace gravel, hard, grey, moist (GLACIAL TILL)		6	SS	39
5						
6				7	SS	34
	6.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 3.7 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 8

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557321, N: 4859620 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	27
	0.5	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	8
1				3	SS	25
2				4	SS	30
3				5	SS	49
4				6	SS	94
5				7	SS	29
6	6.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 9

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557171, N: 4859886 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	5
	0.8	**CLAYEY SILT**, trace sand, trace gravel, stiff, brown, moist (GLACIAL TILL)		2	SS	13
1				3	SS	33
2				4	SS	40
3				5	SS	36
4		...becomes grey		6	SS	21
5	5.0	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

LOG OF BOREHOLE 10

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557109, N: 4860013 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	GROUND SURFACE				
	CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	45
0.8	**CLAYEY SILT**, trace sand, trace gravel, stiff, brown, moist (GLACIAL TILL)		2	SS	10
			3	SS	17
			4	SS	32
			5	SS	48
			6	SS	54
5.0	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)
Mar 11, 2014	4.7

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 11D

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 2

Position : E: 557053, N: 4860109 (UTM 17T)
Elevation Datum : Geodetic
Rig type : CME 55
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	6
	0.6	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown (GLACIAL TILL)		2	SS	18
1				3	SS	23
2				4	SS	67
3				5	SS	44
4				6	SS	50
5		...becomes grey		7	SS	50 / 100mm
6				8	SS	50 / 100mm
7				9	SS	50 / 125mm
8						
9						
10						

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

(continued next page)

LOG OF BOREHOLE 11D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 2 of 2

Position : E: 557053, N: 4860109 (UTM 17T)
Elevation Datum : Geodetic
Rig type : CME 55
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		(continued)				
		CLAYEY SILT, trace sand, trace gravel, very stiff, brown (GLACIAL TILL) *(continued)*		10	NR	50 / 25mm
11						
12						
	12.2	**END OF BOREHOLE**		11	NR	50 / 25mm

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 11S

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557053, N: 4860109 (UTM 17T)
Elevation Datum : Geodetic
Rig type : CME 55
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	6
	0.6	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	18
1				3	SS	23
2				4	SS	67
3				5	SS	44
4	4.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

library: library - terraprobe gint.glb report: terraprobe soil log file: 13-13-3198.gpj

LOG OF BOREHOLE 12

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557046, N: 4860208 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	13
	0.6	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, wet (GLACIAL TILL)		2	SS	27
1				3	SS	17
2				4	SS	44
		...becomes grey , moist		5	SS	50 / 50mm
3						
4	4.6	**END OF BOREHOLE**		6	SS	50 / 50mm

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 3.7 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 13

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557165, N: 4860133 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	8
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	19
1				3	SS	22
2				4	SS	50 / 50mm
3				5	SS	50 / 0mm
4				6	AS	50 / 10mm
	4.7	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 4.0 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 14

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557096, N: 4860199 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Elev Depth (m)	Description	Number	Type	SPT 'N' Value
	GROUND SURFACE			
	CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)	1	SS	16
0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, wet (GLACIAL TILL)	2	SS	24
		3	SS	15
		4	SS	28
		5	SS	50 / 125mm
		6	SS	50 / 75mm
		7	NR	50 / 10mm
5.5	**END OF BOREHOLE**			

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit

Headspace Vapour
Instrument Details
Unstabilized Water Level
Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 4.6 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 15D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 2

Position : E: 557417, N: 4859437 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	8
1	0.8	**CLAYEY SILT**, trace sand, trace gravel, stiff, brown, moist (GLACIAL TILL)		2	SS	9
				3	SS	14
2				4	SS	31
3				5	SS	57
4				6	SS	50 / 75mm
5						
6				7	SS	50 / 100mm
7						
8				8	SS	50 / 50mm
9				9	SS	56
10						

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
Unconfined + Field Vane
Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour
Instrument Details
Unstabilized Water Level
Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

(continued next page)

LOG OF BOREHOLE 15D

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 2 of 2

Position : E: 557417, N: 4859437 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		(continued)				
		CLAYEY SILT, trace sand, trace gravel, stiff, brown, moist (GLACIAL TILL) *(continued)*		10	SS	50 / 50mm
11						
12						
	12.2			11	AS	50 / 25mm
		END OF BOREHOLE				

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL: 10 20 30

Headspace Vapour
Instrument Details
Unstabilized Water Level
Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 9.1 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 15S

Terraprobe

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557417, N: 4859437 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	8
	0.8	**CLAYEY SILT**, trace sand, trace gravel, stiff, brown, moist (GLACIAL TILL)		2	SS	9
1				3	SS	14
2				4	SS	31
3				5	SS	57
4	4.6	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 16

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557522, N: 4859474 (UTM 17T)
Elevation Datum : Geodetic

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	GROUND SURFACE				
	CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	4
0.5	**CLAYEY SILT**, trace sand, trace gravel, very dense, brown, moist (GLACIAL TILL)		2	SS	13
			3	SS	20
			4	SS	76
			5	SS	85
			6	SS	48
5.0	**END OF BOREHOLE**				

Unstabilized water level measured at 4.3 m below ground surface; borehole was open upon completion of drilling.

50 mm monitoring well installed.

Penetration Test Values (Blows / 0.3m)
Dynamic Cone
Undrained Shear Strength (kPa)
Unconfined
Pocket Penetrometer
Field Vane
Lab Vane

Moisture / Plasticity
Plastic Limit
Natural Water Content
Liquid Limit

Headspace Vapour
Instrument Details
Unstabilized Water Level
Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

LOG OF BOREHOLE 17

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557469, N: 4859542 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
		GROUND SURFACE				
0		**CLAYEY SILT**, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	9
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	10
1				3	SS	27
2				4	SS	80
3				5	SS	74
4				6	SS	20 / 100mm
	4.8	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40

Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

LOG OF BOREHOLE 18

Client : Sarah Properties Ltd Developments
Project : Waldemar Development
Location : Township of Amaranth, Ontario

Project No.: 13-13-3198
Date started : April 29, 2014
Sheet No. : 1 of 1

Position : E: 557411, N: 4859702 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0		**GROUND SURFACE**				
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	SS	12
	0.8	**CLAYEY SILT**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		2	SS	12
1				3	SS	35
2				4	SS	24
3				5	SS	50 / 150mm
4				6	SS	83 / 250mm
	5.0	**END OF BOREHOLE**				

Elevation Scale (m)

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

50 mm monitoring well installed.

Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST FORM

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **6**
SAMPLE NUMBER: **3**
SAMPLE DEPTH: **1.5 - 2.0 m**
SAMPLE DESCRIPTION: **SAND AND SILT, some gravel, trace clay**

FILE NO.: **13-13-3198**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**
TEST DATE: **April 29, 2014**
TESTED BY: **SR**
LAB NO.: **1060B**

COARSE SIEVES

Dry Weight (g)		347.5		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
1.5"	37.5	0.00	0.0	**100.0**
3/4"	19.0	0.00	0.0	**100.0**
3/8"	9.5	14.46	4.2	**95.8**
No. 4	4.75	28.17	8.1	**91.9**
No. 10	2.00	34.69	10.0	**90.0**
PAN		312.60		
Dry Weight After Sieving (g)		347.3		
Percent Loss After Sieving		0.05		

FINE SIEVES (after washing)

Dry Weight		50.38		
Percent Passing No.4 (%)		90		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
No. 20	0.840	4.80	9.5	**81.5**
No. 40	0.425	7.74	15.4	**76.2**
No. 60	0.250	10.86	21.6	**70.6**
No. 140	0.105	18.26	36.2	**57.4**
No. 200	0.075	21.04	41.8	**52.4**

HYGROSCOPIC MOISTURE CONTENT

Wt. of wet soil and tare (g)	2.00
Wt. of dry soil and tare (g)	2.00
Wt. of water (g)	0.00
Wt. of tare (g)	1.00
Wt. of wet soil (g) (W_A)	1.00
Wt. of dry soil (g) (W_0)	1.00
Water content (%)	0.00

HYDROMETER

December 6, 2012, new Gs for

Hygroscopic Correction Factor	1.000000
Corrected Sample Weight (M_o)	50.38
Test sample represented by soil (W)	55.97
Gs Correction Factor	0.985209
Specific Gravity	2.717

Date and time	**Elapsed Time**	**H_s in Divisions (G/L)**	**H_c in Divisions (G/L)**	**Temp. T_c (C)**	**Corrected Reading $R = H_s - H_c$**	**Percent Passing P in %**	**L in cm**	**n in milliPoise**	**K**	**Particle Diameter D in mm**	
	1	30.0	5.0	23.3	25.0	**44.01**	11.3029	9.3273	0.0129	0.0434	Hydrometer
	2	26.0	5.0	23.3	21.0	**36.97**	12.1029	9.3273	0.0129	0.0317	L_1
	5	22.5	5.0	23.3	17.5	**30.81**	12.8029	9.3273	0.0129	0.0206	L_2
	15	19.0	5.0	23.1	14.0	**24.64**	13.5029	9.3707	0.0129	0.0123	V_b
	30	17.0	5.0	23.1	12.0	**21.12**	13.9029	9.3707	0.0129	0.0088	H_s
	60	15.0	5.0	23.0	10.0	**17.60**	14.3029	9.3925	0.0129	0.0063	H_m
	250	11.0	5.0	23.6	6.0	**10.56**	15.1029	9.2629	0.0129	0.0032	A
	1440	9.0	5.0	23.2	4.0	**7.04**	15.5029	9.3490	0.0129	0.0013	

Terraprobe

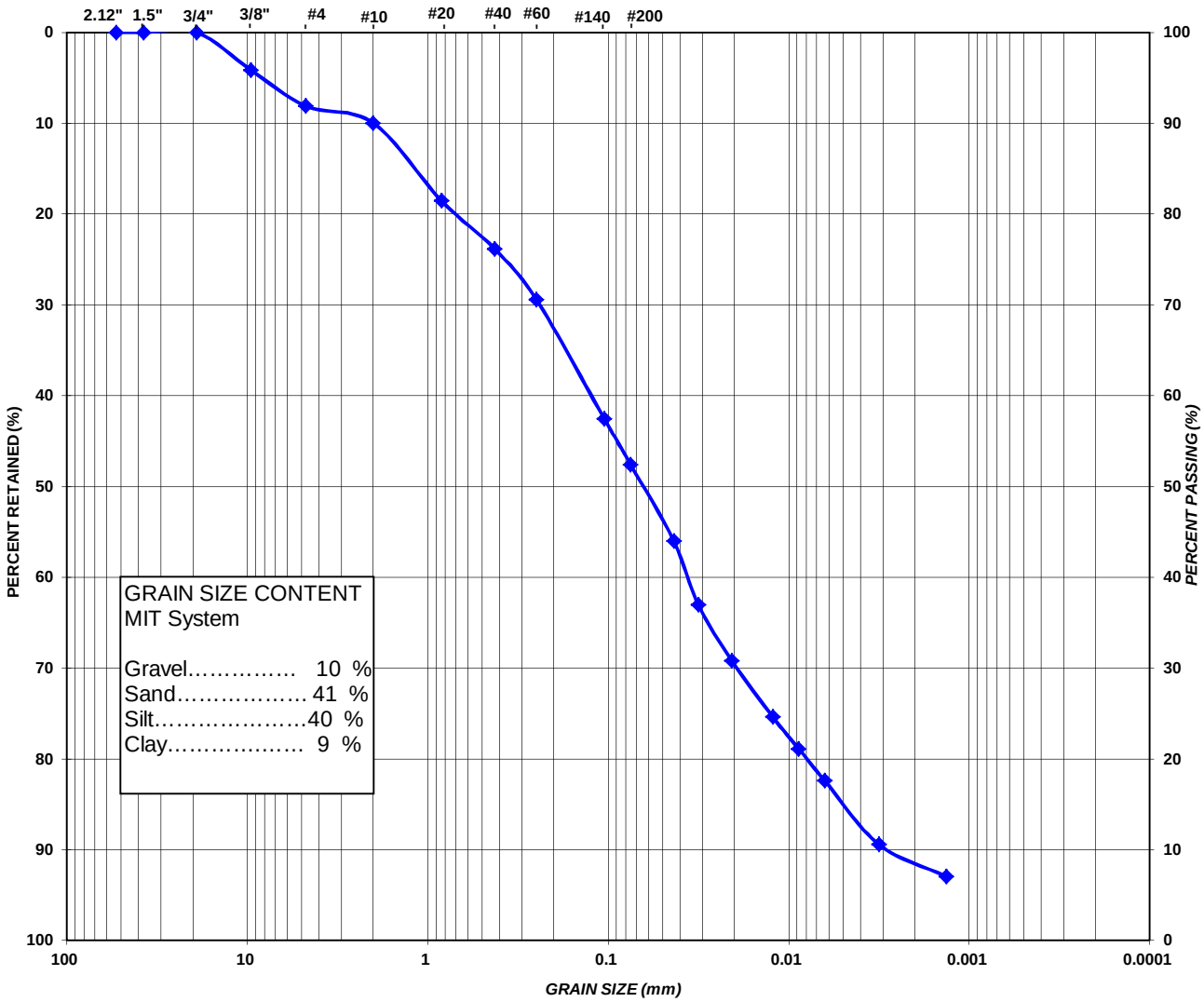
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **6**
SAMPLE NUMBER: **3**
SAMPLE DEPTH: **1.5 - 2.0 m**
SAMPLE DESCRIPTION: **SAND AND SILT, some gravel, trace clay**

FILE NO.: **13-13-3198**
LAB NO.: **1060B**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Terraprobe

SIEVE ANALYSIS TEST FORM

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **1**
SAMPLE NUMBER: **9**
SAMPLE DEPTH: **9.1 - 9.6 m**
SAMPLE DESCRIPTION: **GRAVEL AND SAND, some silt**

FILE NO.: **13-13-3198**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**
TEST DATE: **April 29, 2014**
TESTED BY: **SR**
LAB NO.: **1060A**

COARSE SIEVES

Dry Weight (g)		610.5		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
1.5"	37.5	0.00	0.0	**100.0**
3/4"	19.0	0.00	0.0	**100.0**
3/8"	9.5	123.18	20.2	**79.8**
No. 4	4.75	207.15	33.9	**66.1**
No. 10	2.00	289.51	47.4	**52.6**
PAN		320.53		
Dry Weight After Sieving (g)		610.0		
Percent Loss After Sieving		0.07		

FINE SIEVES (after washing)

Dry Weight		100.48		
Percent Passing No.4 (%)		53		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
No. 20	0.840	33.47	33.3	**35.1**
No. 40	0.425	57.35	57.1	**22.6**
No. 60	0.250	67.24	66.9	**17.4**
No. 140	0.105	75.96	75.6	**12.8**
No. 200	0.075	78.74	78.4	**11.4**

HYGROSCOPIC MOISTURE CONTENT

Wt. of wet soil and tare (g)	2.00
Wt. of dry soil and tare (g)	2.00
Wt. of water (g)	0.00
Wt. of tare (g)	1.00
Wt. of wet soil (g) (W_A)	1.00
Wt. of dry soil (g) (W_0)	1.00
Water content (%)	0.00

HYDROMETER

December 6, 2012, new Gs for

Hygroscopic Correction Factor	1.000000
Corrected Sample Weight (M_o)	100.48
Test sample represented by soil (W)	191.11
Gs Correction Factor	0.985209
Specific Gravity	2.717

Date and time	**Elapsed Time**	**H_s in Divisions (G/L)**	**H_c in Divisions (G/L)**	**Temp. T_c (C)**	**Corrected Reading $R = H_s - H_c$**	**Percent Passing P in %**	**L in cm**	**n in milliPoise**	**K**	**Particle Diameter D in mm**
	1									
	2									
	5									
	15									
	30									
	60									
	250									
	1440									

Hydrometer
L_1
L_2
V_b
H_s
H_m
A

Terraprobe

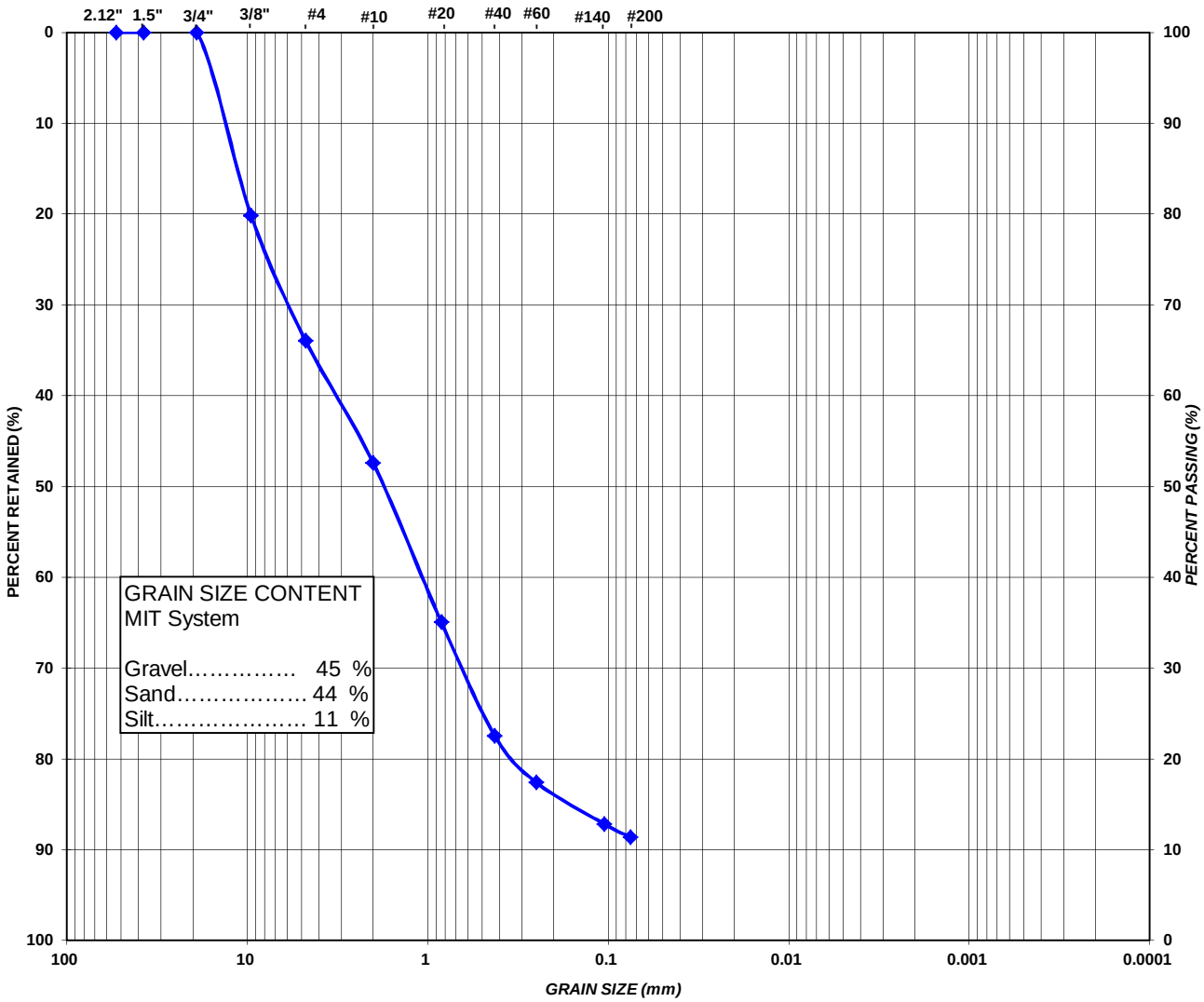
SIEVE ANALYSIS TEST REPORT

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **1**
SAMPLE NUMBER: **9**
SAMPLE DEPTH: **9.1 - 9.6 m**
SAMPLE DESCRIPTION: **GRAVEL AND SAND, some silt**

FILE NO.: **13-13-3198**
LAB NO.: **1060A**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST FORM

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **16**
SAMPLE NUMBER: **5**
SAMPLE DEPTH: **3.0 - 3.5 m**
SAMPLE DESCRIPTION: **SAND AND SILT, some gravel, some clay**

FILE NO.: **13-13-3198**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**
TEST DATE: **April 29, 2014**
TESTED BY: **SR**
LAB NO.: **1060C**

COARSE SIEVES

Dry Weight (g)		373.0		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
1.5"	37.5	0.00	0.0	**100.0**
3/4"	19.0	0.00	0.0	**100.0**
3/8"	9.5	13.94	3.7	**96.3**
No. 4	4.75	39.71	10.6	**89.4**
No. 10	2.00	52.67	14.1	**85.9**
PAN		320.13		
Dry Weight After Sieving (g)		372.8		
Percent Loss After Sieving		0.05		

FINE SIEVES (after washing)

Dry Weight		50.37		
Percent Passing No.4 (%)		86		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
No. 20	0.840	5.47	10.9	**76.5**
No. 40	0.425	8.55	17.0	**71.3**
No. 60	0.250	10.92	21.7	**67.2**
No. 140	0.105	16.82	33.4	**57.2**
No. 200	0.075	19.62	39.0	**52.4**

HYGROSCOPIC MOISTURE CONTENT

Wt. of wet soil and tare (g)	2.00
Wt. of dry soil and tare (g)	2.00
Wt. of water (g)	0.00
Wt. of tare (g)	1.00
Wt. of wet soil (g) (W_A)	1.00
Wt. of dry soil (g) (W_0)	1.00
Water content (%)	0.00

HYDROMETER

December 6, 2012, new Gs for

Hygroscopic Correction Factor	1.000000
Corrected Sample Weight (M_o)	50.37
Test sample represented by soil (W)	58.65
Gs Correction Factor	0.985209
Specific Gravity	2.717

Date and time	**Elapsed Time**	**H_s in Divisions (G/L)**	**H_c in Divisions (G/L)**	**Temp. T_c (C)**	**Corrected Reading $R = H_s - H_c$**	**Percent Passing P in %**	**L in cm**	**n in milliPoise**	**K**	**Particle Diameter D in mm**	
	1	30.0	5.0	23.6	25.0	**41.99**	11.3029	9.2629	0.0129	0.0432	Hydrometer
	2	26.0	5.0	23.6	21.0	**35.27**	12.1029	9.2629	0.0129	0.0316	L_1
	5	23.0	5.0	23.6	18.0	**30.24**	12.7029	9.2629	0.0129	0.0205	L_2
	15	20.0	5.0	23.4	15.0	**25.20**	13.3029	9.3058	0.0129	0.0121	V_b
	30	18.0	5.0	23.2	13.0	**21.84**	13.7029	9.3490	0.0129	0.0087	H_s
	60	16.0	5.0	23.2	11.0	**18.48**	14.1029	9.3490	0.0129	0.0063	H_m
	250	13.0	5.0	23.6	8.0	**13.44**	14.7029	9.2629	0.0129	0.0031	A
	1440	10.0	5.0	23.2	5.0	**8.40**	15.3029	9.3490	0.0129	0.0013	

Terraprobe

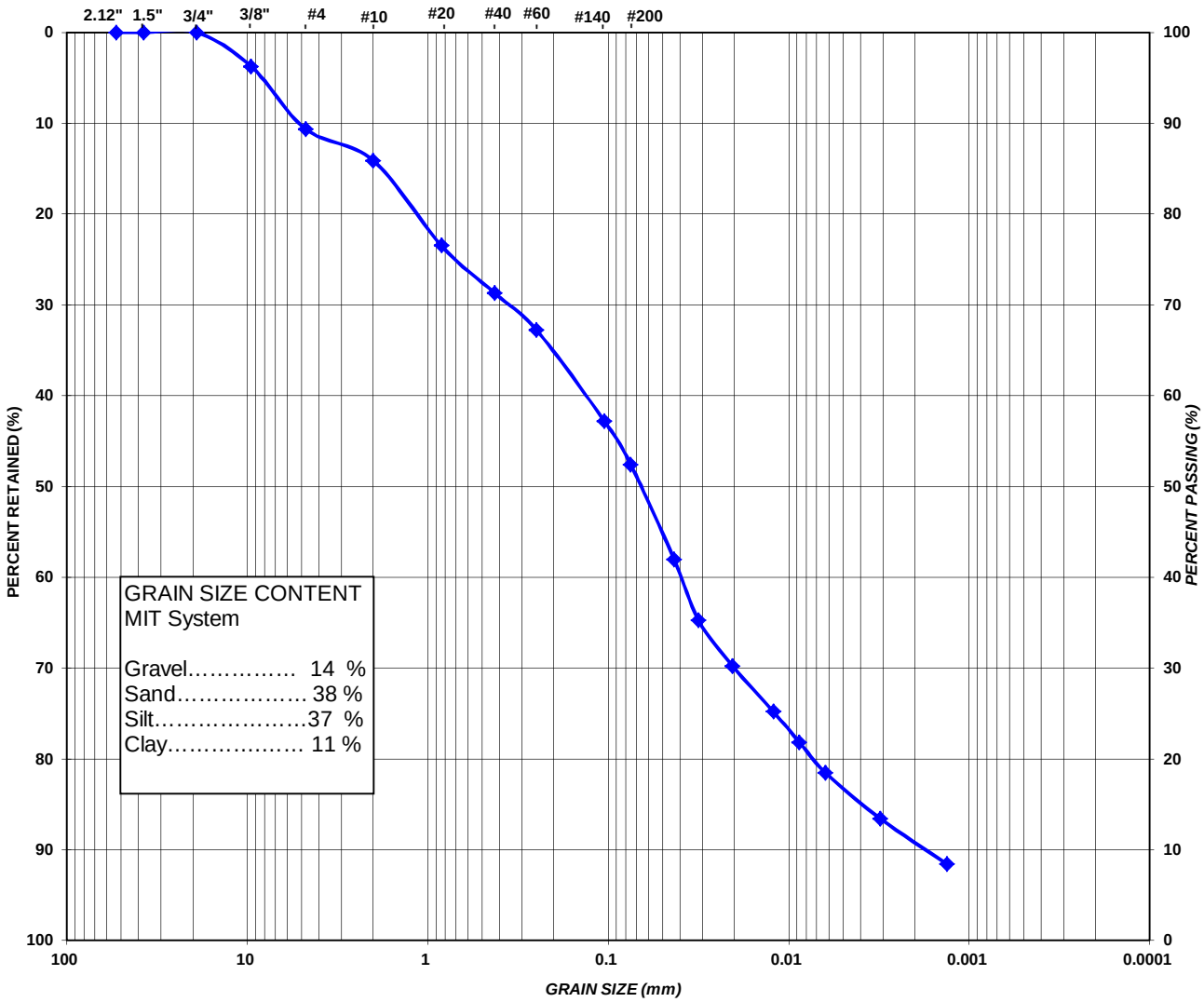
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **16**
SAMPLE NUMBER: **5**
SAMPLE DEPTH: **3.0 - 3.5 m**
SAMPLE DESCRIPTION: **SAND AND SILT, some gravel, some clay**

FILE NO.: **13-13-3198**
LAB NO.: **1060C**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST FORM

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **18**
SAMPLE NUMBER: **5**
SAMPLE DEPTH: **3.0 - 3.5 m**
SAMPLE DESCRIPTION: **SANDY SILT, some clay, trace gravel**

FILE NO.: **13-13-3198**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**
TEST DATE: **April 29, 2014**
TESTED BY: **SR**
LAB NO.: **1060D**

COARSE SIEVES

Dry Weight (g)		259.7		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
1.5"	37.5	0.00	0.0	**100.0**
3/4"	19.0	0.00	0.0	**100.0**
3/8"	9.5	0.00	0.0	**100.0**
No. 4	4.75	5.86	2.3	**97.7**
No. 10	2.00	6.59	2.5	**97.5**
PAN		253.00		
Dry Weight After Sieving (g)		259.6		
Percent Loss After Sieving		0.05		

FINE SIEVES (after washing)

Dry Weight		50.30		
Percent Passing No.4 (%)		97		
SIEVE SIZE		**CUM. WT.**	**PERCENT**	**PERCENT**
Standard	(mm)	**RET.**	**RET.**	**PASSING**
No. 20	0.840	2.46	4.9	**92.7**
No. 40	0.425	4.31	8.6	**89.1**
No. 60	0.250	5.96	11.8	**86.0**
No. 140	0.105	10.21	20.3	**77.7**
No. 200	0.075	12.19	24.2	**73.9**

HYGROSCOPIC MOISTURE CONTENT

Wt. of wet soil and tare (g)	2.00
Wt. of dry soil and tare (g)	2.00
Wt. of water (g)	0.00
Wt. of tare (g)	1.00
Wt. of wet soil (g) (W_A)	1.00
Wt. of dry soil (g) (W_0)	1.00
Water content (%)	0.00

HYDROMETER

December 6, 2012, new Gs for

Hygroscopic Correction Factor	1.000000
Corrected Sample Weight (M_o)	50.30
Test sample represented by soil (W)	51.61
Gs Correction Factor	0.985209
Specific Gravity	2.717

Date and time	**Elapsed Time**	**H_s in Divisions (G/L)**	**H_c in Divisions (G/L)**	**Temp. T_c (C)**	**Corrected Reading $R = H_s - H_c$**	**Percent Passing P in %**	**L in cm**	**n in milliPoise**	**K**	**Particle Diameter D in mm**	
	1	39.5	5.0	23.5	34.5	**65.86**	9.4029	9.2843	0.0129	0.0395	Hydrometer
	2	37.0	5.0	23.5	32.0	**61.09**	9.9029	9.2843	0.0129	0.0286	L_1
	5	33.5	5.0	23.5	28.5	**54.41**	10.6029	9.2843	0.0129	0.0187	L_2
	15	30.0	5.0	23.2	25.0	**47.72**	11.3029	9.3490	0.0129	0.0112	V_b
	30	27.3	5.0	23.2	22.3	**42.57**	11.8429	9.3490	0.0129	0.0081	H_s
	60	25.0	5.0	23.2	20.0	**38.18**	12.3029	9.3490	0.0129	0.0058	H_m
	250	19.0	5.0	23.6	14.0	**26.73**	13.5029	9.2629	0.0129	0.0030	A
	1440	14.0	5.0	23.2	9.0	**17.18**	14.5029	9.3490	0.0129	0.0013	

Terraprobe

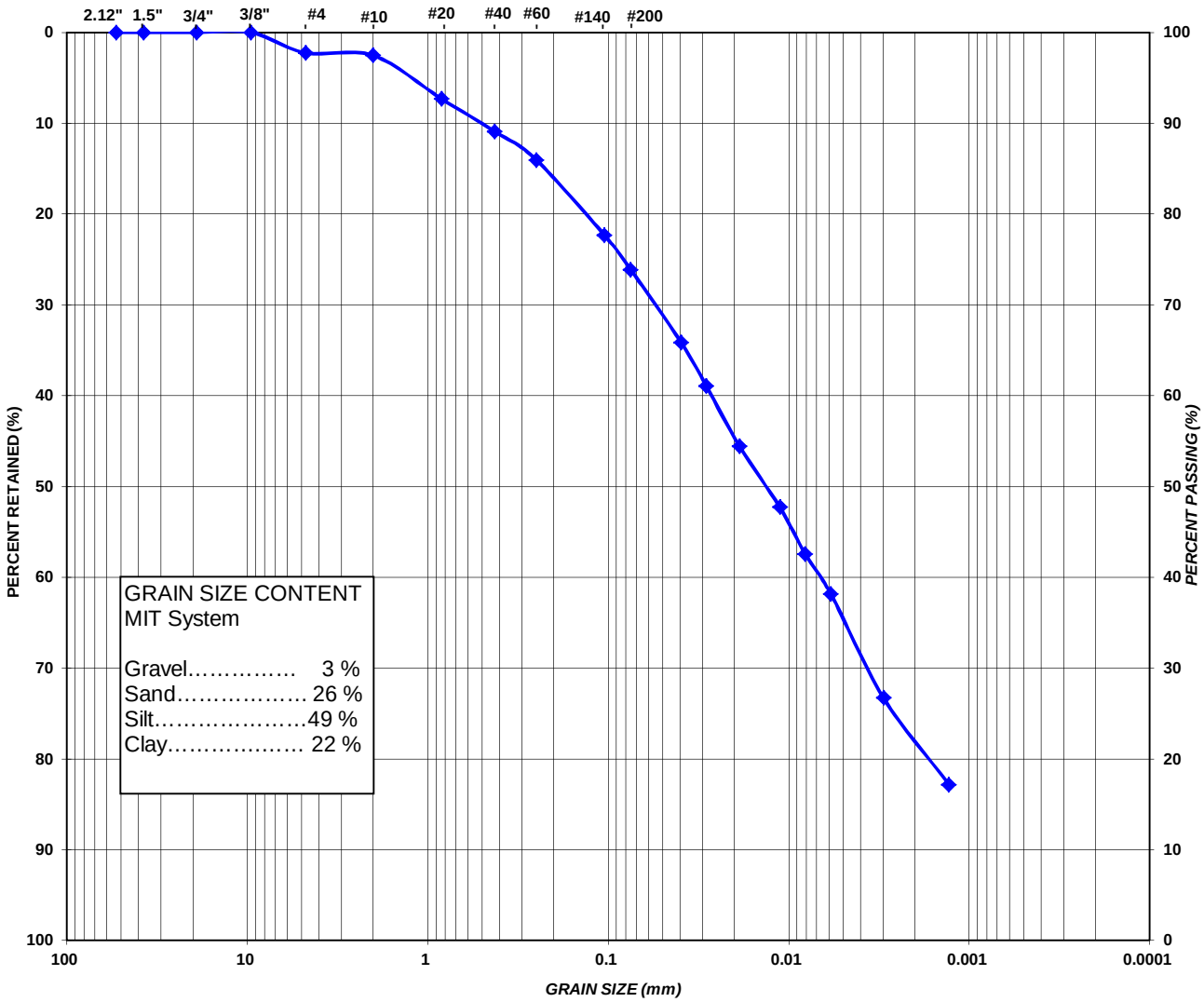
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Waldemar Developments**
LOCATION: **Township of Amaranth, ON**
CLIENT: **Sarah Properties Ltd. Development**
BOREHOLE: **18**
SAMPLE NUMBER: **5**
SAMPLE DEPTH: **3.0 - 3.5 m**
SAMPLE DESCRIPTION: **SANDY SILT, some clay, trace gravel**

FILE NO.: **13-13-3198**
LAB NO.: **1060D**
SAMPLE DATE: **April, 2014**
SAMPLED BY: **T.G.**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES

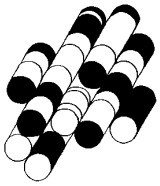


MIT SYSTEM	GRAVEL		SAND			SILT	CLAY
			COARSE	MEDIUM	FINE		

UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

APPENDIX B

TERRAPROBE INC.



TEST PIT LOG 1

Terraprobe

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 9, 2014

Sheet No. : 1 of 1

Position : E: 557197, N: 4860128 (UTM 17T)

Elevation Datum : Geodetic

Rig type : BACKHOE

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		SILTY CLAY, trace sand, compact, brown, moist (TOPSOIL)			
	0.4	**SANDY SILT**, some clay, some boulders, some cobbles, some gravel, dense, brown, moist (GLACIAL TILL)		1	GS
0.5					
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Test pit was dry and open upon completion of excavation.

TEST PIT LOG 2

Terraprobe

Client : Sarah Properties Ltd Developments
Project No. : 13-13-3198-6

Project : Waldemar Developments
Date excavated : January 21, 2014

Location : Township of Amaranth
Sheet No. : 1 of 1

Position : E: 557130, N: 4860240 (UTM 17T)
Elevation Datum : Geodetic

Rig type : BACKHOE

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		SANDY SILT, trace clay, trace gravel, trace cobbles, trace boulders, brown, moist (TOPSOIL)			
				1	GS
0.5					
	0.6	**SAND AND GRAVEL**, some silt, some cobbles, some boulders, brown, wet			
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

little pounding water

library: library - terraprobe gint.glb report: terraprobe test pit log file: 13-13-3198 test pits.gpj

TEST PIT LOG 3

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 21, 2014

Sheet No. : 1 of 1

Position : E: 557052, N: 4860323 (UTM 17T) Elevation Datum : Geodetic

Rig type : BACKHOE

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		SILTY SAND, trace clay, trace gravel, dark brown, moist (TOPSOIL)			
0.5				1	GS
	0.9	**SANDY SILT**, some clay, some cobbles, some boulders, brown, wet			
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

little pounding water

Test pit was dry and open upon completion of excavation.

TEST PIT LOG 4

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 21, 2014

Sheet No. : 1 of 1

Position : E: 556985, N: 4860364 (UTM 17T) Elevation Datum : Geodetic

Rig type : BACKHOE

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type
0.0		**GROUND SURFACE**			
		SILTY SAND, trace clay, trace gravel, dark brown, moist (TOPSOIL)			
0.5	0.5	**COARSE SAND**, some gravel, some cobbles, trace boulders, brown, moist			
1.0					
1.5					
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10 — Natural Water Content (MC) 20 — Liquid Limit (LL) 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Elevation Scale (m)

TEST PIT LOG 5

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 24, 2014

Sheet No. : 1 of 1

Position : E: 556900, N: 4860383 (UTM 17T) Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		SILTY SAND, trace clay, some gravel, dark brown, moist (TOPSOIL)		1	GS
0.5					
	0.6	**SAND**, some silt, some gravel, some cobbles, brown, moist			
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Undrained Shear Strength (kPa): ○ Unconfined, ● Pocket Penetrometer, + Field Vane, ■ Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

TEST PIT LOG 6

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 24, 2014

Sheet No. : 1 of 1

Position : E: 556931, N: 4860324 (UTM 17T)

Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type
0.0		**GROUND SURFACE**			
		CLAYEY SILT, some sand, some gravel, brown, moist (TOPSOIL)			
				1	GS
	0.4	**SAND**, some silt, some gravel, some cobbles, some boulders, brown, wet (GLACIAL TILL)			
0.5					
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0					
	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

TEST PIT LOG 7

Terraprobe

Client : Sarah Properties Ltd Developments
Project No. : 13-13-3198-6

Project : Waldemar Developments
Date excavated : January 24, 2014

Location : Township of Amaranth
Sheet No. : 1 of 1

Position : E: 556922, N: 4860231 (UTM 17T)
Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type
0.0		**GROUND SURFACE**			
		SANDY SILT, trace clay, trace gravel, dark brown, moist (TOPSOIL)			
				1	GS
	0.4	**CLAYEY SILT**, some sand, some gravel, brown, damp (GLACIAL TILL)			
0.5					
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0					
	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

TEST PIT LOG 8

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 24, 2014

Sheet No. : 1 of 1

Position : E: 556958, N: 4860085 (UTM 17T) Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	GS
	0.3	**CLAYEY SILT**, some sand, some gravel, some cobbles, some boulders, brown, moist (GLACIAL TILL)		2	GS
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Undrained Shear Strength (kPa): ○ Unconfined, ● Pocket Penetrometer, + Field Vane, ■ Lab Vane — 40, 80, 120, 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

Elevation Scale (m)

TEST PIT LOG 9

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 24, 2014

Sheet No. : 1 of 1

Position : E: 557013, N: 4860186 (UTM 17T) Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		CLAYEY SILT, some sand, trace gravel, dark brown, moist (TOPSOIL)		1	GS
0.5	0.5	**SANDY SILT**, some clay, some gravel, some cobbles, some boulders, brown, moist (GLACIAL TILL)		2	GS
1.0					
1.5					
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Elevation Scale (m)

Undrained Shear Strength (kPa)
○ Unconfined
● Pocket Penetrometer
+ Field Vane
■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

TEST PIT LOG 10

Client : Sarah Properties Ltd Developments

Project : Waldemar Developments

Location : Township of Amaranth

Project No. : 13-13-3198-6

Date excavated : January 24, 2014

Sheet No. : 1 of 1

Position : E: 557091, N: 4860117 (UTM 17T) Elevation Datum : Geodetic

Rig type : EXCAVATOR

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type
0.0		**GROUND SURFACE**			
		CLAYEY SILT, trace gravel, dark brown, moist (TOPSOIL)			
				1	GS
0.5	0.5	**SANDY SILT**, some clay, some gravel, some cobbles, some boulders, brown, moist (GLACIAL TILL)			
1.0					
1.5					
				2	GS
2.0					
2.5					
3.0	3.1	**END OF TEST PIT**			

Test pit was dry and open upon completion of excavation.

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10 — Natural Water Content (MC) 20 — Liquid Limit (LL) 30

Headspace Vapour

Unstabilized Water Level

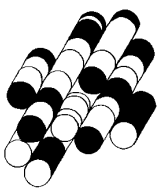
Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Elevation Scale (m)

APPENDIX C

TERRAPROBE INC.



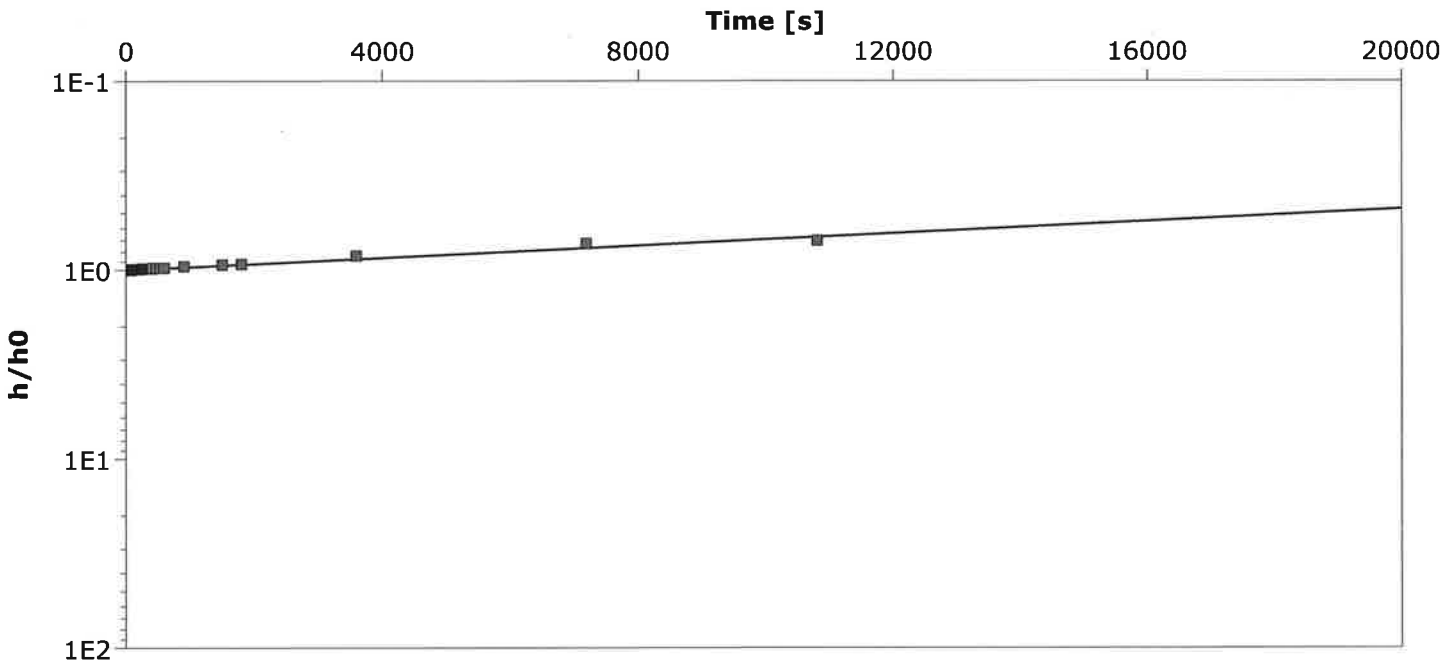
Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	**Slug Test - Water Level Data**	Page 1 of 1
	Project: Waldemar Development	
	Number: 13-13-3198	
	Client: Sarah Properties	

Location: Waldemar, Ontraio	Slug Test: Slug Test MW1D	Test Well: Well 1D
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 12.44	Static Water Level [m]: 1.32	Water level change at t=0 [m]: 11.12

	Time [s]	Water Level [m]	WL Change [m]
1	10	12.43	11.11
2	15	12.427	11.107
3	20	12.425	11.105
4	25	12.42	11.10
5	30	12.418	11.098
6	35	12.415	11.095
7	40	12.41	11.09
8	45	12.405	11.085
9	55	12.40	11.08
10	60	12.395	11.075
11	65	12.391	11.071
12	75	12.39	11.07
13	80	12.384	11.064
14	85	12.38	11.06
15	90	12.378	11.058
16	95	12.372	11.052
17	100	12.37	11.05
18	105	12.366	11.046
19	110	12.36	11.04
20	120	12.355	11.035
21	130	12.352	11.032
22	140	12.348	11.028
23	150	12.341	11.021
24	160	12.336	11.016
25	170	12.33	11.01
26	180	12.325	11.005
27	190	12.316	10.996
28	200	12.311	10.991
29	210	12.305	10.985
30	220	12.30	10.98
31	230	12.295	10.975
32	240	12.286	10.966
33	250	12.28	10.96
34	260	12.276	10.956
35	270	12.271	10.951
36	280	12.265	10.945
37	290	12.261	10.941
38	300	12.256	10.936
39	315	12.245	10.925
40	330	12.241	10.921
41	345	12.234	10.914
42	360	12.226	10.906
43	375	12.22	10.90
44	390	12.212	10.892
45	405	12.204	10.884
46	420	12.119	10.799
47	480	12.17	10.85
48	540	12.14	10.82
49	600	12.115	10.795
50	900	11.964	10.644
51	1500	11.713	10.393
52	1800	11.62	10.30
53	3600	10.645	9.325
54	7200	9.404	8.084
55	10800	9.072	7.752

Terraprobe **11 Indel Lane** **Brampton, Ontario** **L6T 3Y3**	**Slug Test Analysis Report** Project: Waldemar Development Number: 13-13-3198 Client: Sarah Properties

Location: Waldemar, Ontraio	Slug Test: Slug Test MW1D	Test Well: Well 1D
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/7/2014
Aquifer Thickness: 3.10 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
Well 1D	2.43×10^{-8}	

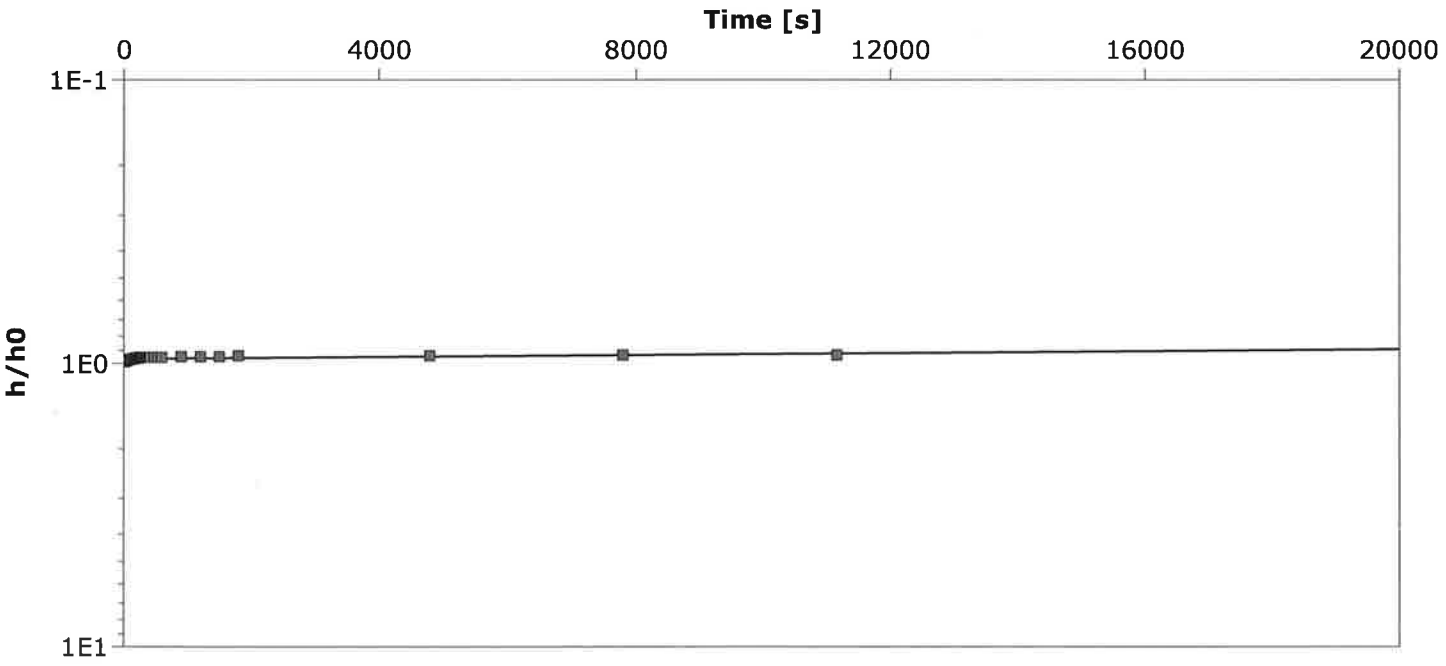
Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	**Slug Test - Water Level Data**	Page 1 of 1
	Project: Waldemar Developments	
	Number: 13-13-3198	
	Client: Sarah Properties	

Location: Waldemar, Ontario	Slug Test: Slug Test MW3S	Test Well: MW3S
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 4.44	Static Water Level [m]: 2.32	Water level change at t=0 [m]: 2.12

	Time [s]	Water Level [m]	WL Change [m]
1	5	4.42	2.10
2	10	4.42	2.10
3	15	4.41	2.09
4	20	4.405	2.085
5	30	4.40	2.08
6	35	4.395	2.075
7	45	4.39	2.07
8	50	4.39	2.07
9	55	4.385	2.065
10	60	4.38	2.06
11	65	4.38	2.06
12	70	4.38	2.06
13	75	4.38	2.06
14	80	4.38	2.06
15	85	4.375	2.055
16	90	4.375	2.055
17	95	4.375	2.055
18	100	4.37	2.05
19	105	4.37	2.05
20	110	4.37	2.05
21	115	4.365	2.045
22	120	4.365	2.045
23	130	4.36	2.04
24	150	4.362	2.042
25	160	4.36	2.04
26	170	4.359	2.039
27	180	4.357	2.037
28	190	4.356	2.036
29	200	4.354	2.034
30	220	4.348	2.028
31	230	4.345	2.025
32	240	4.345	2.025
33	250	4.344	2.024
34	260	4.344	2.024
35	270	4.344	2.024
36	280	4.343	2.023
37	290	4.343	2.023
38	300	4.343	2.023
39	315	4.34	2.02
40	330	4.34	2.02
41	345	4.337	2.017
42	360	4.336	2.016
43	375	4.335	2.015
44	390	4.335	2.015
45	405	4.335	2.015
46	420	4.335	2.015
47	480	4.335	2.015
48	540	4.334	2.014
49	600	4.333	2.013
50	900	4.327	2.007
51	1200	4.324	2.004
52	1500	4.32	2.00
53	1800	4.319	1.999
54	4800	4.31	1.99
55	7800	4.305	1.985
56	11160	4.30	1.98

Terraprobe **11 Indel Lane** **Brampton, Ontario** **L6T 3Y3**	**Slug Test Analysis Report** Project: Waldemar Developments Number: 13-13-3198 Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW3S	Test Well: MW3S
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 2.28 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW3S	2.61×10^{-9}	

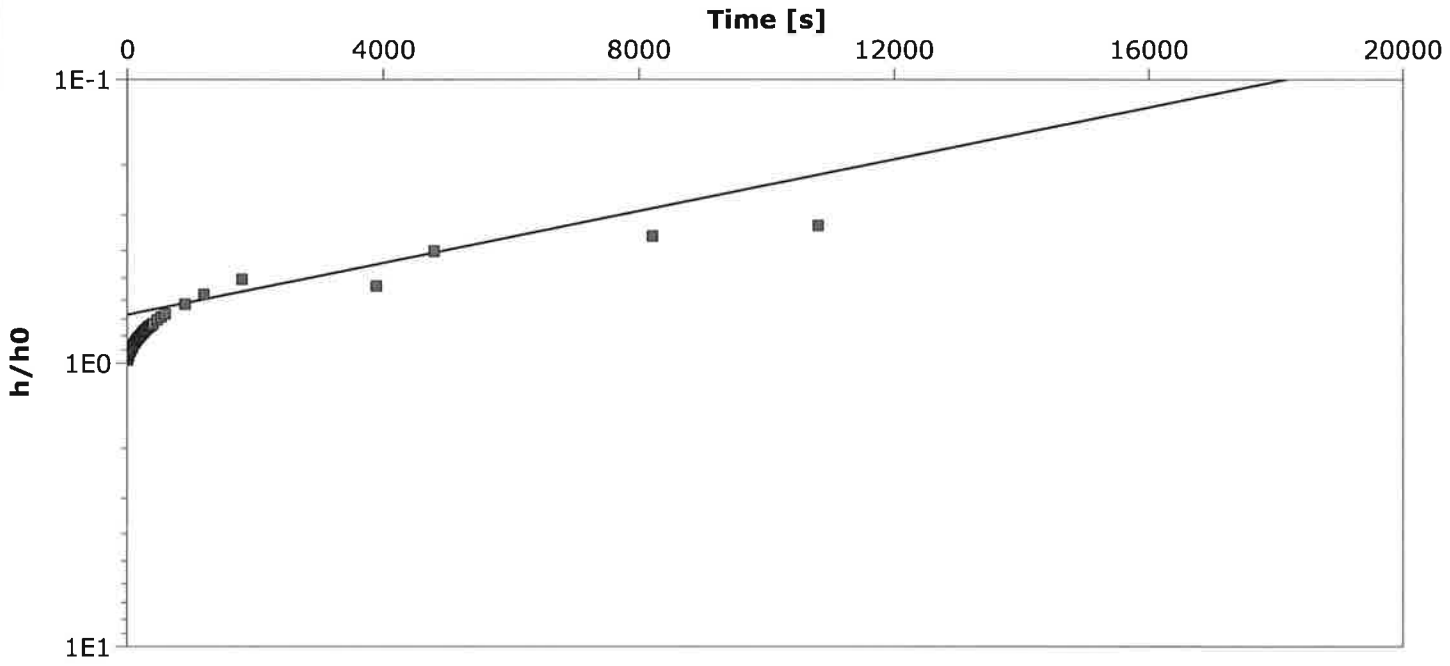
Terraprobe **11 Indel Lane** **Brampton, Ontario** **L6T 3Y3**	**Slug Test - Water Level Data** Page 1 of 1 Project: Waldemar Development Number: 13-13-3198 Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW6	Test Well: MW6
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 4.34	Static Water Level [m]: 1.93	Water level change at t=0 [m]: 2.41

	Time [s]	Water Level [m]	WL Change [m]
1	10	4.28	2.35
2	15	4.25	2.32
3	20	4.23	2.30
4	25	4.21	2.28
5	30	4.19	2.26
6	35	4.17	2.24
7	40	4.155	2.225
8	45	4.13	2.20
9	50	4.123	2.193
10	55	4.11	2.18
11	65	4.10	2.17
12	70	4.075	2.145
13	80	4.056	2.126
14	85	4.04	2.11
15	100	4.025	2.095
16	105	4.00	2.07
17	110	3.99	2.06
18	120	3.98	2.05
19	130	3.965	2.035
20	140	3.95	2.02
21	150	3.935	2.005
22	160	3.926	1.996
23	170	3.905	1.975
24	180	3.892	1.962
25	190	3.88	1.95
26	200	3.87	1.94
27	210	3.856	1.926
28	220	3.845	1.915
29	230	3.853	1.923
30	240	3.823	1.893
31	250	3.81	1.88
32	260	3.803	1.873
33	270	3.794	1.864
34	280	3.784	1.854
35	290	3.775	1.845
36	300	3.765	1.835
37	315	3.753	1.823
38	330	3.74	1.81
39	345	3.73	1.80
40	360	3.718	1.788
41	375	3.71	1.78
42	390	3.698	1.768
43	405	3.685	1.755
44	420	3.676	1.746
45	480	3.63	1.70
46	540	3.59	1.66
47	600	3.545	1.615
48	900	3.42	1.49
49	1200	3.31	1.38
50	1800	3.15	1.22
51	3900	3.222	1.292
52	4800	2.90	0.97
53	8220	2.79	0.86
54	10800	2.72	0.79

Terraprobe **11 Indel Lane** **Brampton, Ontario** **L6T 3Y3**	**Slug Test Analysis Report** Project: Waldemar Development Number: 13-13-3198 Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW6	Test Well: MW6
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 2.67 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW6	6.88×10^{-8}	

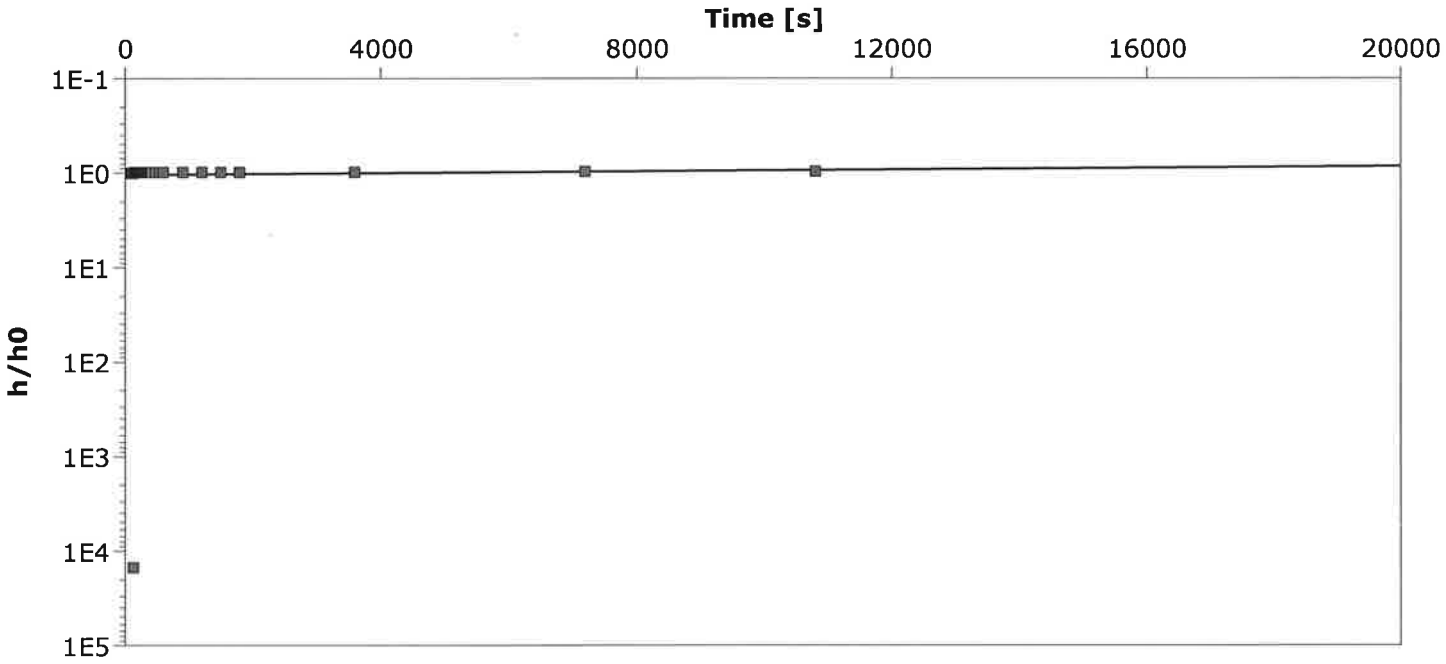
Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	**Slug Test - Water Level Data**	Page 1 of 1
	Project: Waldemar Developments	
	Number: 13-13-3198	
	Client: SarahProperties	

Location: Waldemar, Ontario	Slug Test: Slug Test MW8	Test Well: MW8
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 6.22	Static Water Level [m]: 2.17	Water level change at t=0 [m]: 4.05

	Time [s]	Water Level [m]	WL Change [m]
1	5	6.215	4.045
2	10	6.21	4.04
3	15	6.206	4.036
4	20	6.204	4.034
5	35	6.199	4.029
6	40	6.198	4.028
7	50	6.195	4.025
8	55	6.195	4.025
9	65	6.193	4.023
10	75	6.191	4.021
11	80	6.19	4.02
12	85	6.189	4.019
13	90	6.189	4.019
14	95	6.188	4.018
15	105	6.187	4.017
16	110	6.186	4.016
17	115	6.185	4.015
18	120	6.184	4.014
19	130	60183.00	60180.83
20	140	6.182	4.012
21	150	6.18	4.01
22	160	6.18	4.01
23	170	6.179	4.009
24	180	6.179	4.009
25	190	6.178	4.008
26	200	6.177	4.007
27	210	6.176	4.006
28	220	6.175	4.005
29	230	6.175	4.005
30	240	6.175	4.005
31	250	6.174	4.004
32	260	6.174	4.004
33	270	6.173	4.003
34	280	6.173	4.003
35	290	6.173	4.003
36	300	6.172	4.002
37	315	6.171	4.001
38	330	6.17	4.00
39	345	6.17	4.00
40	360	6.17	4.00
41	375	6.17	4.00
42	390	6.169	3.999
43	405	6.169	3.999
44	420	6.168	3.998
45	480	6.166	3.996
46	540	6.164	3.994
47	600	6.163	3.993
48	900	6.159	3.989
49	1200	6.154	3.984
50	1500	6.149	3.979
51	1800	6.144	3.974
52	3600	6.13	3.96
53	7200	6.095	3.925
54	10800	6.06	3.89

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test Analysis Report
	Project: Waldemar Developments
	Number: 13-13-3198
	Client: SarahProperties

Location: Waldemar, Ontario	Slug Test: Slug Test MW8	Test Well: MW8
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 3.83 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW8	6.72×10^{-9}	

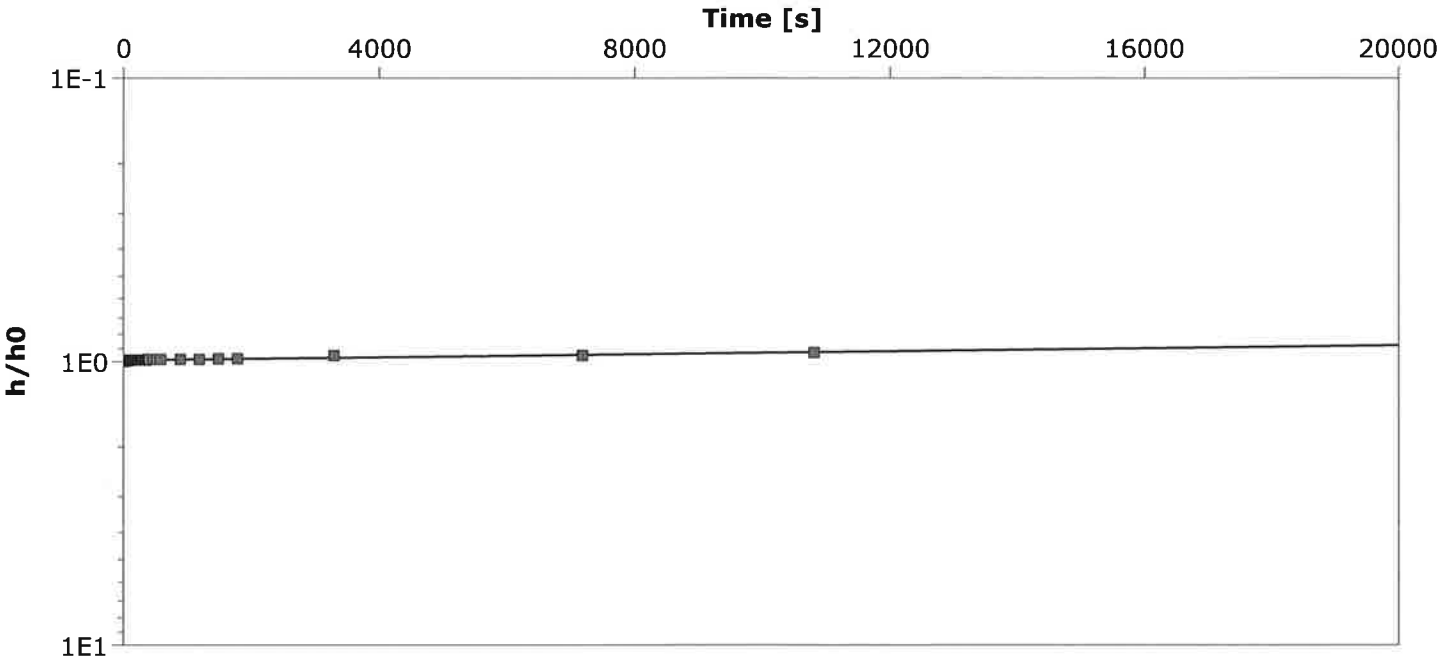
Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	**Slug Test - Water Level Data** Page 1 of 1
	Project: Waldemar Development
	Number: 13-13-3198
	Client: Sarah Properties

Location: Waldermar, Ontario	Slug Test: Slug Test MW9	Test Well: MW9
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 4.68	Static Water Level [m]: 1.51	Water level change at t=0 [m]: 3.17

	Time [s]	Water Level [m]	WL Change [m]
1	5	4.68	3.17
2	10	4.676	3.166
3	15	4.674	3.164
4	20	4.672	3.162
5	25	4.67	3.16
6	30	4.669	3.159
7	40	4.665	3.155
8	45	4.663	3.153
9	50	4.661	3.151
10	60	4.66	3.15
11	65	4.66	3.15
12	70	4.659	3.149
13	75	4.657	3.147
14	85	4.656	3.146
15	90	4.655	3.145
16	95	4.655	3.145
17	100	4.655	3.145
18	105	4.654	3.144
19	115	4.654	3.144
20	120	4.653	3.143
21	130	4.651	3.141
22	140	4.65	3.14
23	150	4.649	3.139
24	160	4.649	3.139
25	170	4.649	3.139
26	180	4.648	3.138
27	190	4.647	3.137
28	200	4.647	3.137
29	210	4.646	3.136
30	220	4.645	3.135
31	230	4.644	3.134
32	240	4.644	3.134
33	250	4.643	3.133
34	260	4.642	3.132
35	270	4.642	3.132
36	280	4.641	3.131
37	290	4.64	3.13
38	300	4.64	3.13
39	315	4.64	3.13
40	330	4.639	3.129
41	345	4.638	3.128
42	360	4.638	3.128
43	375	4.637	3.127
44	390	4.636	3.126
45	405	4.635	3.125
46	420	4.635	3.125
47	480	4.634	3.124
48	540	4.633	3.123
49	600	4.631	3.121
50	900	4.625	3.115
51	1200	4.621	3.111
52	1500	4.615	3.105
53	1800	4.611	3.101
54	3300	4.53	3.02
55	7200	4.53	3.02
56	10800	4.468	2.958

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test Analysis Report
	Project: Waldemar Development
	Number: 13-13-3198
	Client: Sarah Properties

Location: Waldermar, Ontario	Slug Test: Slug Test MW9	Test Well: MW9
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 3.40 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW9	4.02×10^{-9}	

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	**Slug Test - Water Level Data**	Page 1 of 2
	Project: Waldemar Developments	
	Number: 13-13-3198	
	Client: Sarah Properties	

Location: Waldemar, Ontario	Slug Test: Slug Test MW11D	Test Well: MW11D
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 7.38	Static Water Level [m]: 5.62	Water level change at t=0 [m]: 1.76

	Time [s]	Water Level [m]	WL Change [m]
1	10	12.99	7.37
2	15	12.985	7.365
3	20	12.98	7.36
4	25	12.975	7.355
5	30	12.975	7.355
6	35	12.974	7.354
7	40	12.973	7.353
8	45	12.971	7.351
9	50	12.97	7.35
10	55	12.969	7.349
11	60	12.968	7.348
12	65	12.965	7.345
13	70	12.964	7.344
14	75	12.963	7.343
15	80	12.962	7.342
16	85	12.96	7.34
17	90	12.96	7.34
18	95	12.959	7.339
19	100	12.958	7.338
20	105	12.958	7.338
21	110	12.957	7.337
22	115	12.956	7.336
23	120	12.955	7.335
24	130	12.954	7.334
25	140	12.953	7.333
26	150	12.951	7.331
27	160	12.949	7.329
28	170	12.947	7.327
29	180	12.946	7.326
30	190	12.945	7.325
31	200	12.944	7.324
32	210	12.942	7.322
33	220	12.941	7.321
34	230	12.94	7.32
35	240	12.937	7.317
36	250	12.935	7.315
37	260	12.935	7.315
38	270	12.934	7.314
39	280	12.933	7.313
40	290	12.933	7.313
41	300	12.931	7.311
42	315	12.929	7.309
43	330	12.927	7.307
44	345	12.925	7.305
45	360	12.923	7.303
46	375	12.92	7.30
47	390	12.919	7.299
48	405	12.915	7.295
49	420	12.915	7.295
50	480	12.907	7.287
51	540	12.90	7.28
52	600	12.895	7.275
53	900	12.865	7.245
54	1200	12.828	7.208
55	1500	12.794	7.174
56	1800	12.758	7.138
57	3600	12.53	6.91

Terraprobe
11 Indel Lane
Brampton, Ontario
L6T 3Y3

Slug Test - Water Level Data

Project: Waldemar Developments

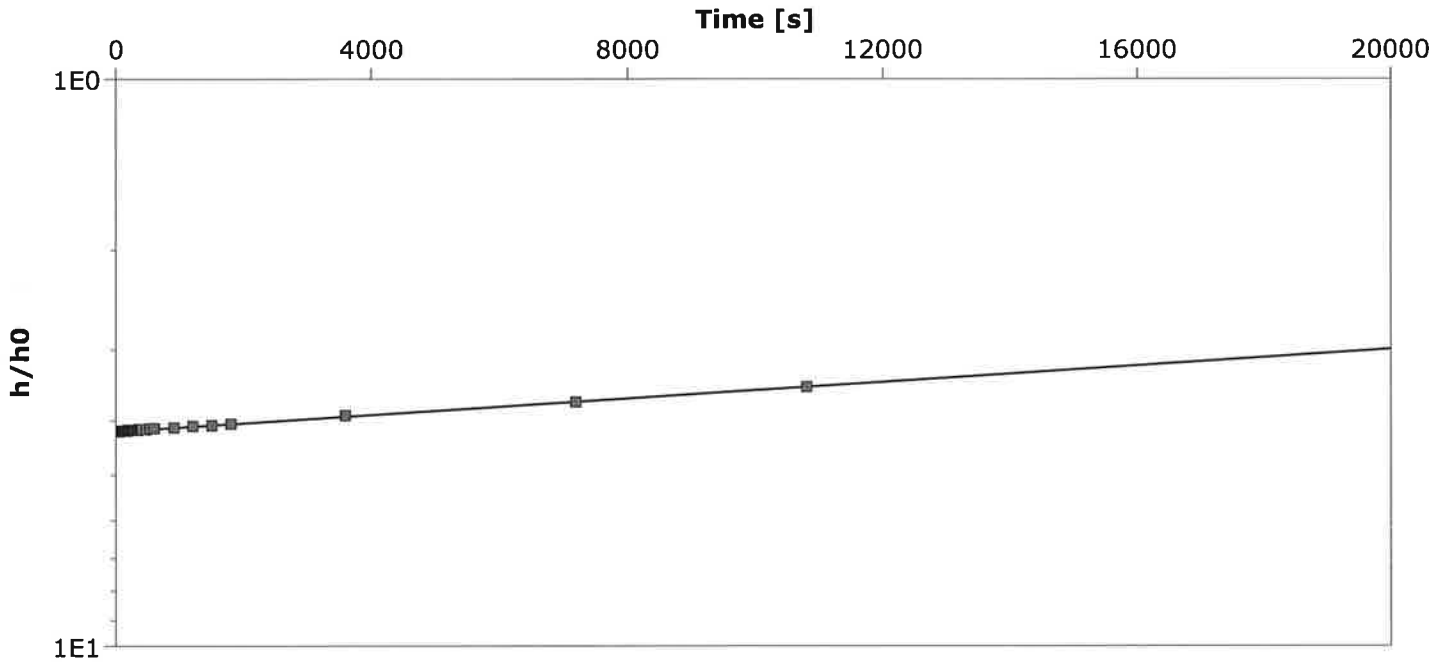
Number: 13-13-3198

Client: Sarah Properties

	Time [s]	Water Level [m]	WL Change [m]
58	7200	12.14	6.52
59	10800	11.76	6.14

Terraprobe **11 Indel Lane** **Brampton, Ontario** **L6T 3Y3**	**Slug Test Analysis Report** Project: Waldemar Developments Number: 13-13-3198 Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW11D	Test Well: MW11D
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 6.58 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW11D	1.09×10^{-8}	

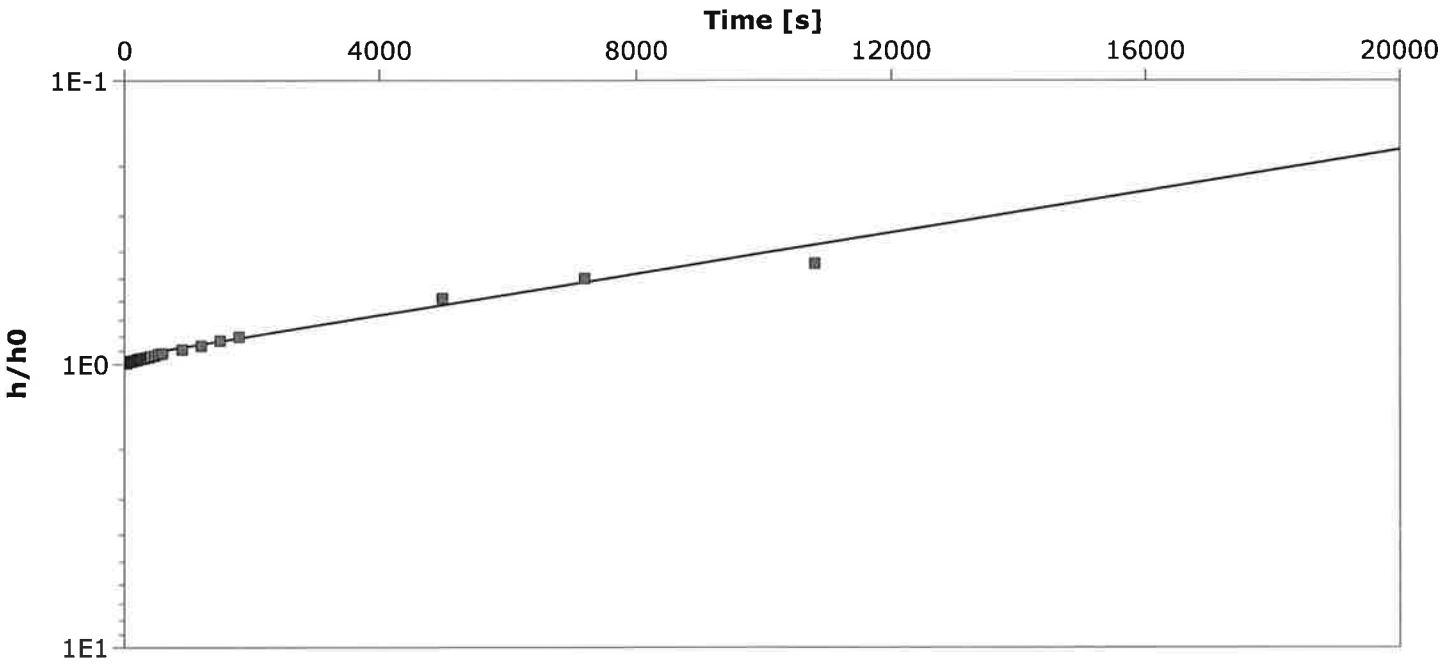
Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test - Water Level Data	Page 1 of 1
	Project: Waldemar Developments	
	Number: 13-13-3198	
	Client: Sarah Properties	

Location: Waldemar, Ontario	Slug Test: Slug Test MW12	Test Well: MW12
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 4.70	Static Water Level [m]: 2.48	Water level change at t=0 [m]: 2.22

	Time [s]	Water Level [m]	WL Change [m]
1	10	4.69	2.21
2	25	4.68	2.20
3	30	4.68	2.20
4	35	4.68	2.20
5	40	4.678	2.198
6	45	4.675	2.195
7	50	4.67	2.19
8	55	4.67	2.19
9	60	4.668	2.188
10	65	4.665	2.185
11	70	4.662	2.182
12	75	4.66	2.18
13	80	4.658	2.178
14	85	4.655	2.175
15	90	4.655	2.175
16	95	4.654	2.174
17	100	4.652	2.172
18	105	4.65	2.17
19	115	4.648	2.168
20	120	4.645	2.165
21	130	4.642	2.162
22	140	4.64	2.16
23	150	4.639	2.159
24	160	4.637	2.157
25	170	4.635	2.155
26	180	4.63	2.15
27	190	4.628	2.148
28	200	4.625	2.145
29	210	4.62	2.14
30	220	4.618	2.138
31	230	4.613	2.133
32	240	4.61	2.13
33	250	4.609	2.129
34	260	4.604	2.124
35	270	4.602	2.122
36	280	4.60	2.12
37	290	4.598	2.118
38	300	4.595	2.115
39	315	4.59	2.11
40	330	4.588	2.108
41	345	4.585	2.105
42	360	4.58	2.10
43	375	4.577	2.097
44	390	4.575	2.095
45	405	4.57	2.09
46	420	4.566	2.086
47	480	4.555	2.075
48	540	4.535	2.055
49	600	4.52	2.04
50	900	4.452	1.972
51	1200	4.395	1.915
52	1500	4.32	1.84
53	1800	4.26	1.78
54	4980	3.78	1.30
55	7200	3.59	1.11
56	10800	3.46	0.98

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test Analysis Report
	Project: Waldemar Developments
	Number: 13-13-3198
	Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW12	Test Well: MW12
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/9/2014
Aquifer Thickness: 2.12 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW12	5.49×10^{-8}	

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test - Water Level Data	Page 1 of 2
	Project: Waldemar Developments	
	Number: 13-13-3198	
	Client: Sarah Properties	

Location: Waldemar, Ontario	Slug Test: Slug Test MW16	Test Well: MW16
Test Conducted by: NA	Test Date: 7/3/2014	
Water level at t=0 [m]: 4.62	Static Water Level [m]: 2.22	Water level change at t=0 [m]: 2.40

	Time [s]	Water Level [m]	WL Change [m]
1	1	4.62	2.40
2	5	4.618	2.398
3	10	4.615	2.395
4	15	4.614	2.394
5	20	4.613	2.393
6	25	4.61	2.39
7	30	4.61	2.39
8	35	4.609	2.389
9	40	4.608	2.388
10	45	4.607	2.387
11	50	4.605	2.385
12	55	4.604	2.384
13	60	4.603	2.383
14	65	4.601	2.381
15	70	4.60	2.38
16	75	4.60	2.38
17	80	4.599	2.379
18	85	4.599	2.379
19	90	4.598	2.378
20	95	4.596	2.376
21	100	4.595	2.375
22	105	4.595	2.375
23	110	4.594	2.374
24	115	4.594	2.374
25	120	4.594	2.374
26	130	4.593	2.373
27	140	4.592	2.372
28	150	4.591	2.371
29	160	4.59	2.37
30	170	4.589	2.369
31	180	4.589	2.369
32	190	4.588	2.368
33	200	4.587	2.367
34	210	4.587	2.367
35	220	4.586	2.366
36	230	4.586	2.366
37	240	4.585	2.365
38	250	4.585	2.365
39	260	4.584	2.364
40	270	4.584	2.364
41	280	4.584	2.364
42	290	4.583	2.363
43	300	4.583	2.363
44	315	4.582	2.362
45	330	4.581	2.361
46	345	4.58	2.36
47	360	4.58	2.36
48	375	4.579	2.359
49	390	4.578	2.358
50	405	4.577	2.357
51	420	4.576	2.356
52	480	4.574	2.354
53	540	4.571	2.351
54	600	4.57	2.35
55	900	4.564	2.344
56	1200	4.556	2.336
57	1500	4.551	2.331

Terraprobe
11 Indel Lane
Brampton, Ontario
L6T 3Y3

Slug Test - Water Level Data

Project: Waldemar Developments

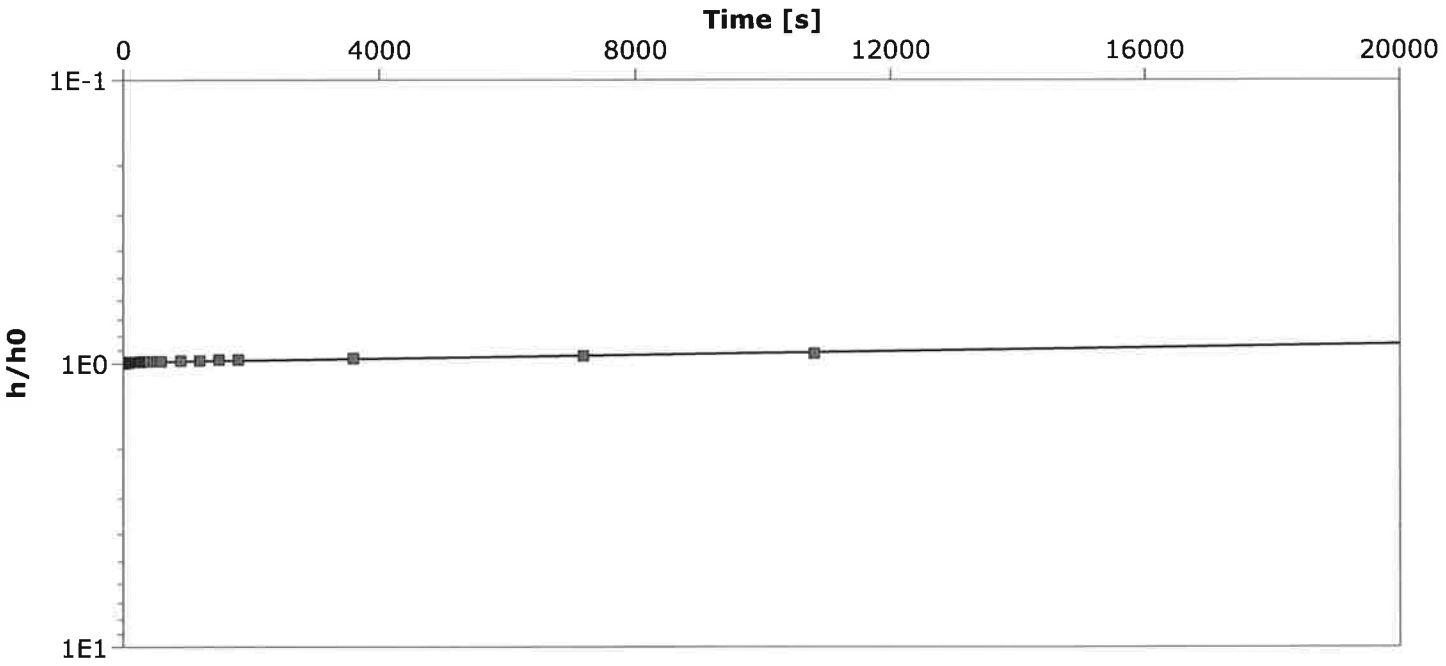
Number: 13-13-3198

Client: Sarah Properties

	Time [s]	Water Level [m]	WL Change [m]
58	1800	4.548	2.328
59	3600	4.52	2.30
60	7200	4.475	2.255
61	10800	4.43	2.21

Terraprobe 11 Indel Lane Brampton, Ontario L6T 3Y3	Slug Test Analysis Report
	Project: Waldemar Developments
	Number: 13-13-3198
	Client: Sarah Properties

Location: Waldemar, Ontario	Slug Test: Slug Test MW16	Test Well: MW16
Test Conducted by: NA		Test Date: 7/3/2014
Analysis Performed by: RS	BR	Analysis Date: 7/7/2014
Aquifer Thickness: 2.78 m		

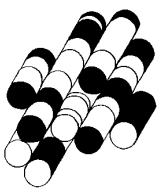


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
MW16	4.80×10^{-9}	

APPENDIX D

TERRAPROBE INC.



Water Balance - Waldemar Development

File No. 13-13-3198

1. Climate Information

Precipitation	860	mm/a
Evapotranspiration	530	mm/a
Water Surplus	330	mm/a

2. Infiltration Rates

Table 2 Approach - Infiltration Factors

Rolling land	0.2
Medium combinations of clay and sand loam	0.2
Cultivated lands	0.1
TOTAL	0.5

Infiltration (0.5 x 330)	165	mm/a
Run-off (330-165)	165	mm/a

Table 3 Approach - Typical Recharge Rates

silty sand to sandy silt	150 - 200	mm/a
silt	125 - 150	mm/a
clayey silt	100 - 125	mm/a

Based on the above, the recharge rate is	165	mm/a
with runoff of	165	mm/a

3. Property Statistics

Building Area	89,283	m^2	8.9	ha
Paved Areas (streets, sidewalks & driveways)	64,809	m^2	6.5	ha
Permeable Areas (open speaces, landscaped areas, parks)	196,116		19.6	ha
TOTAL	350,208	m^2	35.0	ha

Water Balance

File No. 13-13-3198

5. Annual Pre-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Undeveloped	350,208	301,179	185,610	57,784	57,784

6. Annual Post-Development Water Balance-Unmitigated

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Landscaped Areas and Open Spaces	196,116	168,660	103,941	32,359	32,359
Paved Areas (streets, sidewalks, walkways, driveways)	64,809	55,736	5,574	nil	50,162
Building Area Roofs	89,283	76,783	nil	nil	76,783
TOTAL	**350,208**	**301,179**	**109,515**	**32,359**	**159,305**

7. Comparison of Pre-Development and Post-Development

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	301,179	185,610	57,784	57,784
Post-Development	301,179	109,515	32,359	159,305

8. Requirement for Infiltration of Roof Runoff

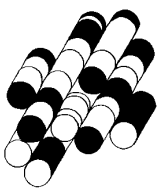
Volume of roof run-off available	76,783 m^3
Volume of post-development infiltration without roof run-off	32,359 m^3
Volume of roof run-off required to match pre-development infiltration rates	25,425 m^3
Percentage of roof run-off required to match pre-development infiltration	33%

9. Annual Post-Development Water Balance-Mitigated

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Landscaped Areas and Open Spaces	196,116	168,660	103,941	32,359	32,359
Paved Areas (streets, sidewalks/walkways/driveways)	64,809	55,736	5,574	nil	50,162
Building Area Roofs	89,283	76,783	nil	25,425	51,358
TOTAL	**350,208**	**301,179**	**109,515**	**57,784**	**133,880**

APPENDIX E

TERRAPROBE INC.



Success Through Science®

Your Project #: 13-13-3198
Your C.O.C. #: 47562101, 475621-01-01

Attention:Ryan Smith

Terraprobe
11 Indell Lane
Brampton, ON
L6T 3Y3

Report Date: 2014/07/09
Report #: R3082994
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B4B5966
Received: 2014/07/04, 12:40

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Total Ammonia-N	9	N/A	2014/07/08	CAM SOP-00441	US GS I-2522-90
Nitrate (NO3) and Nitrite (NO2) in Water (1)	9	N/A	2014/07/07	CAM SOP-00440	SM 4500 NO3I/NO2B
Total Kjeldahl Nitrogen in Water	9	2014/07/08	2014/07/08	CAM SOP-00454	EPA 351.2 Rev 2

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rickey Samaroo, Customer Service
Email: rSamaroo@maxxam.ca
Phone# (905) 817-5700

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

RESULTS OF ANALYSES OF WATER

Maxxam ID		WO1031		WO1032		WO1033		WO1034		
Sampling Date		2014/07/04		2014/07/04		2014/07/04		2014/07/04		
COC Number		475621-01-01		475621-01-01		475621-01-01		475621-01-01		
	Units	MW1D	RDL	MW3S	RDL	MW6	RDL	MW8	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	0.12	0.050	<0.050	0.050	0.053	0.050	<0.050	0.050	3666213
Total Kjeldahl Nitrogen (TKN)	mg/L	3.9	1.0	0.41	0.20	19	10	3.1	2.0	3667213
Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	3665255
Nitrate (N)	mg/L	<0.10	0.10	0.14	0.10	0.32	0.10	2.67	0.10	3665255
Nitrate + Nitrite	mg/L	<0.10	0.10	0.14	0.10	0.32	0.10	2.67	0.10	3665255

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		WO1035	WO1036	WO1036		WO1037		WO1038		
Sampling Date		2014/07/04	2014/07/04	2014/07/04		2014/07/04		2014/07/04		
COC Number		475621-01-01	475621-01-01	475621-01-01		475621-01-01		475621-01-01		
	Units	MW9	MW11D	MW11D Lab-Dup	RDL	MW12	RDL	MW16	RDL	QC Batch
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.12		0.050	<0.050	0.050	<0.050	0.050	3666213
Total Kjeldahl Nitrogen (TKN)	mg/L	1.6	1.0		1.0	<2.0 (1)	2.0	12	10	3667213
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	3665255
Nitrate (N)	mg/L	0.17	<0.10	<0.10	0.10	1.61	0.10	3.42	0.10	3665255
Nitrate + Nitrite	mg/L	0.17	<0.10	<0.10	0.10	1.61	0.10	3.42	0.10	3665255

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Maxxam ID		WO1039		
Sampling Date		2014/07/04		
COC Number		475621-01-01		
	Units	DUP1	RDL	QC Batch
Inorganics				
Total Ammonia-N	mg/L	0.062	0.050	3666213
Total Kjeldahl Nitrogen (TKN)	mg/L	<10 (1)	10	3667213
Nitrite (N)	mg/L	<0.010	0.010	3665255
Nitrate (N)	mg/L	0.33	0.10	3665255
Nitrate + Nitrite	mg/L	0.33	0.10	3665255

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

TEST SUMMARY

Maxxam ID: WO1031
Sample ID: MW1D
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1032
Sample ID: MW3S
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1033
Sample ID: MW6
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1034
Sample ID: MW8
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1035
Sample ID: MW9
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1036
Sample ID: MW11D
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

TEST SUMMARY

Maxxam ID: WO1036
Sample ID: MW11D
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1036 Dup
Sample ID: MW11D
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai

Maxxam ID: WO1037
Sample ID: MW12
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1038
Sample ID: MW16
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

Maxxam ID: WO1039
Sample ID: DUP1
Matrix: Water

Collected: 2014/07/04
Shipped:
Received: 2014/07/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	3666213	N/A	2014/07/08	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	3665255	N/A	2014/07/07	Surinder Rai
Total Kjeldahl Nitrogen in Water	AC	3667213	2014/07/08	2014/07/08	Sarabjit Raina

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Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C

Results relate only to the items tested.

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Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
3665255	SAU	Matrix Spike [WO1036-01]	Nitrite (N)	2014/07/07		105	%	80 - 120
			Nitrate (N)	2014/07/07		114	%	80 - 120
3665255	SAU	Spiked Blank	Nitrite (N)	2014/07/07		100	%	80 - 120
			Nitrate (N)	2014/07/07		112	%	80 - 120
3665255	SAU	Method Blank	Nitrite (N)	2014/07/07	<0.010		mg/L	
			Nitrate (N)	2014/07/07	<0.10		mg/L	
3665255	SAU	RPD [WO1036-01]	Nitrite (N)	2014/07/07	NC		%	25
			Nitrate (N)	2014/07/07	NC		%	25
3666213	COP	Matrix Spike	Total Ammonia-N	2014/07/08		97	%	80 - 120
3666213	COP	Spiked Blank	Total Ammonia-N	2014/07/08		98	%	85 - 115
3666213	COP	Method Blank	Total Ammonia-N	2014/07/08	<0.050		mg/L	
3667213	SNR	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2014/07/08		NC	%	80 - 120
3667213	SNR	QC Standard	Total Kjeldahl Nitrogen (TKN)	2014/07/08		93	%	80 - 120
3667213	SNR	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2014/07/08		83	%	80 - 120
3667213	SNR	Method Blank	Total Kjeldahl Nitrogen (TKN)	2014/07/08	0.13 , RDL=0.10		mg/L	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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Maxxam Job #: B4B5966
Report Date: 2014/07/09

Terraprobe
Client Project #: 13-13-3198

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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APPENDIX F

TERRAPROBE INC.

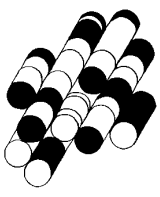

TABLE 1

Ground Water Elevations
Wademar Developments

	5-Jun-14		6-Jun-14		3-Jul-14		23-Oct-14	
Well ID	Grouond Water Level m(bgs)	Ground Water Elevation (masl)	Grouond Water Level m(bgs)	Ground Water Elevation (masl)	Grouond Water Level m(bgs)	Ground Water Elevation (masl)	Grouond Water Level m(bgs)	Ground Water Elevation (masl)
MW 1D	NV	NV	10.98	463.22	1.32	472.88	3.08	471.12
MW 1S	1.02	473.18	3.78	470.42	1.48	472.72	1	473.2
MW 2	1.5	469.3	5.6	465.2	3.35	467.45	1.88	468.92
MW 3D	5.43	464.67	5.63	464.47	8.23	461.87	7.14	462.96
MW 3S	1.62	468.48	3.26	466.84	2.32	467.78	1.06	469.04
MW 4	4.28	466.1	5.45	464.93	4.91	465.47	4.81	465.57
MW 5D	5.77	462.73	5.78	462.72	6.01	462.49	6.21	462.29
MW 5S	4.61	463.89	4.67	463.83	4.67	463.83	4.69	463.81
MW 6	1.12	465.58	2.43	464.27	1.93	464.77	NV	NV
MW 7	1.48	471.32	4.89	467.91	1.83	470.97	1.39	471.41
MW 8	1.64	467.36	5.69	463.31	2.17	466.83	1.55	467.45
MW 9	1.12	464.88	3.37	462.63	1.51	464.49	1.3	464.7
MW 10	2.15	467.45	3.58	466.02	2.59	467.01	3.56	466.04
MW 11D	5.33	462.97	7.19	461.11	5.62	462.68	6.29	462.01
MW 11S	4.73	463.57	4.85	463.45	4.84	463.46	DRY	DRY
MW 12	1.93	464.27	1.99	464.21	2.48	463.72	3.33	462.87
MW 13	2.83	459.97	2.95	459.85	3.26	459.54	3.64	459.16
MW 14	1.73	461.47	1.96	461.24	2.33	460.87	4.35	458.85
MW 15D	6.2	464.2	11.49	458.91	7.14	463.26	7.96	462.44
MW 15S	1.07	469.33	4	466.4	2.2	468.2	2.26	468.14
MW 16	1.54	463.91	3.47	461.98	2.22	463.23	1.91	463.54
MW 17	1.68	466.07	3.65	464.1	2.23	465.52	2.71	465.04
MW 18	1.71	461.79	3.06	460.44	2.1	461.4	1.25	462.25

NV - No value