# HYDROGEOLOGICAL ASSESSMENT FOR CLASS ENVIRONMENTAL ASSESSMENT BOVAIRD DRIVE (HIGHWAY 7) FROM LAKE LOUISE DRIVE TO PEEL / HALTON BOUNDARY BRAMPTON, PEEL REGION, ONTARIO

Submitted to:

#### **Region of Peel**

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#### 1.0 INTRODUCTION

AMEC Earth and Environmental Limited (AMEC) was retained by Peel Region to characterize the hydrogeological conditions along Bovaird Drive West between Lake Louise Drive/Worthington Avenue in Brampton and the Peel regional boundary, Ontario (study area) as part of a Class Environmental Assessment for the study area being conducted by AMEC Philips. This assessment was carried out in support of redevelopment along the existing Bovaird Road alignment, which, along with surrounding property and borehole locations, is shown on Figure 1.

#### 2.0 SCOPE OF WORK

The scope of work for the hydrogeological work involved an assessment of hydrogeological conditions along the alignment with detailed focus on stream crossing to determine any potential impacts of the road on groundwater resources during and after construction. The hydrogeological assessment component of the study involved the following:

- Review of borehole logs and grain size analyses from 3 geotechnical boreholes;
- Groundwater elevation monitoring at three monitoring wells located along Bovaird Drive West:
- In-situ hydraulic conductivity testing of three monitoring wells along Bovaird Drive West;
- Assessment of Ontario Ministry of Environment (MOE) water well records within the study area;
- Identification of significant groundwater recharge and discharge areas;
- Characterization of the study area hydrogeology based on field data;
- An evaluation of the potential impact of the proposed redevelopment on local groundwater resources, private wells and streams; and
- Mitigation measures were developed and recommended as needed to protect existing groundwater flow patterns and stream flows.

#### 3.0 STUDY AREA DESCRIPTION

#### 3.1 Land Use

The study area extends southwest from the edge of Brampton to the regional boundary between Peel Region and Halton Region at the edge of Georgetown. At the northeast edge of the study area at the railway crossing are a train station and residential areas. The rest of the study area is mostly undeveloped agricultural land with some residences and farms along major roads. Most of the area has a land use of intensive agriculture, with much smaller percentages of land use being cultural meadows, construction areas, commercial industrial open space and



numerous other classifications as shown on Figure 2. Details of the land uses are presented on Figure 2.

#### 3.2 Topography and Drainage

The study area is located on the South Slope and Peel Plain physiographic regions characterized by gently sloping glacial till plains from the Oak Ridges Moraine approximately 10 km to the northwest to Lake Ontario approximately 25 km to the southeast (Chapman and Putnam 1984; Singer et al. 2003).

The topography within the study area slopes gradually down from a high elevation of approximately 250 m above mean sea level (amsl) in the northeast to a lower elevation of approximately 235 m amsl at the top of the Credit River Valley in the southwest. The ground elevation then decreases more steeply down to an approximate elevation of 190 m amsl at the Credit River located just beyond the southwest edge of the study area.

The ground slope varies from 0.005 south-easterly in the eastern part of the study area to about 0.01 south-easterly in the central part to about 0.03 southerly near the Credit River in the western part of the study area. A topographic map which presents the surface contours and the drainage patters is presented on Figure 3.

Several tributaries to the Credit River cross Bovaird Drive and flow southerly. There are two major tributaries which cross Bovaird Drive, one in the west, about 800 m east of the Credit River crossing of Bovaird and Huttonville Creek in the eastern portion of the study area. The other three minor tributaries which pass under Bovaird Drive appear to be intermittent and. Two of these are located east of Huttonville Creek, namely the Springbrook and Churchville tributaries.

A number of other unnamed tributaries also drain the study area. Many of the small tributaries are intermittent streams especially in their upper reaches, south and north of Bovaird Drive. Natural drainage of the area soils ranges from good to imperfect (Soil Survey of Peel County, Ontario Soil Survey, 1953)

#### 3.3 General Geology

The surficial geology of the study area is shown on Figure 4. The surface deposits in the area consist predominantly red to brown clay and silt of the Halton Till, which overlies the relatively flat-lying shale bedrock of the Queenston Formation. Three small areas of glaciolacustrine sand are identified within the study area: one near the Springbrook tributary and; one north of the Credit River and one south of the Credit River at the western end of the study area. Bedrock or bedrock drift is exposed at two locations in the western end of the study area. Modern alluvium has been mapped in the valleys of the credit river, Huttonville Creek and parts of two small tributaries in the western part of the study area.

The overburden in the area ranges from less than 1 m thick at Creditview Road and along the Credit River Valley up to 15 m thick between Mississauga and Heritage Roads as shown on the



cross-section profile along Bovaird Drive on Figure 5. The native overburden at most other locations consists of sandy silt or silty sand till (diamict), namely the Halton Till.

Sand or silty sand, as shown on figure 5, is identified generally underlying clayey silt till at the overburden bedrock contact in the vicinity of Mississauga road and up to 500 m east of it and at an isolated location in the Credit River Valley. In the vicinity of Mississauga Road, discontinuous glaciolacustrine sand lenses (with gravel on occasion) have been reported to overlie bedrock at a number of drilled locations in the northeast part of the study area, north of Bovaird Drive and east of Mississauga Road (AMEC 2008).

There are few users of groundwater for domestic purposes as the yields from overburden and from bedrock are generally very low.

#### 4.0 FIELD INVESTIGATION METHODOLOGY

#### 4.1 Borehole Drilling and Monitoring Well Installation

To determine hydrogeological conditions along the study area, AMEC completed a borehole drilling and well installation program as part of the geotechnical investigation completed between October 13 and 28, 2009. The borehole and monitoring well locations are shown on the study area map of Figure 1. Of the 55 boreholes drilled for the hydrogeological investigation, seven were completed with groundwater monitors. Two ground water monitors were installed at two depths at one of the locations (BC3 and BC3W). One monitor was completed in bedrock near the Credit River (BC35) and three were completed in overburden at B10, B11, BC11 and BC4. The boreholes were drilled and sampled using standard geotechnical investigation techniques and the monitors were installed in general accord with AMEC's monitor installation standard operating procedures. Additional details on the monitor installation can be found in the Geotechnical Investigation Factual Report for Bovaird Drive (AMEC, April, 2010). Well construction details are provided on Table 1

Due to the location of some monitors on the shoulder of Bovaird Drive, two could not be located for further monitoring nor testing. Single well response tests were completed in three of the monitors (BC3, BC11 and BC35).

#### 4.2 In-Situ Hydraulic Conductivity Testing

Hydrogeologic characteristics of the shale bedrock and the saturated overburden were evaluated by completing single well response tests at monitors BC3, BC11 and BC35. A slug test analyzed by the Bouwer and Rice method was completed in BC3 (shale bedrock) on January 27, 2010. The test in BC3 was initiated by pumping the monitor nearly dry with a WaTerra inertial pump and monitoring the recovery manually with an electric water level tape. Short term pumping tests and recovery was analyzed in monitors BC11 (overburden clayey silt till) and BC35 (shale bedrock) on March 16, 2010. These tests were initiated by pumping nearly dry with a downhole submersible pump and monitoring the drawdown and recovery with downhole pressure transducers and data loggers.



#### 4.3 Groundwater Monitoring

Groundwater levels were measured with a manual electric water level tape in all monitors immediately after installation and in all monitors that could be located on January 27 and March 16, 2010. The depth to groundwater in overburden and shallow bedrock monitors ranges between 1.5 and 3 m bgs, except near the Credit River Valley, where it may be 11 m below the top of the river valley. Static groundwater levels were measured in monitors BC3, BC03-W, BC04, BC11, and BC35 and the data are provided in Table 2.

#### 4.4 Groundwater Quality

Groundwater quality of the overburden and bedrock units was assessed from investigations conducted previously by others.

#### 4.5 Water Well Records and Well Survey

Water well records available from the Credit Valley Conservation Authority and the City of Brampton databases were reviewed and assessed electronically by Aquaresource Inc. (Aquaresource) to plot well locations and prepare stratigraphic cross- sections. Figures and cross sections were prepared by Aquaresource for review and assessment by AMEC staff.

#### 5.0 FINDINGS

#### 5.1 Geology

The general geology beneath Bovaird Drive was interpreted from MOE well logs and is presented on the cross-section on Figure 5 and discussed in Section 3.3. The distribution of soils in the subsurface in the immediate vicinity of Bovaird Drive was assessed from the geotechnical boreholes drilled in October, 2009.

Logs of boreholes drilled along Bovaird Drive West within the study area indicated varying thicknesses of clay (rarely sandy) fill beneath surface, especially adjacent to surface water courses, except under the road where aggregate fill was encountered. These soils were is generally underlain by a silt and sand till (Halton Till), underlain by the Queenston Shale bedrock. Where no fill was identified at surface, the topmost soil was generally sandy silt till or occasionally clayey till continuing down to the interface of the Queenston Shale bedrock.

An interpretation of the subsurface soils near Bovaird Drive is provided by the cross-section shown on Figure 6.

#### 5.1.1 Fill Materials

The fill materials encountered consist of sand and gravel fill and silty clay fill. The sand and gravel fill was thickest (1.2 to 1.4 m) under the paved portions of the street. Where there was no pavement, the sand and gravel fill was generally about 0.6 m thick and underlain by 1 m or more of silty clay fill. Fill materials at BC3 and BC 4 in the Huttonville Creek valley are thicker being up to 5 m thick at BC 3. Near the Credit River Valley at BC35, the fill extends about 11 m down from ground surface to the shale bedrock.



The average thickness of fill, consisting of sand and gravel fill at surface and silty clay or rarely silty sand, encountered under and in the vicinity of the road was 4.3 m

#### 5.1.2 Clayey Silt Till

Beneath the fill, a layer of clayey silt till with an average thickness of 2 m was encountered at 32 of the locations drilled. It is inferred, that in general, the clayey silt till overlies the sandy silt throughout much of the area providing a less permeable cap for infiltration into the more permeable underlying sandy silt till. The clayey silt till was not found to be in direct contact with the bedrock except near Huttonville Creek (BC3 and BC4)

#### 5.1.3 Sandy Silt Till

Sandy silt till was encountered at 29 of the locations drilled with an average thickness of about 2 m. At 14 of the locations it was overlain by clayey silt till. Clayey silt till was not identified overlying the sandy silt till at 15 locations. In these cases the sandy silt till was directly underlying about 2 m of fill. The sandy silt till commonly was in direct contact with the bedrock except at one location drilled where 0.7 m of gravel and sand was found to underlie the silty sand till.

#### 5.1.4 Bedrock

Queenston Shale bedrock was encountered at nine of the locations drilled at an average depth of 4.8 m bgs, with the depth below ground surface ranging from 1.4 m bgs at BC31 to 11 m bgs at BC35.

#### 5.2 Hydrogeologic Characteristics

The hydraulic conductivity of the sandy silt till was evaluated at one monitoring locations and of the shale bedrock at two locations. The hydraulic conductivity of the sandy silt till at BC 11 was calculated from short term pumping recovery data to be about 3 x  $10^{-8}$  m/s. The analysis of recovery from a very short pumping test in the bedrock at BC35 indicated a hydraulic conductivity of about 7 x  $10^{-8}$  m/s. These hydraulic conductivities are considered to be about and indicate that the sandy silt till and bedrock at the locations tested is very low yielding and they not considered to be sufficient for any reasonable water use. The analysis details are presented in Appendix B

#### 5.2.1 Hydraulic Heads

There are insufficient data available from the recently installed monitors to infer shallow groundwater flow. Groundwater flow directions can be inferred from analysis of the distribution of hydraulic heads as determined from the MOE well log database. The directions of groundwater flow in the saturated overburden and shallow bedrock are inferred to be affected by the presence of Huttonville Creek in the east and the Credit River in the west. The presence of the other tributaries in the study area seems to have little effect on the inferred groundwater flow patterns, supporting the conclusion that these are often intermittent streams in the study



area. The impacts of these minor surface water courses on the shallow groundwater would be minimal compared to the impacts of Huttonville Creek and the Credit River.

Horizontal groundwater gradients calculated from the interpreted shallow groundwater contours shown on Figure 7. The horizontal groundwater gradient of the shallow groundwater (water table gradient) is about 0.01 ranging from easterly to southerly depending on the effects of surface water distribution, increasing to 0.12 southerly near the Credit River. Depending on the hydraulic conductivity of the saturated overburden and shallow fractured bedrock which may range between  $3 \times 10^{-6}$  and  $3 \times 10^{-8}$  m/s, and using an effective porosity of 0.2, the lateral ground water flow velocity is estimated to range between 0.04 and 4 m/yr.

Groundwater elevations were calculated for monitors BW3(bedrock) and BW3C (overburden silty clay fill) near Huttonville Creek on January 17 and March 16, 2010. The vertical gradient across the 0.6 m of clayey silt till and the 1.4 m of upper shale bedrock considered to be isolated between the two monitors was calculated to be about 0.14 downward in January, 2010 and 0.17 upward in March, 2010. It may be that the gradients across these units reverse seasonally, being affected by recharge or stream stage.

Assuming that the vertical hydraulic conductivity of the clayey silt till and upper shale is between  $3 \times 10^{-8}$  and  $3 \times 10^{-9}$  m/s, the vertical flow velocity (upward or downward) through the silty clay till and upper bedrock near Huttonville Creek is estimated to range between 0.07 and 0.7 m/yr.

#### 5.2.2 Groundwater Use

The distribution of groundwater monitors and water wells within the study area as determined from the water well data base, is presented on Figures 8 and 9. All known locations of reported water wells and monitor wells installed for environmental investigations are shown on Figure 8. Only reported water wells and a few investigation wells not used for water supply (identified as IWA, OGS, MNR, MTO and UGAIS) and are presented on Figure 9. The condition and current use of these wells is not known at present.

Based on the hydrogeologic conductivities expected for the saturated sol and shale bedrock, they are not considered in general to be viable aquifers. It is noted however that the occurrence of discontinuous sand and gravel lenses in the sandy silt till or located at the till/bedrock interface could possibly produce limited water for domestic use.

#### **Bedrock Wells**

Approximately thirty seven locations for wells completed in bedrock (shallow and deep) are presented on Figure 9 (excluding the three IWA wells, three OGS wells, two MTO wells, seven UGAIS wells, and one MNR well). It is expected that the fourteen bedrock wells located along and east of Creditview Road in the developed area are no longer required for water supply as this area is serviced with Municipal water.

A total of twenty six wells completed in bedrock within the study area may be used for domestic purposes.



#### **Overburden Wells**

In total twenty-three overburden wells have been identified within the study area which may be sources of water for use by residents.

In the area east of Mississauga Road, twelve wells completed in overburden were identified, of which four may be sources for domestic water use. Four overburden wells located on the west side of Mississauga road may also be sources of water use by local residents. All but one of the remaining fifteen overburden wells are located west of Heritage Road

#### 5.2.3 Groundwater Quality

Groundwater data from twenty monitors in the vicinity of the study area was reviewed and a summary of the more relevant parameters is presented on Table 3. The monitors had been installed and sampled for several previous studies including the IWA study and studies by private owners for proposed subdivision development. Eight of the monitors are located within the western part of the study area between Mississauga and Creditview Roads.

The chemical data indicate fresh groundwater in the overburden and shallow bedrock and saline groundwater in the deeper bedrock. Groundwater in the deeper bedrock is poorer in quality as indicated by the significantly higher concentrations than the concentrations detected in the overburden for hardness, total dissolved solids (TDS), bromide, chloride, sulphate and sodium. Concentrations of hardness, TDS, chloride, sulphate, iron, manganese and sodium in deeper bedrock groundwater exceeded the respective Ontario Drinking Water Standards (ODWS). In the overburden, only hardness exceeded the ODWS operational guideline (OG) at all locations sampled. TDS, chloride, nitrate, iron, manganese and sodium concentrations exceeded the ODWS at only a few locations.

Hardness concentrations ranged from 120 mg/l to 645 mg/l in the overburden and 530 mg/l to 4900 mg/l in deep bedrock. TDS concentrations ranged from 260 mg/l to 1500 mg/l in the overburden and 2600 mg/l to 19 000 mg/l in deep bedrock. Sulphate concentrations ranged from 11 mg/l to 317 mg/l in overburden, below the ODWS AO of 500 mg/l, and 310 mg/l to 1700 mg/l in the deep bedrock.

There were no significant differences in the concentrations of fluoride, nitrate, nitrite, iron or manganese between the overburden and bedrock groundwater. Nitrate concentrations did not exceed the health related ODWS of 10 mg/l in the overburden or bedrock groundwater, except at one location in the overburden, where a nitrate concentration of 11 mg/l was reported.

In summary, the groundwater quality in the overburden and shallow bedrock although hard, is by and large of acceptable quality for drinking. Elevated concentrations of sodium in shallow groundwater, likely resulting from application of road de-icing materials, were reported at a few locations. The quality of groundwater in the deeper bedrock is poorer and much more highly mineralized, with relatively very high concentrations of chloride, sodium, sulphate and TDS.



#### 5.2.4 Sensitive Areas

The CVC has identified several areas, shown on Figure 10, which are considered sensitive. These include a Life Science Area of Natural and Scientific Interest (ANSI) in the west end of the study area adjacent to the Credit River and two of its tributaries. There are also two Provincial Wetlands located just west of Heritage Road and one further to the west between the two western tributaries to the Credit River all of which are very near Bovaird Drive and appear to be within the project limit area. Several other wetlands identified are of less concern as they are located further from Bovaird Drive although they may be within the project limit area.

#### 5.2.5 Water Budget Analysis

The impact of the proposed development on the recharge/discharge characteristics of the Site is dependent on the pre-development conditions of the Site and the type of development proposed.

The soils along the Bovaird Drive corridor are classified in the *Soil Survey of Peel County* as Chinguacousy and Oneida clay loams. Both soil types are derived from shale and limestone based till. Despite relatively slow infiltration and percolation, these soil types exhibit good drainage due to relatively rapid runoff. For the purposes of this analysis, the native soil on the Site has been classified as clay loam.

Recharge to aquifers can occur through several processes including: direct infiltration of precipitation, influent losses from watercourses, irrigation, leakage from water mains and sewers, and flow between aquifers. Of these, direct infiltration is the most important recharge mechanism. In any area, recharge is dependent on a complex interaction of several physical variables including: intensity and duration of rainfall, air temperature, textural properties of soils, soil moisture capacity (SMC), water table depth, ground surface characteristics, vegetation type and topography. In summary, there is no simple way to accurately measure recharge to an aquifer system.

Indirect measurement of recharge by the measurement of baseflow in streams and the use of ground water models has been used in comprehensive sub-watershed studies, but this approach is unwarranted due to the relatively small size and linear nature of the Bovaird Drive corridor.

Where more sophisticated methods for evaluating the effects of urban development on recharge are impractical, a water balance model based on local precipitation, temperature and soils data is commonly used.

#### 5.2.6 Water Budget Calculation

The seasonal infiltration/recharge characteristics of the Site were evaluated using a general water balance equation of the form:

Potential Infiltration (I) = Precipitation (P) – Actual Evapotranspiration (AET) – Runoff (R)



An estimate of AET for the Site was made using the Thornthwaite Model for approximating potential evapotranspiration (PET). The Thornthwaite Model is based on an empirical relationship between PET and mean air temperature (Palmer and Havens, 1958) given by the formula:

PET =  $16d (10T/I)^a$ , where:

- PET = monthly evapotranspiration (mm)
- T = mean monthly temperature (°C)
- I = annual thermal index = sum of the monthly indices (i)
- $i = (T/5)^{1.514}$  Note: i = 0 when average T ( ${}^{\circ}$ C) < 0
- d = correction factor for monthly sunshine duration based on latitude of approximately 44° N.
- $a = 0.49 + 0.0179I 0.0000771I^2 + 0.000000675I^3$

The climate station operated by Environment Canada that is closest to the Site is located at Toronto International Airport (43°41′N, 79°38′W). Records for mean monthly temperature and precipitation (rainfall and snowfall) were reviewed for the period 1971 to 2000. (Environment Canada: Canadian Climate Normals, 2004).

Estimates of runoff for the Site were made on the basis of the surface soil/sediment types, type of cover and slopes using runoff coefficients based on standard methods for drainage analysis (MTO, 1997). The runoff coefficient (C<sub>r</sub>) is the ratio of the depth of runoff to the corresponding depth of rainfall falling on an area. Where there are different land uses and soil types on a Site, a composite runoff coefficient based on the following formula is used:

$$C = \frac{A_1C_1 + A_2C_2 +}{A_t}$$
 Equation 1

where:

C = Composite runoff coefficient

 $A_{1,2}$  = Area (ha) corresponding to specific land use or soil type

 $C_{1,2,}$  = Runoff coefficient ( $C_r$ ) corresponding to  $A_{1,2,...}$ 

 $A_t$  = Total drainage area, ha

Runoff coefficients, corresponding to a return period of 5 to 10 years, used for the Site are based on empirical values obtained from the MTO Drainage Management Manual (1997) and adjusted for estimated capture of runoff by underdrained swales. The runoff coefficients (MTO, Design Chart, 1.07) are summarized in the worksheet provided in Appendix D of this report.

Post-development runoff coefficients were selected to reflect the discharge of runoff from the various land uses in the Bovaird Drive corridor as shown on Figure 2 of the report. Runoff



coefficients were also adjusted to account for evaporation losses when air temperatures were less than zero degrees Celsius ( $0^{\circ}$ C).

A simple spreadsheet model (Appendix D) was used to calculate PET and water balance on a monthly basis for pre- and post-development conditions on the site. General assumptions made in calculating PET and water balance are as follows:

- When the monthly thermal index (i) = 0, the PET is zero
- When T < 0°C, infiltration (I) = 50 percent of the difference between precipitation and runoff
- When PET exceeds (P R), AET equals (P R)

#### 5.2.6.1 Pre-Development Water Balance

Table 4 summarizes the results of the water balance model computed for pre-development conditions:

**Table 4: Pre-development Water Balance** 

Month	Precipitation mm	AET mm	Runoff mm	Infiltration mm
January	52.2	0.0	8.1	22.0
February	42.6	0.0	6.6	18.0
March	57.1	0.0	8.9	24.1
April	68.4	31.5	17.3	19.6
May	72.5	54.2	18.3	0.0
June	74.2	55.5	18.7	0.0
July	74.4	55.6	18.8	0.0
August	79.6	59.5	20.1	0.0
September	77.5	57.9	19.6	0.0
October	64.1	37.7	16.2	10.2
November	69.3	10.6	17.5	41.2
December	60.9	0.0	9.5	25.7
Year	793	363	180	161



These data indicate that net infiltration contributing to aquifer recharge occurs primarily in the spring and fall of the year with a deficit occurring in the summer months (See Appendix D for details). The estimated annual recharge rate of 161 mm is a reflection of the combination of the local clayey silt soils and the disturbed conditions observed on the Site.

#### 5.2.6.2 Post Development Water Balance

The widening of Bovaird Drive represents a relatively small decrease in the area available for the recharge of local aquifers. In calculating the post-development water balance, the loss of recharge area was estimated to be approximately nine hectare.

Table 5 and Figure 1 (Appendix D) summarize the estimated water balance for pre- and post-development conditions in the vicinity of the Bovaird Drive corridor:

Table 5: Summary of Annual Infiltration/Recharge

Stage	Pre-Dev	velopment	Post Dev	elopment
Month	Infiltration	Recharge	Infiltration	Recharge
	mm	m <sup>3</sup>	mm	m <sup>3</sup>
January	22.0	127564	21.7	125658
February	18.0	104104	17.7	102549
March	24.1	139538	23.7	137454
April	19.6	113689	18.8	109140
May	0.0	0.0	0.0	0.0
June	0.0	0.0	0.0	0.0
July	0.0	0.0	0.0	0.0
August	0.0	0.0	0.0	0.0
September	0.0	0.0	0.0	0.0
October	10.2	59216	9.5	54954
November	41.2	238404	40.4	233796
December	25.7	148824	25.3	146602
Totals	161	931339	157	910153

Based on the water balance calculation, the estimated post development infiltration of 157 mm represents a estimated net loss of annual recharge capacity in the Bovaird Drive corridor of 21,186 m3 or 2.3 percent of the pre-development capacity. This is considered to be a negligible change and well within the margin of error for a water budget calculation.



#### 6.0 CONCLUSIONS

The findings of this investigation permit the following conclusions to be presented.

- 1 The land use within the study area consists primarily of agricultural (more than 60 %) predominated by intensive agricultural.
- 2 Topographic gradients are low, generally to the southwest, (<0.01) except at the Credit River Valley.
- 3 Major perennial streams in the Study area are the Credit River, Huttonville Creek and the large westernmost tributary to the Credit River in the study area. Lesser, ephemeral streams in the Study area include the Springbrook and Church tributaries, and the unnamed tributaries between Huttonville creek and the westernmost tributary of the Credit River within the study area.
- 4 The overburden in the area, underlain by Queenston Shale bedrock, consists primarily of clayey silt till (upper) to sandy silt till (lower) (both Halton Till) which is less than 1 m thick at Creditview Road and along the Credit River Valley up to 15 m thick in the central portion of the study area.
- 5 Discontinuous deposits of sand (occasionally with gravel) have been identified, primarily in the vicinity of Mississauga Road and east of it.
- 6 The direction of groundwater flow as inferred from MOE water well data for shallow wells is south-westerly, modified to some extent by discharge into Huttonville Creek and the Credit River within the study area and Fletcher's Creek, east of the study area. The other tributaries, except the most westerly on in the study area, are considered to be ephemeral and do not influence groundwater flow directions throughout most of the year.
- 7 Approximately forty-nine wells completed in overburden and bedrock within the study area may be used for domestic purposes. No information on the condition nor current use of these wells is available.
- 8 The hydrogeologic characteristics determined for the overburden and bedrock indicate that both are poor aquifers, generally incapable of supplying sufficient water for domestic uses. Wells that intercept the discontinuous sand or sand and gravel lenses, generally at the bedrock interface may produce sufficient water for domestic use.
- 9 The quality of the groundwater from wells completed in overburden and shallow bedrock (<5 m below bedrock surface), although very hard, meets the ODWQS. The quality of groundwater in deep bedrock, in addition to being very hard, may be very mineralized and concentrations of a number of parameters (some health related) exceed the ODWQS.



- 10 There is minor evidence of impact from road de-icing to the groundwater in overburden and shallow bedrock.
- 11 Several small Provincial Wetlands and an ANSI have been identified within the study area by the Credit Valley Conservation Authority.
- 12 Water budget analysis indicates that the net effect of widening Bovaird Drive from two to four lanes may decrease recharge by less than 3 per cent, an insignificant amount considering the range of error inherent in the assumptions and calculations.
- 13 Impacts to surface water, groundwater or water supply wells from reconstruction of Bovaird Drive and its associated structures (culverts, bridges) is expected to be minimal.

#### 7.0 RECOMMENDATIONS

Based on the findings of this assessment, the following recommendations are presented for consideration.

- 1 Locate all groundwater monitors installed and equip with data logging equipment to measure groundwater levels for six to nine months from late winter until late fall.
- 2 Prior to construction, complete a door-to-door water well survey for all water supply wells located within the study area to provide baseline data for comparison with future conditions.
- 3 Review of the potential for impacts of discharge to surface water and impacts to wetlands be revisited when reconstruction options especially as related to bridge reconstruction are developed with more certainty.

#### 8.0 CLOSURE

This report has been prepared for the exclusive use of The Region of Peel for specific application to this portion of this Class Environmental Assessment.

Respectfully Submitted,

AMEC Earth & Environmental,

a division of AMEC Americas Limited

Prepared by:

Tomas Cihula, M.Sc., P.Geo. Project Hydrogeologist

Comas Glant

Dirk Gevaert, M.Sc., P.Geo Associate Hydrogeologist

SW1309037

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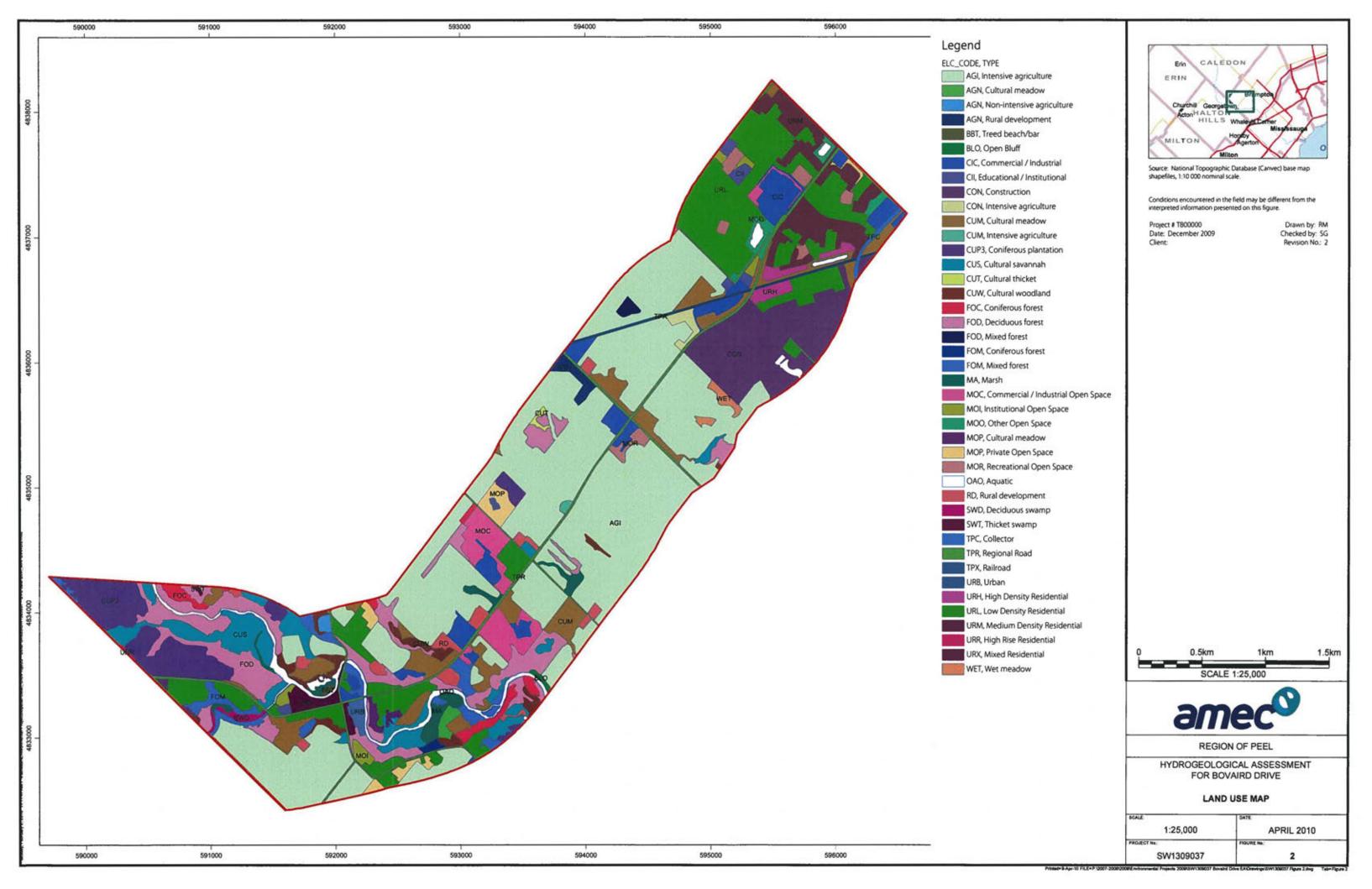


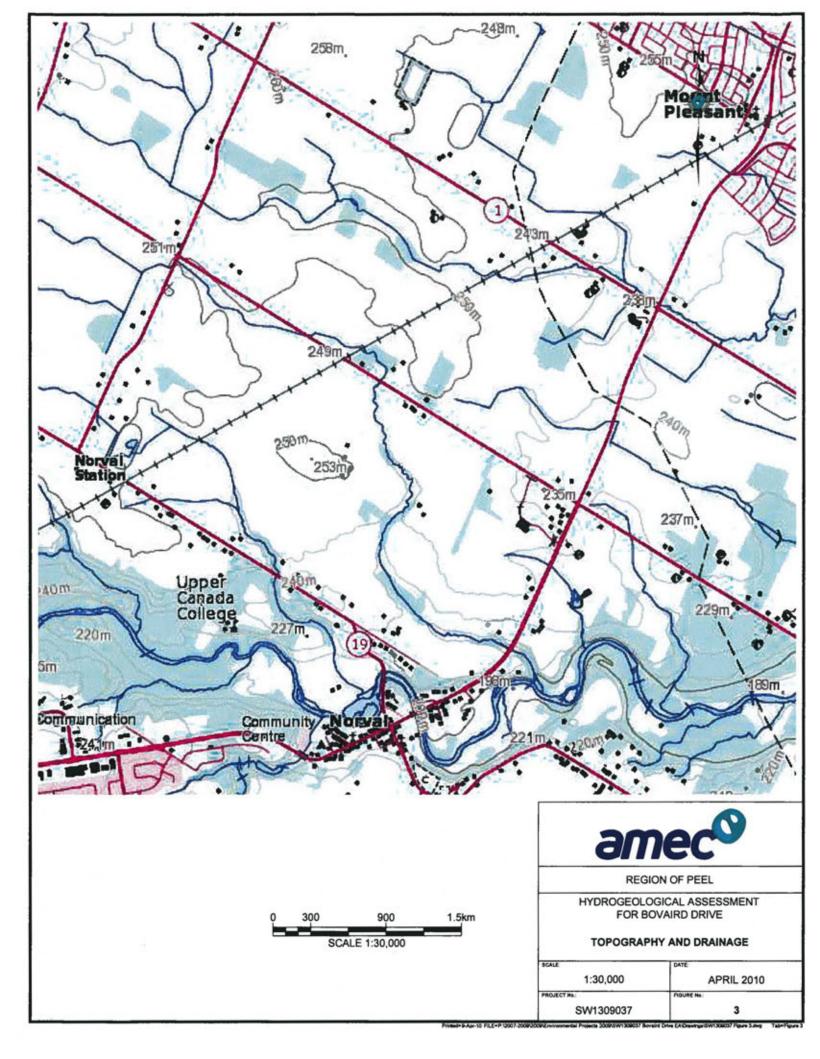
#### 9.0 REFERENCES

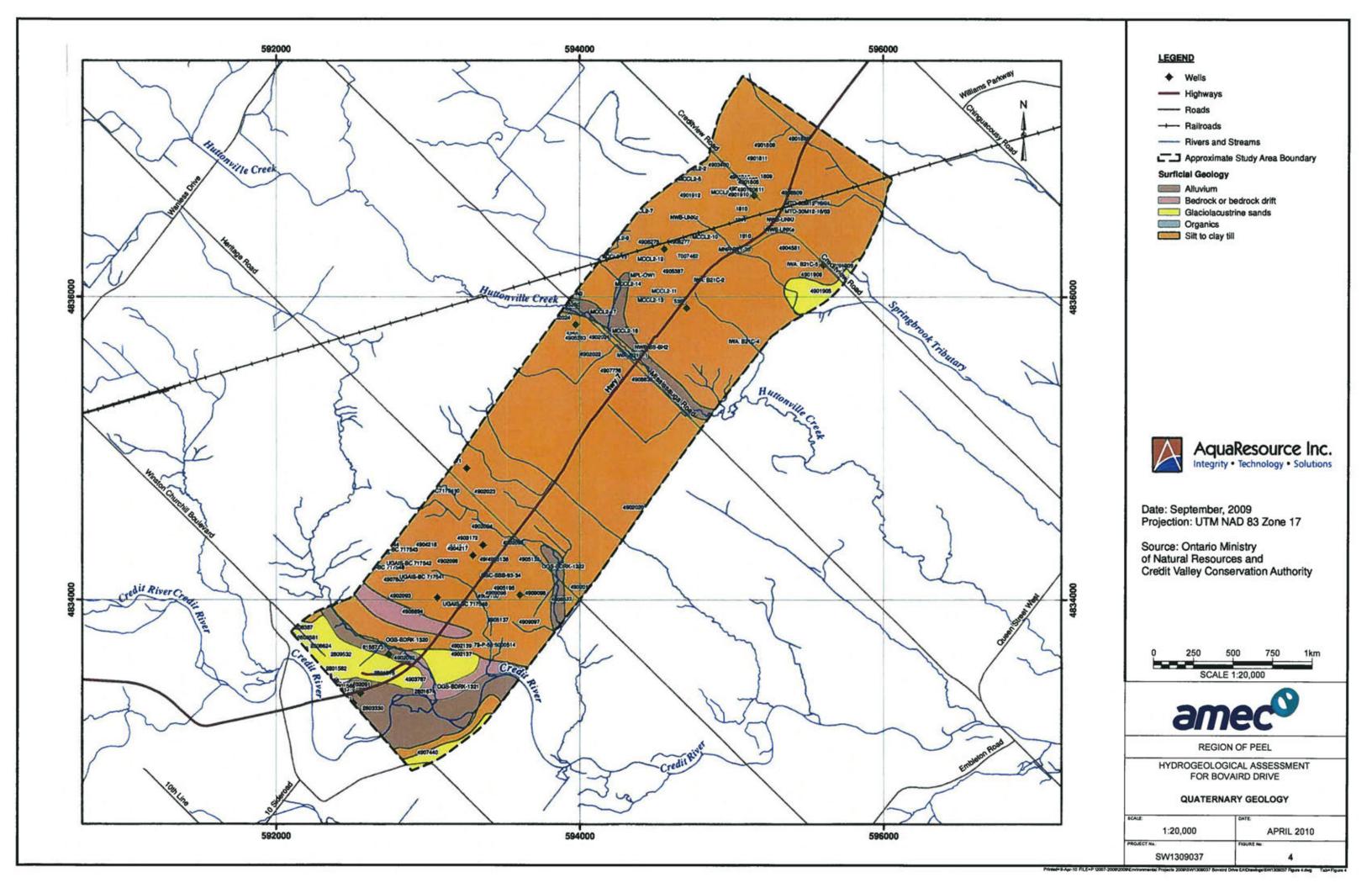
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- Golder Associates Limited (Golder), <u>IWA Landfill Site Search, Peel Region, Step 6</u>, <u>Hydrogeological Report, Site B-21c</u>, December 1993.
- Singer, S.N., Cheng, C.K. and Scafe, M.G., *The Hydrogeology of Southern Ontario*, *2<sup>nd</sup> Edition*, Ontario Ministry of Environment, Toronto, Ontario, 2003.

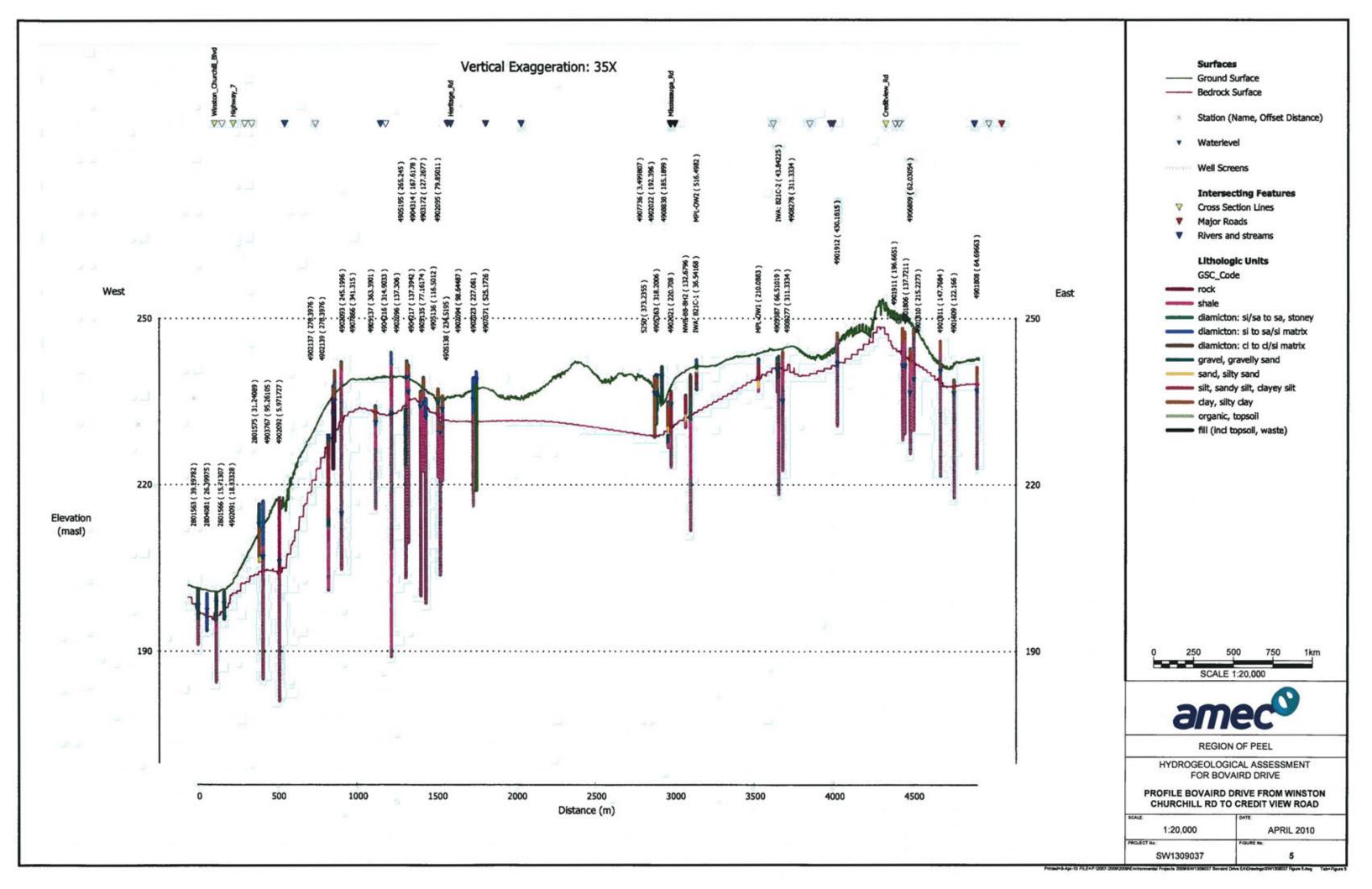


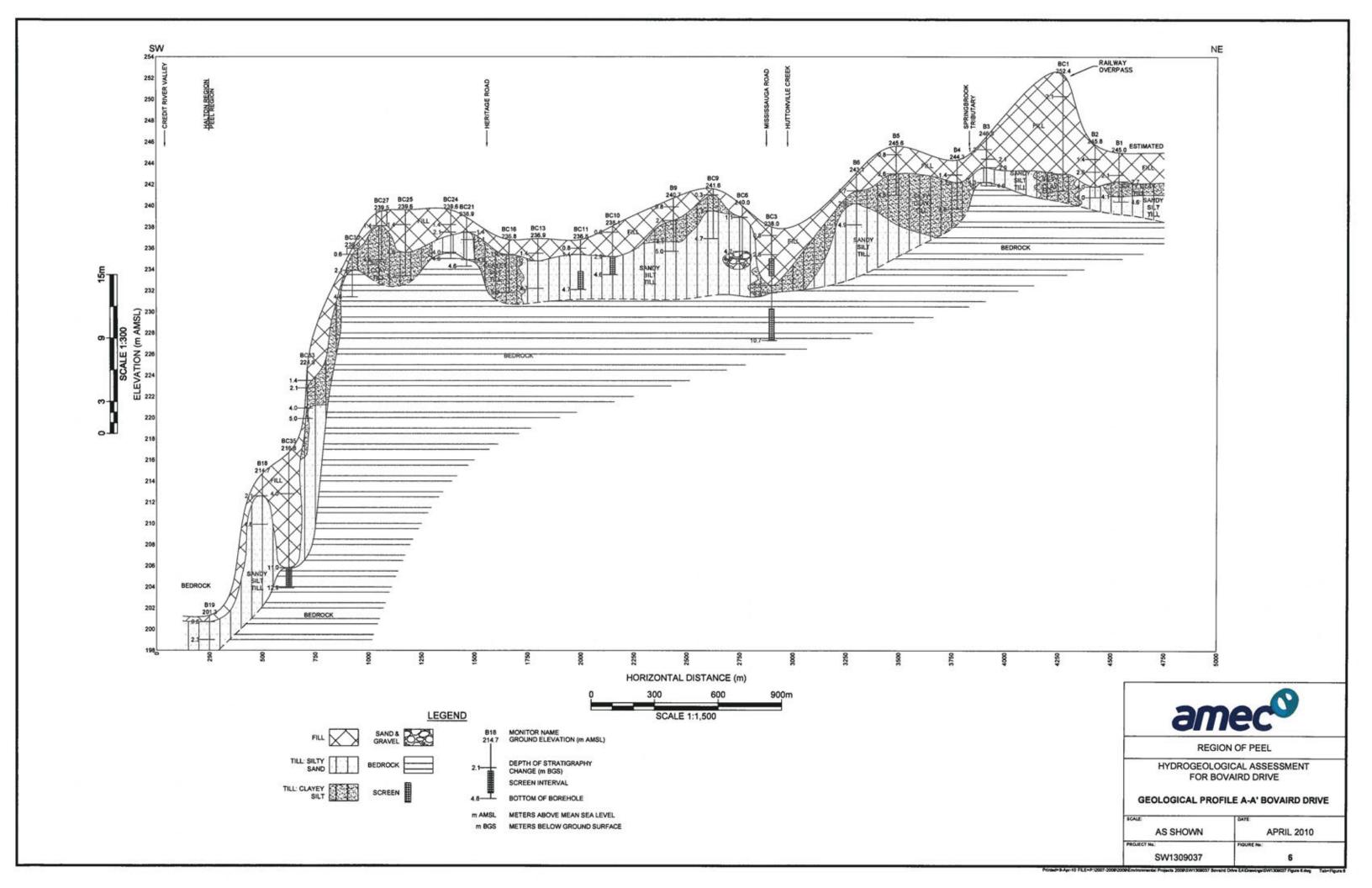


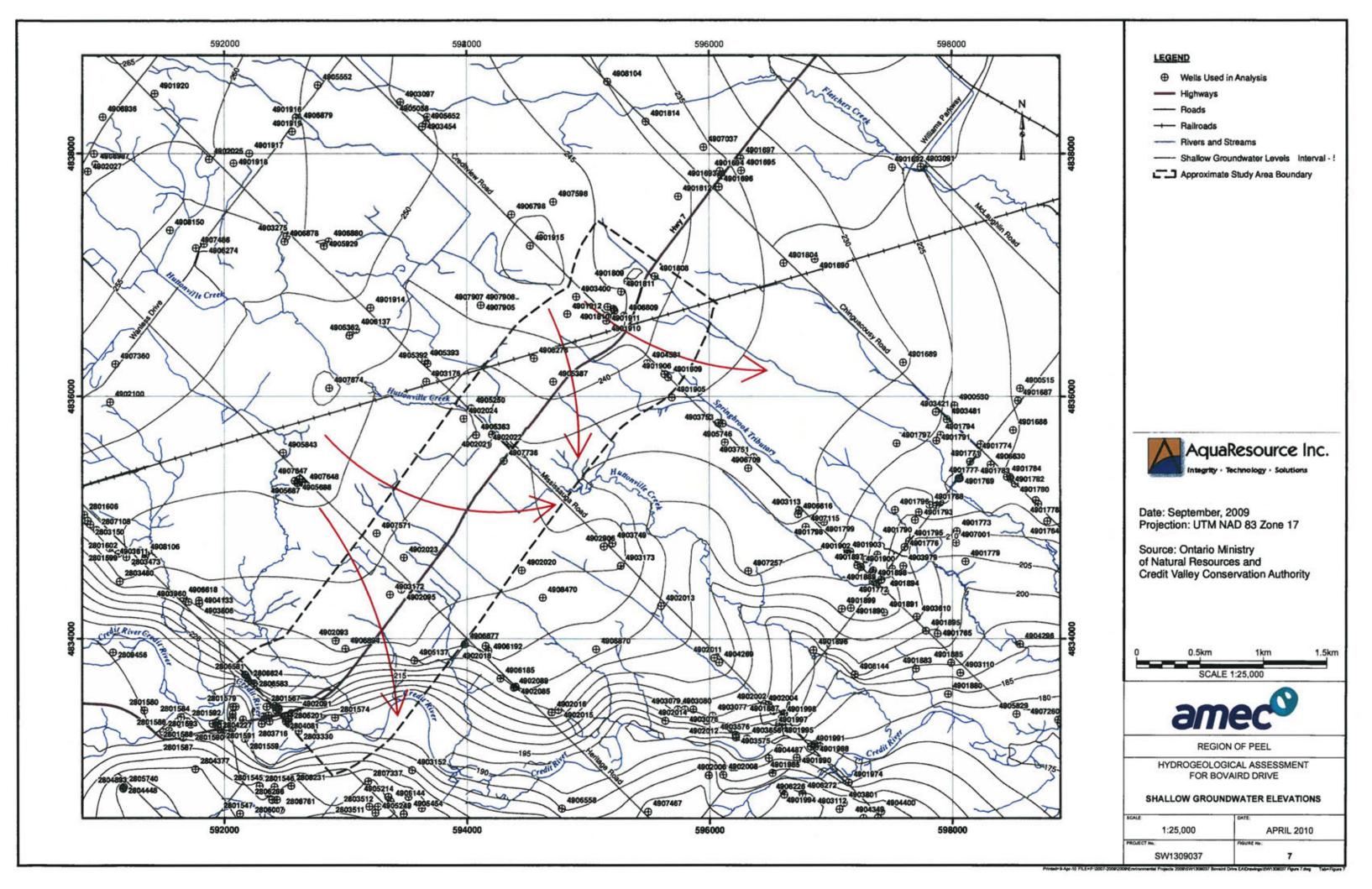


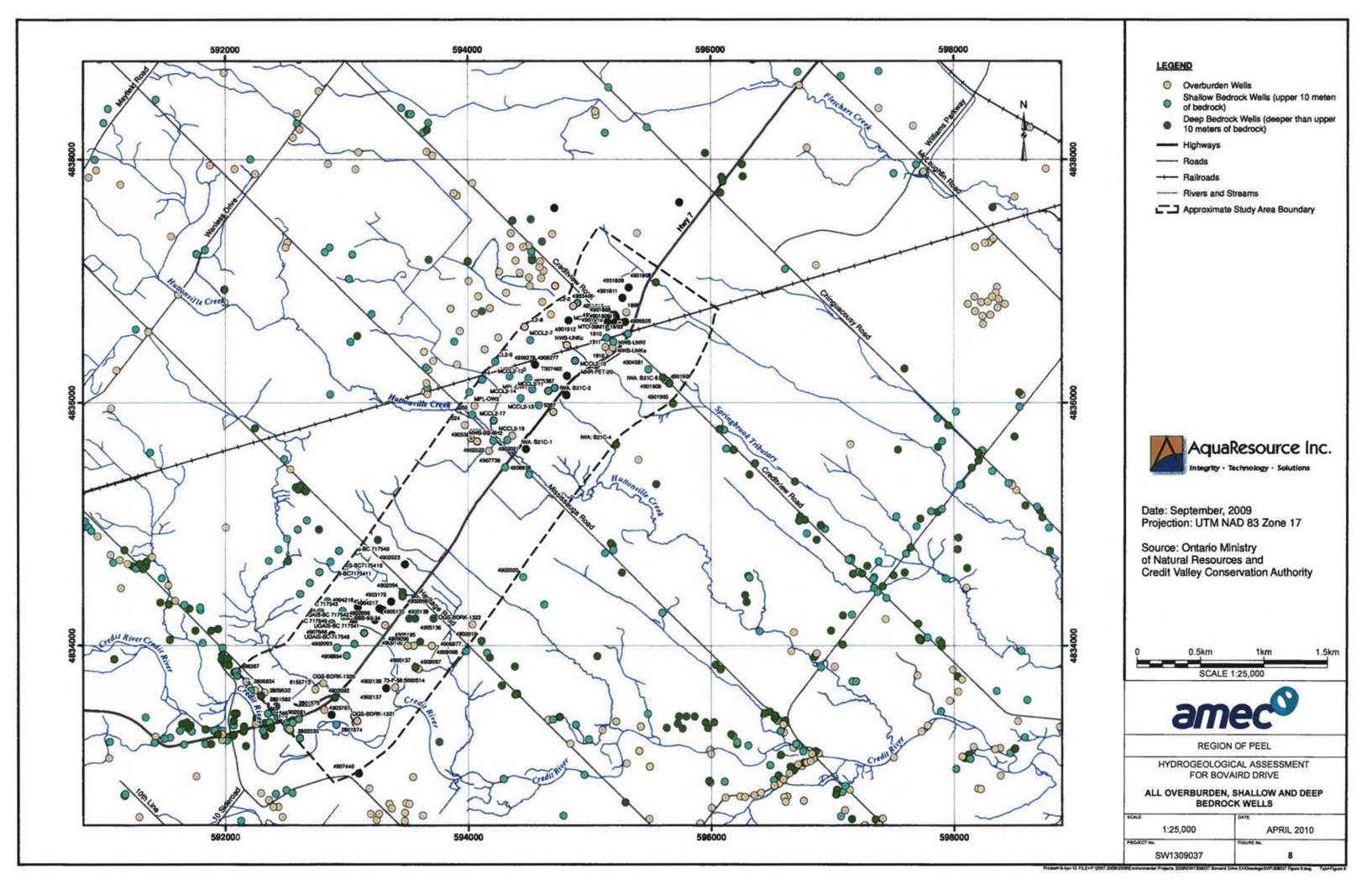


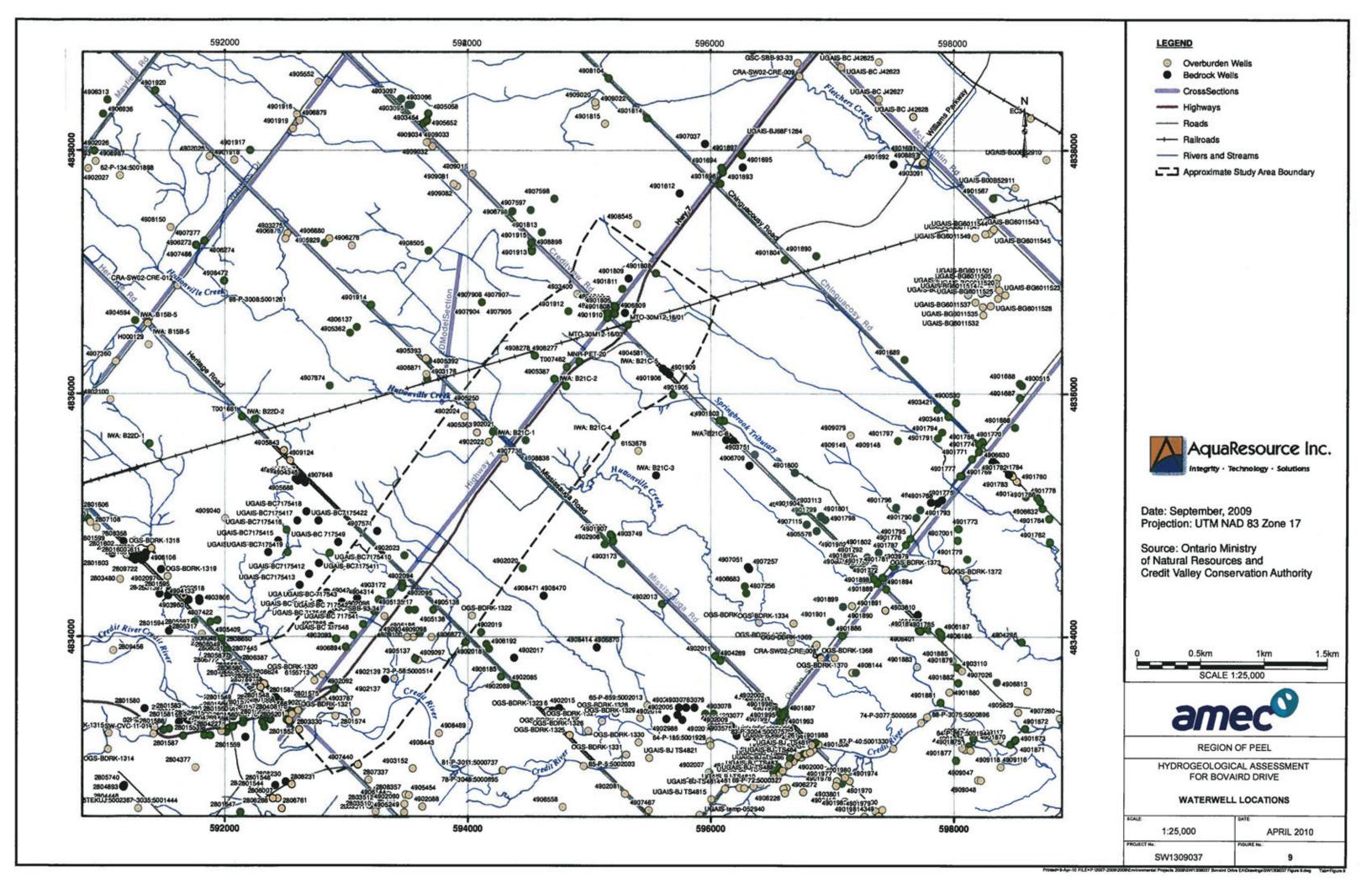


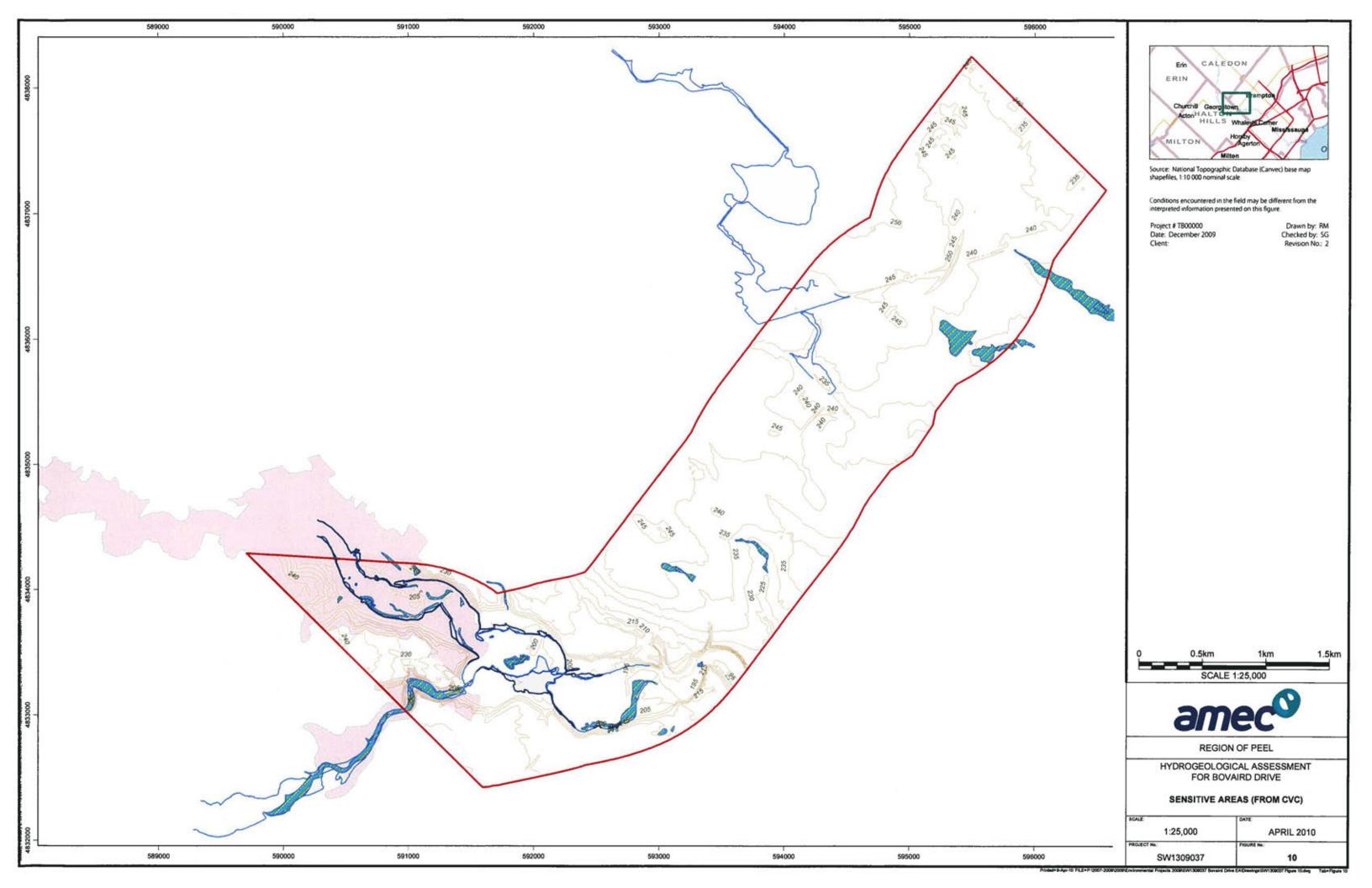














## TABLE 1 WELL COMPLETION DETAILS HYDROGEOLOGICAL ASSESSMENT BOVAIRD DRIVE WEST (HIGHWAY 7) - LAKE LOUISE DRIVE TO PEEL / HALTON BOUNDARY BRAMPTON, ONTARIO

Monitor Name	Screened Unit	Well Location along	Completion Date		(NAD 83)	Well	Top of Pipe Elevation	Stickup	Ground Elevation	Boring Depth	Well Depth	Screen Length		d Interval BGS)		ck Interval BGS)
		Bovaird Drive W.		Easting	Northing	(cm)	(m AMSL)	(cm)	(m AMSL)	(m BGS)	(m BGS)	(m)	Тор	Bottom	Тор	Bottom
BC03	SHALE	Mississauga Rd.	14-Oct-09	594 358	4 835 573	3.8	237.87	-17	238.04	10.7	10.7	3.0	7.7	10.7	7.7	10.7
BC03-W	silty CLAY fill	Mississauga Rd.	26-Oct-09	594 358	4 835 573	3.8	237.84	-20	238.04	4.6	4.6	1.6	3.0	4.6	3.0	4.6
BC04	silty SAND fill and CLAY/SILT TILL	Mississauga Rd.	14-Oct-09	594 387	4 835 579	3.8	237.79	-17	237.96	10.7	4.6	1.6	3.0	4.6	3.0	4.6
BC10	SILT & SAND TILL	Bell Tower	15-Oct-09	593 954	4 834 959	-	-		238.14	4.6	4.6	1.6	3.0	4.6	3.0	4.6
B11	CLAY & SILT TILL	West of Bell Tower	15-Oct-09	593 927	4 834 941		-		237.95	4.6	4.6	1.5	3.0	4.5	3.0	4.5
BC11	SILT & SAND TILL	Culvert West of	15-Oct-09	593 830	4 834 784	5.1	236.56	-27	236.83	4.7	4.6	1.6	3.0	4.6	3.0	4.6

217.53

76

216.77

12.9

12.9

1.6

11.3

12.9

11.3

#### NOTES:

BC35

UTM coordinates and ground elevations are from professional survey.

Remaining information is from borehole logs, except stickup and well ID, which were measured.

27-Oct-09

592 899

4 833 605

5.1

Bell Tower Culvert East of

2868

-- not available

ID - inside diameter of well

m BGS - metres below ground surface

SHALE

m AMSL - metres above mean sea level

m BTOP - metres below top of pipe

12.9

## TABLE 2 GROUNDWATER ELEVATIONS HYDROGEOLOGICAL ASSESSMENT BOVAIRD DRIVE WEST (HIGHWAY 7) - LAKE LOUISE DRIVE TO PEEL / HALTON BOUNDARY BRAMPTON, ONTARIO

Monitor	Screened	Top of Pipe	Ground	Date	Depth to G	roundwater	Groundwater
Name	Unit	Elevation (m Al	Elevation MSL)	Measured	(m BTOP)	(m BGS)	Elevation (m AMSL)
BC03	SHALE	237.87	238.04	14-Oct-09	1.63	1.80	236.24
	J			27-Jan-10	3.32	3.49	234.55
				16-Mar-10	2.20	2.37	235.67
BC03-W	silty CLAY fill	237.84	238.04	26-Oct-09	dry	dry	
				27-Jan-10	2.88	3.08	234.96
				16-Mar-10	2.68	2.88	235.16
BC04	silty SAND fill and CLAY/SILT TILL	237.79	237.96	14-Oct-09	3.03	3.20	234.76
	04o.aaa			27-Jan-10	3.37	3.54	234.42
				16-Mar-10	2.49	2.66	235.30
BC10	SILT & SAND TILL	22	238.14	15-Oct-09		4.10	234.04
				27-Jan-10	not fo	ound	
				16-Mar-10	not fo	ound	
B11	CLAY & SILT TILL		237.95	15-Oct-09	-	2.40	235.55
				27-Jan-10	not fo	ound	
				16-Mar-10	not fo	ound	
BC11	SILT & SAND TILL	236.56	236.83	15-Oct-09	3.23	3.50	233.33
				27-Jan-10	not fo	ound	
				16-Mar-10	1.06	1.33	235.50
BC35	SHALE	217.53	216.77	27-Oct-09	dry	dry	
				27-Jan-10	11.60	10.84	205.93
				16-Mar-10	11.16	10.40	206.37

#### NOTES

Groundwater depths in 2009 were mesaured after borehole completion and may not be representative.

<sup>--</sup> not available

m BGS - metres below ground surface

m AMSL - metres above mean sea level

m BTOP - metres below top of pipe

### TABLE 3 HISTORICAL GROUNDWATER CHEMISTRY HYDROGEOLOGICAL ASSESSMENT

#### BOVAIRD DRIVE WEST (HIGHWAY 7) - LOUISE DRIVE TO PEEL / HALTON BOUNDARY BRAMPTON, ONTARIO

Sample Name / Location	Stratigraphic Unit	Date Collected	Hardness	Total Dissolved Solids	Bromide	Chloride	Fluoride	Nitrate as N	Nitrite as N	Sulphate	Iron	Manganese	Sodium
		Unit	mg/i	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
		ODWS 1	80 - 100	500		250	1.5	10 (a)	1 (a)	500	0.3	0.05	200
		77.77	OG	AO		AO	MAC	MAC	MAC	AO	AO	AO	
SITE B-22d						-							a.v
B-15b-4C		25-Mar-93	320	300	< 0.08	6	0.29	< 0.2	< 0.2	11	0.015	0.015	14
B-22d-1C	Middle and Upper	25-Mar-93	250	260	< 0.08	16	0.44	6.6	< 0.2	40	0.7	0.096	38
B-22d-PL7	TILL	7-Apr-93	320	540	< 0.08	2	0.28	< 0.2	< 0.2	60	0.14	0.5	110
B-22d-PL9		7-Apr-93	280	430	< 0.08	33	0.19	4.8	< 0.2	42	< 0.01	0.17	11
SITE B-21c													
B-21c-1C		26-Mar-93	460	610	< 0.08	19	0.15	< 0.2	< 0.2	180	0.18	0.29	8.4
B-21c-2C		26-Mar-93	440	620	< 0.08	91	0.18	10	0.5	76	0.018	0.006	39
B-21c-3C	Overburden and	26-Mar-93	240	420	< 0.08	18	0.29	11	0.24	47	0.013	0.11	12
B-21c-4C	Shallow Bedrock	26-Mar-93	270	480	< 0.08	29	0.21	10	< 0.2	55	< 0.01	0.046	9.7
B-21c-5C		26-Mar-93	120	470	< 0.08	53	0.33	4.2	< 0.2	48	0.062	< 0.005	22
B-21c-6C		26-Mar-93	430	470	< 0.08	33	0.21	7.4	< 0.2	62	< 0.01	< 0.005	14
BB-BH2		28-May-08	645	1520	5.3	605	0.2	< 0.1	< 0.1	317	0.79	0.049	207
GW-2	TILL and Shallow	6-Jun-07	430	580		96	< 0.1	< 0.01	< 0.01	59	0.21	0.07	26
GW-3	Bedrock	6-Jun-07	410	493		42	< 0.1	< 0.01	0.01	30	< 0.05	0.033	21
GW-4		6-Jun-07	370	445		29	0.2	3.2	0.01	84	< 0.05	0.073	19
SITE B-21c													
B-21c-1A		26-Mar-93	2500	7900	35	2800	0.4	< 0.2	< 100	1700	< 0.01	0.25	1400
B-21c-2A		26-Mar-93	4900	2600	10	1100	0.52	1.3	< 2	310	< 0.01	0.8	2600
B-21c-4A		26-Mar-93	1700	6300	21	2100	0.4	4.4	< 2	1300	0.83	0.14	1500
B-21c-4B	Deep Bedrock	26-Mar-93	2100	10000	46	4300	0.4	10	< 2	990	< 0.01	0.21	2000
B-21c-5A		26-Mar-93	1400	19000	90	9200	0.37	< 0.2	< 2	1400	1.5	0.52	3600
B-21c-6A		26-Mar-93	530	4300	8.1	840	0.64	< 0.2	< 2	1700	0.31	0.047	550

#### NOTES:

Site B-21e South of intersection between Bovaird Drive West and Creditview Road (Golder 1993).

GW-2, -3, -4 South of intersection between Bovaird Drive West and Creditview Road (Credit Valley Conservation 2007).

Site B-22d South of intersection between Wanless Drive and Heritage Road approximately 2 km northwest of Bovaird Drive West (Golder 1993).

BB-BH2 Approximately 100 m north of intersection of Bovaird Drive West and Mississauga Road along Huttonville Creek (Blackport 2008).

'--' no criterion / not analyzed / not available

Ontario Drinking Water Standards (ODWS), Objectives and Guidelines (MOE 2003, revised June 2006).

< Less than the Method Detection Limit (MDL)

Method detection limit exceeds ODWS
 Concentration exceeds ODWS

OG Operational Guideline AO Aesthetic Objective

MAC Maximum Acceptable Concentration

IMAC Interim Maximum Acceptable Concentration

(a) Total concentration of nitrate and nitrite should not exceed 10 mg/l (as N).



**RECORD OF BOREHOLES** 

## **APPENDIX A**

# BOREHOLE LOGS AND MONITOR DETAILS

RECORD OF BOREHOLE	No.	B 0	1									ā	m	ec <sub>o</sub>
Project Number: TT93042	_			_	_	10.00	g Location:	150 m West				Logge	d by:	JF
Project Client: AMEC infrastructure Group	-						g Method:	150 mm Sc		Augering	X-2000			SN
Project Name: Geotechnical investigation to				71007	study			Truck Moun	The state of				wed by:	training of
Project Location: Bovaird Drive from Lake Lo Boundary at Caseley Drive,	Brampto	on, ON.			_	Date:	Started:	Oct 13, 09		ompleted: Oct 1	3, 09	Hevisi	on No.:	0, 2/9/10
LITHOLOGY PROFILE	S	OIL SA	AMPLI	NG	-	-		TESTING	* Rinse pt		z	co	MMENT	rs
DESCRIPTION  DESCRIPTION	Sample Type	Sample Number	Recovery (%)	r W Value	DEРТН (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact ▲ Remould	PPT • DCPT Nilcon Vane o intact • Remould	Soil Va parts per 100 2 Lower E W,	6 8 10 12  pour Reading million (ppm) 00 300 400  uplosive Limit (LEL) W W	INSTALLATION	GF	& IAIN SIZ TRIBUTI (%)	Œ
Local Ground Surface Develors 0.0 m about 170 mm ASPHALT	San	S	ě	SPT	- SE	1 2	20 40	ear Strength (kPa) 60 80	Plastic 20	Liquid 60 80	SS.	GR 5	SA S	a CL
0	2				t									
Gravelly Sand / Sand and Gravel FILL trace sat moist	ss	1	100	36			٥		a <sup>g</sup>			34 5	54 1	2
	ss	2	100	34		-1 -	o		<b>5</b>					
	ss	3	83	50/15			5	ş	<b>5</b> 9					
grey2  Clayey Silit FILL trace organics, trace rootlets	1				- 2	-2 -								
Clayery Silt FILL trace organics, trace rootlets moist  Drown SILTY CLAY / CLAYEY SILT TILL some sand to sandy trace organic	SS 7	4	100	21			0		∆ <sup>40,20</sup>					
SILTY CLAY / CLAYEY SILT TILL some sand to sandy, trace gravel very stiff moist	-		_		- 3 -	-3 -								
	SS	5	100	25	-		0		-18			6 2	4 4	4 26
Drown 4	,				-4	-4 -								
very dense moist	1							o	9					
End of Borehole 4	6 5	•	100	503				3						
104 Crockford Boulevard Scarborough, Ontario	estanding	ground	water me	easured	in oper	n boreho	le on completi	on of drilling.						
Connedo MID 2022	ile as pres otschnical d and the s	ented, do Engineer coompan	not comer. Also, bo	orehole in lanation o	horough nformeti of Borek	understa on should note Logi.	ending of all pote the read in conju	ential conditions p unction with the g	recent and rec solschnical re	puire interpretative as port for which it was	seletance from	•		cale: 1:32 ge: 1 of 1

R	ECORD (	OF BORE	HOLE N	o.	B 02	2								a	med	co
		TT93042		551100					Drilling	Location:	200 m East	of CNR Crossing Bridge		Logged		
Pro	***********	AMEC infrastruct			-		-		0.0000000000000000000000000000000000000	Method:	150 mm Sc	olid Stem Augering		Compile	d by: SN	
l		Geotechnical inv		State of the	All of the	Mark Salar	and the second	study	Drilling	g Machine:	Truck Moun			Review	ed by: PB	
Pro		Boundary at Case					on		Date 5	Started:	Oct 13, 09	_ Date Completed: Oct 1	3, 09	Revision	No.: 0, 2	/9/10
	LITHO	LOGY PROFIL	E	SC	IL SA	MPLI	NG		-	FIELD	TESTING	LAB TESTING   ♣ Rinse pH Values.	,	001	MENTS	
Lithology Plot		DESCRIPTION		Sample Type	ample Number	scovery (%)	SPT N' Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact Δ Remodel * Undramed Sh	fionTesting  PPT • DCPT  Nilcon Vane*  • Intact  • Remould  ear Strength (vPa)	2 4 6 0 10 12 Soli Vapour Reading parts per million (gong) 100 290 300 400  ▲ Lower Explorator Limit (LEL) W, W W, Plastic Liquid	INSTRUMENTATION INSTALLATION	GRA DISTR	& IN SIZE IBUTION (%)	
3	Local Ground Surfac abo	a Elevation: 0.0 m out 170 mm ASPHAL	.T	OS.	- on	Œ	S	-	1 =	20 40	60 80	20 40 60 80	22	GA SA	SI	CL
	Gravelly :	brown Sand / Sand and Gra moist		SS	1	100	40			o		o				
		trace cobbles	1.4	SS	2	100	32	-	-1 -	0		_5				
		brown Silty Sand FILL trace gravel moist	1,4	ss	3	100	23			0		<b>_</b> 10				
-		trace rooflets	-2.6 2.6	SS	4	100	10	-2	-2-	0		<u>.</u> 5				
	tra	brown Clayey Silt FILL ice sand, trace grave moist						-3	-3 -							
9				SS	5	100	13			0		.5				
• • •	SILT AN	brown and grey D SAND / SILTY SAN ace clay, trace gravel dense moist						4	4-							
0			-5.0	ss	6	100	40	- 5	-5 -	o		10				
		End of Borehole	5.0													
104	EC Earth & Environment ivision of AMEC A Crockford Boulevarborough, Ontario	mericas Limited	¥ No freest	anding	groundv	water me	asured	in oper	n boreho	le on completi	on of drilling.					
Tel Fax	arborough, Ontario nada M1R 3C3 +1(416) 751-6565 x +1(416) 751-759 w.amec.com	6	Borehole details a qualified Geote commissioned a	chnical I	Engineer.	. Also, bo	rehole in	nformeti	on should	nding of all pote the read in conj	ential conditions pr unction with the g	resent and require interpretative a sotechnical report for which it was	seistance fro	m	Scale:	:1:32 1 of 1

R	ECORD	OF BOREH	IOLE N	o. <u>!</u>	B 03	3											ame	eco
180	ject Number:	TT93042		-	-			-		Location		200 m East					Logged by:	JF
	oject Client:	AMEC infrastructs								Methox		150 mm So			gering	-		SN
	ject Name:	Geotechnical Inve			2000		N. Santa	tudy				Truck Moun					Reviewed by:	1000000
Pro	eject Location:	Bovaird Drive from Boundary at Case	n Lake Louis ley Drive, Br	e Drive ampto	n, ON.	el/Halt	on	_	Date S	Started:		Oct 13, 09	_ Date	Com	pleted: Oct	13, 09	Revision No.:	0, 2/9/10
	ЦТН	OLOGY PROFILE	E	SC	NL SA	MPLI	NG			FIE	LDT	TESTING		AB TI	ESTING	- 1	001111515	-
Lithology Plot	Local Ground Surfu	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT MTO V: Δ Intac ▲ Rem	ane*	ionTesting PPT	So A part 100	# 6 il Vapo is per mil 200 ver Explo	8 10 12 ur Reading Bon (ppm) 300 400 sive Limit (LEL) V W, Liquid 60 80	INSTRUMENTATION	GRAIN SIZ DISTRIBUT (%)	ZE
	at	out 200 mm ASPHAL	200					-		-						П		
	Gravelly	brown Sand / Sand and Grav moist		ss	1	83	34				0		م					
		grey Sitty Sand FILL trace to some clay	<del>12</del>	ss	2	67	9		-1 -	o			ъ9					
		moist		ss	3	56	12	- 2	-2 -	o			₽8					
	frace gravel	brown Clayey Silt FILL pocket of sand, trace i moist	-2.1 2.1 brick debris	ss	4	56	18			0			∆5 o¹€					
***		brown	<u>2.9</u>					F								1 1		
0 0 0		AND SAND/SILTY Sa trace clay, trace gravel very dense moist	AND	ss	5	92	50/15	- 3 - - -	-3 -		55 15	} .	<b>4</b> 8€					
о •								-4	-4 -									
111		reddish brown WEATHERED SHALE End of Borehole	-4.3 4.3	SS	6	100	50/5				55	}	.gs					
	EC Earth & Envi	ronmental	¥ No freest	apriino	ground	salar ma	age store	in one	n breeke									
104 Sca	ivision of AMEC a Crockford Boule arborough, Ontari hada M1R 3C3		Basebala del III	y				- ope	- worth					4				

	ECORD	OF BOREL	HOLE No	<b>o.</b> 1	B 04	<u>1</u>			Drillin	g Locatio	n: 5	m East	of Asi	nby Fk	eld Driv	re .		Le	am	ec	S
	ject Client:	AMEC Infrastruct	ure Group							g Method		50 mm							ompiled by:	SN	
	ject Name:	Geotechnical Inv		Bovaii	rd Driv	e Clas	EA S	tudy	-		_	ruck Mo							eviewed by		
		Bovaird Drive fro	m Lake Louis	e Drive	to Pe	eVHalt				Started:		ct 13, 09	77		mplete	d: Oct 1	3, 09		evision No.:		V10
_	LITH	Boundary at Case OLOGY PROFIL		_		MPLI	NG.		_	FIE	DTE	STING	_	LAR	TEST	ING		-		_	_
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	'N' Value	ОЕРТН (m)	EVATION (m)	Pen O SPT MTO Va ∆ Intact ▲ Remo	netration	Testing  F • DC  Illicon Vani Intact Remould  Strength (kP)	PT A	Soil Var parts per 100 20		10 12 ading pm) 400	INSTRUMENTATION		COMMEI & GRAIN S XSTRIBU (%)	IZE	
3	Local Ground Surfs ab	ce Develor: 0.0 m out 220 mm ASPHAL	Ť	Sa	Sa	P.	SPT	8	==	20	40		+	20 4	0 60	80	22	GR	SA	SI	a
		brown Sand / Sand and Gra moist	<del>0.2</del>	SS	1	100	57				(	>	٥								
		trace asphalt debris	<u>-14</u>	ss	2	100	65	1	-1 -			o	o								
	trace sand,	trace gravel, trace org rootlets moist		ss	3	100	38	-2	-2 -		0		٥								
	ti	reddish brown CLAYEY SILT TILL race sand, trace grave hard moist		ss	4	100	71					0	5								
		trace cobbles		ss	5	100	50/15	- 3 - 3	-3 -		580 15										
								-4	4-												
	\	pieces of shale End of Borehole	4.6 4.6	-99	•		50/1				58										
A di 104	EC Earth & Envi vision of AMEC a Crockford Boule rborough, Ontari	Americas Limited ward	¥ No freest	anding	groundw	vater me	asured	in ope	n boreho	ole on com	pletion	of drilling.							11111, 6400	2222	
Tel - Fax	ada M1R 3C3 +1(416) 751-656 +1(416) 751-75 v.amec.com	5	Borehole details a qualified Geote commissioned an	chnical B	ingineer.	Also, bo	rehole in	formati	ion should	t be reed in	potentia	condition on with the	present geoteci	and req	uire inter port for w	pretative a hich it was	selstance fro	-	P	Scale: 'age: 1	

	ECORD (	OF BOREHOLE	No.	Ē	3 05	<u> </u>			Drillin	g Location:	250 m West	of Ashby	Field Drive		an Logged by:	ec <sub>®</sub>
Pro	ject Cllent:	AMEC Infrastructure Grou	ф						Drillin	g Method:	150 mm Sc	olid Stem	Augering		Compiled by:	SN
Pro	ject Name:	Geotechnical investigation	n for Bo	ovain	d Driv	e Clas	B EAS	Study	Drillin	g Machine:	Truck Moun	nted Drilli			Reviewed by:	РВ
Pro	ject Location:	Bovaird Drive from Lake L Boundary at Caseley Drive	ouise I	Orive	to Pe	el/Halt	ton		Date	Started:	Oct 14, 09	_ Date C	ompleted: Oct 1	4, 09	Revision No.:	0, 2/9/10
		LOGY PROFILE				MPLI	NG			FIELD	TESTING		TESTING			
Lithology Plot	1	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SPT □ MfTO Vane* Δ Intact ▲ Remould	ppT • DCPT  Nilcon Varie*  o Intact Remould	Soil Va A parts pe 100 2	H Values 6 8 10 12 apour Reading r million (ppm) 200 300 400 apoisse Limit (LEL) W U Liquid	INSTRUMENTATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE ION
5	Local Ground Surfac abo	e Elevation: Q.0 m out 220 mm ASPHALT	-	Sa	S	8	S	-	<u> </u>	20 40			40 60 80	22	GR SA	SI CL
	Gravelly S	brown land / Sand and Gravel FILL moist	0.2	ss	1	100	37					<b>.</b> 3				
		- brown	-1.4	ss	2	89	38		-1 -			<b>3</b>				
	trace clay	Sitty Send FILL, trace gravel, trace organics moist		ss	3	100	28	- 2	-2 -			Δ7922				
		reddish brown CLAYEY SILT TILL ce sand, frace gravel hard	-2.6 2.6	SS	4	100	35			0		∆1Q14				
	tr	moist ace shale fragments	s	3S	5	100	85/23	- -3 - -	-3 -		85, 23	0 <sub>0</sub> 10				
			-4.6		6	100	508	-4	4-		8	0,10				
		End of Borehole	4.6	55	6	100	50/8				8					
A di 104	EC Earth & Environ vision of AMEC Ar Crockford Boulev rborough, Ontario ada M1R 3C3	mericas Limited = NOT	freestand	ting g	roundw	vater me	easured	in ope	n boreh	ole on completi	on of drilling.					

Borshole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative as a qualified Geotechnical Engineer. Also, borshole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borshole Logi.

Scale: 1:32

	ECORD OF I	BOREHOLE N	lo.	B 0	<u>6</u>			Drillin	g Location:	450 m East	of Mississ	auga Road		Logged		<u>د</u> ي
Pr	oject Client: AMEC	infrastructure Group	-50000					Drillin	g Method:	150 mm Sc	oild Stem A	ugering		Compile	ed by: SN	
Pr	oject Name: Geote	chnical investigation for	r Bova	ird Driv	ve Clas	s EAS	tudy	Drillin	g Machine:	Truck Moun	ted Drill			Review	ed by: PB	
Pr	oject Location: Bovair	rd Drive from Lake Lou lary at Caseley Drive, E	se Driv	n ON	<b>wel/Hatt</b>	ton		Date	Started:	Oct 14, 09	_ Date Co	empleted: Oct 1	4, 09	Revisio	n No.: 0, 2	9/10
	LITHOLOG		_	OIL SA		NG			FIELD	TESTING		TESTING				- 8
Lithology Plot		RIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact ▲ Remould	tionTesting  PPT	Soil Va A perta per 100 2 A Lower E W, Pastic	Values 6 8 10 12 pour Reading million (ppm) 20 300 400 plosive Limit (LEL) W W. Liquid 0 60 80	INSTRUMENTATION INSTALLATION	GRA	MMENTS & AIN SIZE RIBUTION (%)	α
	Local Ground Surface Elevative about 235	mm ASPHALT	1	1	_	0,	-									
	Gravelly Sand / 5 tra r	rown -0.2 0.3 Sand and Gravel FILL coe sift	ss	1	100	46				0	م					
	Sandy trace clay, trace of	n to grey 0.1 y SIH FILL gravel, trace organics noist	ss	2	83	29	-	-1 -	0		a <sup>0</sup> o <sup>14</sup>					
	SILTY CLAY / 6 trace sand	rown 1.  CLAYEY SILT TILL d, trace gravel hard		3	89	38	-2	-2 -			∆ <sup>30</sup> 2					
			ss	4	100	40					∆ <sup>35</sup> ,19					
0	SILT AND SAND trace clay ven	-2 7/ SILTY SAND TILL , trace gravel y dense st to wet	ss	5	100	68	- 3 -	-3 -		0	∆ <sup>25</sup> 5 <sup>18</sup>					
9 9 9							-4	4-								
9		Borehole 4.		6	100	50/13		7	5	<b>3</b>	0 620					
	EC Earth & Environment		water de	pth on c	ompletic	on of drill	ling on	10/14/2	009 at a depth	of: 49m.						
104 Sci	Crockford Boulevard arborough, Ontario															
Tel Fax	nada MŤR 3C3 +1(416) 751-6565 x+1(416) 751-7592 w.amec.com	Borehole detai a qualified Geo commissioned	is as pres technical and the a	ented, do Engineer ccompan	not cons . Also, bo ying Expl	titute a tr prehole in lanation o	formation Borel	underst on shoul ole Log'.	anding of all pote d be read in conj	ential conditions p unction with the g	resent and rug sotschnical re	uire interpretative as port for which it was	saletance fro	om	Scale: Page:	1:32 1 of 1

		OF BORE	HOLE No	<b>o.</b> <u>!</u>	B 07	<u> </u>			Delline		ation	•	Fast s	4 11	-1	0	4			ć	900	ec	0
	ject Number: ject Client:	AMEC infrastruct	hum Group						Drilling				m Easto 0 mm S							Logge		SN	
	ject Client: ject Name:	Geotechnical inv		Rounis	nd Delu	a Clas	. EAS	tucke					ck Mour			ugen	ng				iled by: wed by:		
	ject I varrie.	Boyaird Drive fro						nuuy	Date S				14, 09			mnlat	ad: Oct	14, 09			ion No.:		2/10
- 10		Boundary at Case	eley Drive, Bra	amptor	n, ON.			_	T					_				T	_	110413		<u>0, 2,</u>	
Lithology Plot	LIN.	DESCRIPTION	E	Sample Type	Sample Number	Recovery (%)	N. Value	(m)	ELEVATION (m)	O SP	Penetro PT   Vane'	ationTo	DCP1 con Vane*	* A	Soil Va arts per 00 2	Values 6 8 pour R million ( 0 30 plostive I	10 12 eading ppm) 0 400 Limit (LEL)	INSTRUMENTATION		GI	MMEI & RAIN S TRIBU (%)	IZE	
tholog				атре	ample	9000	SPT %	DEPTH	LEVA	* Undr		hear Str	Remould ength (kPa)		lastic .	-	Liquid	STAL	GF		( / <b>0)</b> SA	Si	CL
	Local Ground Surfa	ce Elevation: 0.0 m bout 80 mm ASPHAL	T	o)	(i)	Œ	Ø.	-	<u> </u>	-	20 40	0 60	80	+	20 4	0 60	80	122	Gr	-	30	31	
	Gravelly	brown Sand / Sand and Gra some sitt moist																					
		brown		SS	1	83	18	Ė	-					1									
	some sand to	CLAYEY SILT TILL sandy, trace gravel, tr stiff moist	race oxidation	ss	2	89	15	-,	-1-	0				5.	-				,		21	49	29
		brown ID SAND / SILTY SAN race clay, trace gravel very dense moist												ļ									
		mosa		SS	3	100	69	- 2	-2-				0	A <sup>10</sup>									
		ace cobbles / boulder	80						0	0													
0								- - - 3	-3-					ļ									
				ss	5	100	54/15					54 15		5									
0								-						ļ									
								-4	4-					ļ									
SS 6 100 50/15												50.		0									
Φ1.		End of Borehole	-4.7 4.7	55	6	100	50/15	-		-	H	50 15	-	1				+	1				
A di 104	Crockford Boule	Americas Limited vard	¥ No freesta	anding (	groundw	rater me	easured	in open	boreho	ele on o	comple	tion of	drilling.	_					_				
Tel Fax	rborough, Ontari hada M1R 3C3 +1(416) 751-656 : +1(416) 751-75 w.amec.com	5	Borehole details a qualified Geote commissioned ar	as press chrical E nd the ac	nted, do Englineer. company	not cons Also, bo /ing/Expl	titute a ti rehole in anation o	horough Mormatio of Boreix	understa on should ole Log'.	inding o	of all po	tential o junctio	onditions on with the o	present protects	and req nical re	uire inte port for	erpretative which it w	assistance no	from		P	Scale:	

l	ECORD OF E	BOREHOLE N	о.	B 09	9			Drilling	Location:	25 m East of	f Driveway	y #2055 (Pro Go	ıŋ	am Logged by:	ec®
		infrastructure Group							Method:	150 mm So				Compiled by:	SN
Pro	ject Name: Geotec	hnical investigation for	Bovai	rd Driv	re Clas	s EAS	tudy	Drilling	Machine:	Truck Moun	ted Drill			_ Reviewed by:	РВ
Pro	ject Location: Bovalre	d Drive from Lake Louis	e Driv	e to Pe	el/Halt	on		Date S	Started:	Oct 15, 09	_ Date C	ompleted: Oct 1	5, 09	Revision No.:	0, 2/9/10
$\vdash$	LITHOLOGY	ary at Caseley Drive, Br PROFILE			MPLI	NG	Г	Т	FIELD	TESTING	LAB	TESTING			
Lithology Plot		RIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION (m)	O SPT □ MTO Varie* Δ Intact Δ Remould * Undrained Sh	tionTesting PPT   DCPT Nilcon Vane* O Intact Remould per Strength (kPs)	Soil Va A parts per 100 2 A Lower E W, Plastic	H Values 6 8 10 12 apour Reading rimition (ppm) 200 300 400 applicative Limit (LEL) W W, Liquid	INSTRUMENTATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE
		n: 0.0 m rown Gravel FILL	05	55	-	- os	-	<u> </u>	20 40	80 80	20	40 60 80	==		
	m	-0.8	ss	1	78	22			0		0			35 46	19
	trace sand, t	rey 0.8 Itay FILL trace organics noist	ss	2	100	18	- 1	-1-	o		Δ <sup>25</sup>				
	trace	rootiets	ss	3	100	21		-2 -	o		Δ <sup>35</sup>				
	CLAYEY trace sand, h	rown 2.1  SILT TILL  , trace gravel sard soist	ss	4	100	31			0		L <sup>10</sup>				
			ss	5	100	32	-3	-3 -	o		o				
	SILT AND SAND trace very	-4.1 / SILTY SAND TILL dense wet					4	4							
•	End of	-5.0 Borehole 5.0	ss	6	100	58	- 5	-5		0	o				
A di 104 Sca	EC Earth & Environmenta vision of AMEC Americas I Crockford Boulevard rborough, Ontario lada M1R 3C3	Limited = Groundw							009 at a depth			quine interpretative ex		<del></del>	

R	ECORD	OF BOREH	OLE N	o. <u> </u>	B 10	2														ar	ne	ഹ
Pro	ject Number:	TT93042							Drilling	Location:	32	0 m Wes	t of D	rivew	ay #20	055				ogged by	: <u>JF</u>	
Pro	ject Client:	AMEC infrastructu	ire Group						Drilling	Method:	15	0 mm S	oild S	item .	Auger	ing			0	ompiled	by: SN	
	ject Name:	Geotechnical Inve						tudy	Drilling	Machine:	Tr	ick Mou							R	eviewed	by: PE	
Pro	ject Location:	Boundary at Case	n Lake Louis ley Drive, Br	e Drive ampto	to Pe	el/Halt	on		Date S	started:	<u>0</u>	t 15, 09	D	ate C	omple	ted: Oct	15, 09	9	R	evision N	lo.: <u>0,</u>	2/9/10
_	шн	OLOGY PROFILE		so		MPLI	NG		(iii)			esting	3	Rinse p	f Values 6 β	10 12 leading (ppm)	ATION	z		COMM	k	
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	T 'N' Value	DEPTH (m)	ELEVATION	MTO Vane Δ Intact ▲ Remould * Undrained S	÷	con Vane' Intact Remould	-	Lower E W <sub>p</sub>	100 ax	Umit (LEL)	TRUMENT	INSTALLATION	-	GRAIN DISTRIE (°)	BUTTO	١
\$	Local Ground Surfa	ce Elevation: 0.0 m brown		Sa	Sar	B.	SPT	DE	3			0 80		Plastic 20	40 6	Liquid 0 80	- S	S.	GR	SA	SI	CL.
		Sand and Gravel FILL trace to some silt moist		ss	1	83	34			0			08									
•		brown  BAND / SILT AND SANI race clay, trace gravel very dense	— — <u>0.8</u> 0.8 D TILL	ss	2	100	70	-	-1-			0	08						9	36	49	6
•				SS	3	100	50/15				50 15		08									
0		reddish brown		ss	4	100	50/15	- 2	-2 -		59 15		08									
,																						
		brown		SS	5	100	50/13	- 3	-3 -		50 13		07									
9																						
								-4	4-													
9	tr	ace cobbles / boulders wet	-4.6	SS	Б	100	50/5	- \frac{1}{2}	? -		58											
		End of Borehole	4.6								5											
A di 104 Sca	EC Earth & Environment Vision of AMEC / Crockford Boule intorough, Ontari ada M1R 3C3	Americas Limited ward	⊈ Groundwa	ater dep	th on co	ompletio	n of drill	ing on :	10/15/20	09 at a dept	th of:	4.4 m.		:		- 1						

		OF BORE	HOLE N	o.   !	B 11	<u>1</u>													ar	ne	5C_	9
Pro	ject Number:	TT93042				-		_		g Location	· <u>54</u>	00 m East	of Driv	eway #2	2472	_		— ı	ogged by	r: :	JF	_
Pro	ject Client:	AMEC Infrastruc			_					g Method:	_	50 mm Sc	lid Ste	m Auge	ering			— (	Compiled	by:	SN	_
Pro	ject Name:	Geotechnical Inv	restigation for	Boval	rd Driv	e Clas	8 EAS	tudy	Drilling	g Machine	: <u>T</u>	ruck Moun	ted Dr	111			3:554	— F	Reviewed	by:	PB	_
Pro	ject Location:	Boundary at Cas	m Lake Louis	e Drive	n, ON.	eVHalt	on		Date :	Started:	0	ct 15, 09	_ Dat	e Compi	leted: Oc	t 15,	09	_ F	Revision N	lo.:	0, 2/9/10	_
	ЦТН	OLOGY PROFIL				MPLI	NG			FIEL	D TE	STING		AB TE		T						
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SPT MTO Van Δ Intact ▲ Remou	e" N old •	Testing  T   DCPT  Blicon Vane*  Intact Remould  Strength (kPa)  60   80	Sc A par 100 A Lov W,	er Explosit W	Reading (Spm) (Spm	3	INSTRUMENTATION	GR	GRAIN DISTRIE	K N SIZ BUTH	E ON	α
		grey Sand and Gravel FILI ome silt, trace organic moist	L 25	ss	1	100	12			0			ao <sup>®</sup>			9.6.6						
		trace clay some cobbles		SS	2	100	18	-,	-1 -	0			ΔÄ <sup>RH</sup>									
	trace sar	grey Sitty Clay FILL ad, trace gravel, trace moist		SS	3	100	9			0			۵ <sup>15</sup> ۵	5								
		brown						- 2 - -	-2 -									Bentoni	te: 0.3 m -	3.0 m		
				ss	4	100	7		Z :	0			5	o <sup>29</sup>								
		reddish brown CLAY / CLAYEY SIL race gravel, trace sha hard damp		ss	5	100	71	- 3 -	-3 -			o	181م									
								- 4	4-									Slotted	pipe and sa	and: 3.	0 m - 4.5	im
		End of Borehole	-4.6 4.6	SS	6	100	50/8				50		.9									
A di 104	EC Earth & Envi vision of AMEC / Crockford Boule rborough, Ontari	Americas Limited vard	⊈ Groundwa	ater dep	oth on co	ompletio	n of drill	ng on	10/15/20	009 at a dep	oth of:	2.4 m										
Can Tel- Fax	ada M1R 3C3 +1(416) 751-656 +1(416) 751-75 v.amec.com	5	Borshole details a qualified Geote commissioned ar	ns press chrical E nd the ac	nted, do Ingineer. company	not cone Also, bo ying Expl	titute a th rehole in anation o	orough formetik f Boreh	understa on should ole Log'.	nding of all p	otentia onjunct	conditions pation with the gr	resent an rotechnic	d require i al report i	nterpretativ or which it s	o senie	tance	from			ale: 1 ::	

RECORD OF BO	REHOLE N	о.	B 12	2								amec®
Project Number: TT93042							Drilling	Location:	250 m East of	of Driveway #2472		Logged by: JF
Project Client: AMEC Infra	structure Group						Drilling	Method:	150 mm So	ild Stem Augering		Compiled by: SN
Project Name: Geotechnic	al Investigation for	Bovai	rd Driv	e Clas	s EAS	tudy	Drilling	Machine:	Truck Moun	ted Drill		Reviewed by: PB
Project Location: Boundary	ve from Lake Louis t Caseley Drive, Br	e Driv	e to Pe	el/Halt	on		Date S	Started:	Oct 15, 09	Date Completed: Oct 1	5, 09	Revision No.: 0, 2/9/10
LITHOLOGY PR			IL SA		NG			FIELD	TESTING	LAB TESTING		
DESCRIPT		Sample Type	Sample Number	Recovery (%)	SPT N Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact Δ Remould * Undrained St	<ul> <li>Intact</li> </ul>	# Rinee pri Values 2 4 6 8 10 12 Soil Vapour Reading A parts per milition (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL) W, W W, B=	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
brown Sand and Grav trace sit moist		ss	1	100	19			0		,Q9		
grey Silty Ctay F trace sand, trace moist		ss	2	100	16		-1-	o		40 ol5		
						,						
SILT AND SANO/ SILT face clay, trace dense to very moist	gravel	SS	3	100	19	- 2	Z .	o		A <sup>10</sup> o <sup>18</sup>		
		ss	4	100	48				0	∆&2		
trace yellow :	tains	ss	5	100	64	-3	-3 -		o	<sub>Δ</sub> ϑ1		
						-4	4-					
grey	-4.9 hole 4.9	ss	6	100	50/15				59. 15	۵853		
Ena of Sore	and 4.9											
AMEC Earth & Environmental A division of AMEC Americas Limit 104 Crockford Boulevard Scarborough, Ontario Canada M1R 3C3	" <u>                                     </u>								n of: <u>1.7 m</u> .	resent and require interpretative a	ulatere t	T

a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log.

Scale: 1:32

		OF BORE	HOLE N	o. <u> </u>	B 15	5			D. W.		400 W				am	eco
	ject Number: ject Client:	TT93042  AMEC Infrastruct	tura Group	-						Location: Method:	150 mm So				Logged by:	SN
		Geotechnical Inv		Bouel	ed Deba	n Class	e EA S	turk.			Truck Mount		genng		Compiled by: Reviewed by:	
	ject Name: ject Location:							tuuy		tarted:	Oct 28, 09		mpleted: Oct 2	9.00	Revision No.:	
PIO		Boundary at Cas	eley Drive, Br	ampto	n, ON.				Dates					0,09	nevision No.:	0, 2/9/10
Lithology Plot	шн	DESCRIPTION	E	Sample Type	Sample Number	Hecovery (%)	SPT 'N' Value	<b>DEPTH (m)</b>	ELEVATION (m)	Penetra O SPT □ MTO Vane* Δ Intact ▲ Remould	♦ Intact • Remould	A Rinse pH1 2 4 6 Soil Vap 4 parts per r 100 200 A Lower Exp W,	9 8 10 12 our Reading nation (ppm) 0 390 490 losive Limit (LEL) W W,	INSTRUMENTATION INSTALLATION	COMMEN & GRAIN S DISTRIBU (%)	IZE
Ś	Local Ground Surts	ce Elevation: 0.0 m brown		Sar	Sar	æ	SP	- SE	] ]	20 40	ear Strength (kPa) 60 80	Plastic 20 40	Liquid 60 80	SS G	SA.	SI CL
	,	Sand and Gravel FILL trace to some sit moist	•	ss	1	71	31			0		s <sup>30</sup>				
	b	reddish brown Clayey Silt FILL race sand, trace grave moist	— — —- <u>0.9</u> N	ss	2	100	16	- 1	-1-	o		∆5-10				
	trace	to some asphaltic con	ncrete	ss	3	83	25	-2	-2 -	o		∆ <sup>5</sup> o <sup>16</sup>				
				ss	4	33	30			0		o <sup>a</sup>				
		brown Sand and Gravel FILL trace sit, trace clay moist		ss	5	100	16	3	-3	o		<b>∆</b> 1811				
		grey Silty Clay FILL trace to some sand moist						4	4-							
917	 SILTY	reddish brown CLAY / CLAYEY SIL trace sand hard		SS	6	100	70	-	-5 -		0	∆ <sup>5</sup> o <sup>16</sup>				
		moist End of Borehole														
A di 104	EC Earth & Envi vision of AMEC a Crockford Boule rborough, Ontari	Americas Limited ward	¥ No freest	anding (	groundw	vater me	asured	in oper	n boreho	ie on completi	on of drilling.					
Can Tel - Fax	ada M1R 3C3 +1(416) 751-656 +1(416) 751-75 v.amec.com	5	Borehole details a qualified Geote commissioned as	chnical B	ngineer.	Aleo, bo	rehole in	formatic	on should	nding of all pote be read in confi	ential conditions pr unction with the ge	resent and requi totachnical repo	ire interpretative as ort for which it was	elatance from		Scale: 1:32 age: 1 of 1

Pro Pro	ject Number: ject Client: ject Name:	AMEC Infrastruct Geotechnical Inve	ture Group estigation for	Boval	rd Driv	e Clas		tudy	Drilling			m West o	lid Stem ted Drili	Augerin	9	7.00	_ c	ogged by: compiled by: eviewed by:	JF SN PB	
Pro	ject Location:	Bovaird Drive fro Boundary at Case	eley Drive, Bra	ampto	n, ON.				Date	Started:		t 27, 09			ed: Oct 2	7,09	·H	evision No.:	0, 2/9	V10
Lithology Plot	Local Ground Surfi	DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION  DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT W Value	DEPTH (m)	ELEVATION (m)	Penet O SPT ( MTO Vario Δ Intact ▲ Remoult * Undrained:	PPT O	Festing  DCPT  Icon Vane* Infact Remould  trength (I/Ps) 0 80	A Rines p 2 4 Soil V. A parts p 100 Lower B W, Plastic	H Values 6 8 apour Re ir million (p 200 300 Explosive L W	10 12 rading pm) 400 imit (LEL) W,	INSTRUMENTATION	GR.	COMMEN & GRAIN S DISTRIBU (%)	ZE	a
	,	brown Sand and Gravel FILL trace to some silt moist	-0.1	ss	1	100	25			o			o <sup>6</sup>				33	51	16	
		some gravel to gravelly	,	ss	2	78	22	-1	-1 <del>-</del>	0			o <sup>7</sup>							
			-2.1	SS	3	100	50/15	- 2	-2 -		500 15		o <sup>4</sup>							
		brown ND SAND / SILTY SAN trace clay, trace cobbl very dense moist		ss	4	100	52/15				530 15		.o <sup>6</sup>							
				SS	5	100	50/15	- - 3 - - -	-3 <del>-</del>		590 15		o <sup>10</sup>							
				SS	6	100	50/8	4	4-		50°		<sub>6</sub> 20							
A I	Auger refusal	End of Borehole on possible boulder a	-4.8 4.8 t 4.8 m depth.								8									
A di 104 Sca	EC Earth & Envi vision of AMEC : Crockford Boule rborough, Ontari hada M1R 3C3	Americas Limited ward	¥ No freesta																	
Tel Fax	+1(416) 751-656 +1(416) 751-75 warnec.com		Borehole details a qualified Geoter commissioned ar	on prese chrical E nd the ac	nted, do i Ingineer. compeny	Also, bo ring/Expl	utute a th rehole in anation o	formetic f Boreh	understa on should ole Log'.	ending of all p the read in co	otential	conditions pr on with the ge	recent and re rotechnical r	eport for t	rpretative a which it was	seistance from		- 1	Scale: 1 age: 1	

R	ECORD	OF BOREHOLE N	o.	B 19	9								ame	<b>c</b> ⊗
Pro	oject Number:	TT93042						Drilling	Location:	20 m East o	f Caseley Drive		Logged by: JF	
Pro	oject Cllent:	AMEC Infrastructure Group						Drilling	Method:	150 mm Sc	olid Stem Augering		Complied by: SN	
Pro	oject Name:	Geotechnical investigation for	Bovai	rd Driv	e Clas	8 EAS	tudy	Drilling	Machine:	Truck Moun	ited Drilli		Reviewed by: PE	
Pre	oject Location:	Boundary at Caseley Drive, Br	e Driv	e to Pe	el/Halt	on		Date S	started:	Oct 27, 09	Date Completed: Oct 2	7, 09	Revision No.: 0,	2/9/10
	LITH	OLOGY PROFILE		NL SA					FIELD	TESTING	LAB TESTING			
Lithology Plot	Local Ground Surfs	DESCRIPTION  co Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT N' Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane' Δ Intact Δ Remould ' Undrained St	<ul> <li>Intact</li> </ul>	★ Pirree pH Values  2 4 6 8 10 12  Soil Vapour Reading  Δ parts per mileon (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL)  W <sub>r</sub> W  W <sub>r</sub> Plustic  20 40 60 80	INSTALLATION	GRAIN SIZE DISTRIBUTION (%)	<b>N</b>
	,	brown sand and Gravel FILL some sitt moist	ss	1	100	25			o		o <sup>4</sup>			
•	.] s	reddish brown 0.6  D SAND / SILTY SAND TILL ome grawel, trace clay ompact to very dense moist	ss	2	100	14		1 - 1	o		o <sup>14</sup>			
0	tr	ace cobbles / boulders	ss	3	100	50/15	- 2			50 15	o <sup>11</sup>			
0		-23	SS	4	100	50/5	- 1			58				
		End of Borehole 2.3								5				
	Auger refusal	on possible boulder at 2.3 m depth.												
104	IEC Earth & Envir fivision of AMEC A 4 Crockford Boule arborough, Ontari	vard = 140 meest	anding	groundw	rater me	asured	in open	boreho	e on complet	tion of drilling.				

AMIC Earth & Environmental
Advision of AMEC Americas Limited
104 Crockford Boulevard
Scarborough, Ontario
Canada M1R 3C3
Tel +1(416) 751-6565
Fax +1(416) 751-7592
www.amec.com

	ECORD ect Number:	OF BOREH	OLE N	o.	BC (	<u>01</u>			Drilling	Location:	15 m l	East of	CNR Cross	ing Bridge		Logged by:	ne(	3
Pro	ect Client:	AMEC Infrastructu	ire Group	0	<u></u>				Drilling	Method:	150 m	nm Sol	ld Stem Aug	ering		Complied b	: SN	
Pro	ect Name:	Geotechnical Inve	stigation for	Bovai	rd Driv	e Clas	s EAS	tudy	Drilling	Machine:	Truck	Mount	ed Drill			Reviewed b	y: PB	
Pro	ect Location:	Bovaird Drive from	n Lake Louis	e Drive	to Pe	el/Halt	on		Date S	Started:	Oct 13	3, 09	Date Comp	oleted: Oct 1	3, 09	Revision No	.: 0, 2	9/10
_	ЦТН	Boundary at Case OLOGY PROFILE	ley Drive, Bri		NL SA		NG		T	FIELD	TESTI	NG T	LAB TE	STING	Т			
Lithology Plot	Local Ground Surfi	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION (m)	Penet O SPT [ MTO Vane Δ Intact Δ Remouk ' Undrained:	PPT • Nilcon o into	ng DCPT Vane* act mould th (kPa)	# Rines pri Val 2 5 6 Soil Vapou 4 parts per mili 100 200	B 10 12 or Reading on (ppm) 300 400	INSTRUMENTATION	COMME & GRAIN DISTRIB (%)	SIZE	a
	at	out 210 mm ASPHAL	53393					-										
		brown Sand and Gravel FILL moist	<u>-0.2</u>	ss	1	100	50/15		:		50 15		0					
				ss	2	100	50/15	- 1	-1 -		5% 15		0					
				SS		100	10			0			.5					
		trace to some sitt		55	3	100	12	- 2	-2 -	0								
	,	Sandy Silt FILL. race clay , trace gravel moist		ss	4	100	23		:	0			<b>1</b> 5					
								- - 3	-3 -									
				SS	5	89	42				0		<b>.</b> 5					
								-4	4-									
				ss	6	100	59	- 5	-5 -		o		.0					
								[										
A di 104 Sca Can Tel	C Earth & Envi vision of AMEC Crockford Bould borough, Ontar ada M1R 3C3 +1(416) 751-656 +1(416) 751-75	Americas Limited evard	No freest Borehole details a qualified Geote	AM DERMA	nted, do	not cone	stitute a t	horough	understr	nding of all o	ntential cond	Stions or	seent and require	interpretative as	selstance from	•	Scale:	1:32

RECORD OF BOREHOLE No. BC 01 Project Number: TT93042 Drilling Location: 15 m East of CNR Crossing Bridge Logged by: SOIL SAMPLING LITHOLOGY PROFILE FIELD TESTING LAB TESTING Rinse pH Values 4 6 8 10 12 COMMENTS INSTRUMENTATION PenetrationTesting Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W, W, O SPT | PPT | DCPT GRAIN SIZE sample Number DESCRIPTION Recovery (%) MTO Vane\* Nilcon Vane\*
Δ Infact ♦ Infact
A Remould ♦ Remould Sample Type DISTRIBUTION (%) ithology DEPTH ( \* Undrained Shear Strength (kPa) 20 40 60 80 SA SI CL. brown Sandy Silt FILL trace clay , trace gravel moist SS 7 100 43 0 SS 100 42 -8 SS 9 83 21 ò CLAYEY SILT TILL trace sand, trace gravel very stiff to hard moist 10 -10

trace cobbles / boulders

-11
End of Borehole 11

reddish brown

• 11.0

SS

10 100 50/15

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative essistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

0

Scale: 1:32

Page: 2 of 2

Pro	ECORD OF BOREHOLE		ВС	02				g Location:			ssing Bridge		Logged by:	ec <sup>®</sup>
	ect Client: AMEC Infrastructure Ground ject Name: Geotechnical Investigation	No.	ded Del	m Clas	- EAG	turk.		g Method:	150 mm Sc Truck Moun	Samuel Sa	gering		Compiled by:	Aggreen Commercial
	ect Location: Bovaird Drive from Lake L	707 1992			Ş	study		Started:	Oct 13, 09		npleted: Oct 1	3. 09	Revision No.:	
-	Boundary at Caseley Drive	, Brampt	on, ON	AMPLI			T		TESTING		ESTING			-
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT W Value	DEРТН (m)	ELEVATION (m)	Penetra O SPT   MTO Vane*  A intact A Remould  Undrained Sh	ntionTesting  PPT	Fires pH 1  Soil Vap  parts per n 100 200  Lower Exp  Plastic	Values ) 8 10 12 our Reading million (ppm) ) 300 400 loske Limit (LEL) W W.	INSTRUMENTATION	GRAIN SI DISTRIBUT (%)	ZE
	about 180 mm ASPHALT		1 %	-	8	- "	1	20 40	60 80	20 40	60 80		u1 u1	
	brown Sand and Gravel FILL trace silt	0.2 0.2 SS	1	83	42			c		eg <sup>a</sup>				
		ss	2	83	33	-,	-1 -	o		م				
	trace cobbles	ss	3	78	20	- 2	-2 -	o		<b>J</b> 5				
	brown Clayey Silt FILL trace sand, trace gravel moist	21 21 SS	4	917	15			0		728				
		ss	5	100	14	-3	3-	o		a 0 o <sup>20</sup>				
	brown Silty Sand Fit.L trace gravel, trace asphalt debris moist	-4.1 4.1				-4	4-							
		ss	6	100	33	- 5	-5 -	0		729				
	Drown Clayey Slit FILL trace sand, trace gravel moist													
A di	vision of AMEC Americas Limited =	reestanding	ground	twater me	easured	in ope	n boreho	le on complet	on of drilling.					
Scar Can Tel - Fax	* qualified	etalis as pres Geotechnica ned and the	i Enginee	r. Also, bo	oreinole in	<b>riformet</b>	ion should	anding of all pot to be read in con	ential conditions p unction with the g	resent and requi sotschnicsi repo	ire interpretative a ort for which it was	selstance from		Scale: 1:32 age: 1 of 2

## RECORD OF BOREHOLE No. BC 02



Project Number: TT93042 Drilling Location: 20 m West of CNR Crossing Bridge Logged by: JF

	LITHOLOGY PROFILE	SC	NL SA	MPLI	NG			FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION (m)	PenetrationTesting ○ SPT □ PPT ● DCPT MTO Vane* Nicon Vane* △ Intact ← Intact △ Remould ◆ Remould * Undrained Sheer Strength (kPa)	pars per macin (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL) W, W W, P O Plastic Liquid	INSTRUMENTATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
3	brown Clayey Sift FILL trace sand, trace gravel moist	ss	7	100	31	-		20 40 60 80	20 40 e0 e0 ∆5 <sub>0</sub> 12	22	GR SA SI CL
						- - - - -	-7-				
		ss	8	100	23	- 8	-8 -	ο	o <sup>13</sup>		
		ss	9	89	15	-9	.9 	o	o <sup>19</sup>		
	brown 10.2 Sand and Slit / Sandy Slit Fil.L trace clay, trace gravel moist					- 10 -	-10 -				
	-11.1 End of Borehole 11.1	ss	10	100	83	-"	-11 -	o	o <sup>8</sup>		

1000	ECORD	OF BORE	HOLE N	o.	ВС	03			Dellin	Lasation	20 m East o	d Masias	ausa Basad			ec <sub>o</sub>
1	ject Number: ject Client:	AMEC Infrastruct	ture Group							Location: Method:	150 mm S		Account to the		Logged by: Compiled by:	SN
	ject Name:	Geotechnical inv		Boval	rd Driv	e Clas	s EA SI	udv			Truck Mour		Augunng		Reviewed by:	
		Boyaird Drive fro	m Lake Louis	e Drive	e to Pe	el/Halt				Started:	Oct 14, 09	7,000	Completed: Oct 1	4, 09	Revision No.:	
	LITH	Boundary at Cas DLOGY PROFIL				MPLI	NG T	_	Т	FIELD	TESTING	-	BTESTING			
Lithology Plot	Local Grovest Surfe	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetra O SPT   MTO Vane*  Δ Intact  A Removal	AtionTesting  PPT	# Rinee 3 4 Soil V A parts p	pH Values 6 9 10 12 /apour Reading ar million (ppm) 200 300 400 Explosive Limit (LEL) W W	INSTRUMENTATION	COMMEN & GRAIN SI DISTRIBUT (%)	IZE
	ab	out 320 mm ASPHA	LT									1		8 8		
	s	brown land and Gravel FILL trace silt moist		ss	1	78	29			o		•		56 56		
		Sitty Sand FILL trace gravel moist		ss	2	83	19	- 1 - 1 	-1 <del>-</del>	0		Ű				
	tra	ice clay, trace organic	:s	ss	3	100	51	- 5 - Ž	Z -		0	ļ.		ll		
		grey Sitty Clay FILL ace sand, trace grave		ss	4	78	11			0		<u></u> 5				
	46	moist		ss	5	100	12	- - 3 - - -	-3 -	0		<b>4</b> 5				
gr.								-4	-4-							
				ss	6	100	20		-5	o		∆ <sup>10</sup>		II		
	 tr	reddish brown CLAYEY SILT TILL ace sand, trace grave very stiff moist												Beni	tonite: 0.3 m - 7.7 r	m
A di 104 Sca Can	Crockford Bouler rborough, Ontario ada M1R 3C3	Americas Limited vard	Groundw	as press	nted, do	not cons	titute a the	orough	understa	nding of all pot	ential conditions p	present and n	ve in depth after ren	seletance from		Seeder 4 - 22
Fax	+1(416) 751-656: +1(416) 751-759 v.amec.com		a qualified Geote commissioned a	chnical E	inglineer.	Also, bo	rehole inf	ormetk	on should	be read in con	unction with the o	ectachnical	report for which it was			Scale: 1:32 age: 1 of 2

#### RECORD OF BOREHOLE No. BC 03



Project Number: TT93042 Drilling Location: 20 m East of Mississauga Road Logged by: JF

	LITHOLOGY PROFILE	sc	AL SA	MPLI	NG			FIEL	D TE	STING	T	LAE	TES	STING	G						-
										Testing		Rinse p	H Value	8 10	12	NO.		COM		8	
_	DECODIFICAL		ž	_			Ē	O SPT	□ PPT	DCPT	4	Soil V parts pe 100 Lower E	apour e millor	Readir (ppm)	ng	EN		GRA	& N SIZ	E	
9	DESCRIPTION	1, pe	N N	36	Valu	Ê	No.	MTO Van  Δ Intact  ▲ Remou	e. V	Icon Vane*	-	Lower E	200 Diplosiv	e Limit (	(00 LEL)	NEW YEAR	ı	<b>STR</b>	BUTT	ON	
Lithology Plot		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION	V C 1 / 2 / C 2 / C		Remould trength (kPa)	1	Plastic	W		•	INSTRUMENTATION INSTALLATION		(	%)		200
3		Sar	Sas	æ	g.	8	1 4	20	40	0 80	$\perp$	20	40	60	80	<u> </u>	GR	SA	s		CL
唨	(minerom-					-	-		E0.		1:	(Various	2	·							
nr	CLAYEY SILT TILL (continued) -6.2 reddish brown 6.2	SS	7	100	50/13				50 13		₽2										
	WEATHERED SHALE trace limestone fragments			7.770		-	-		ä		1	4			*****						
	damp					-	- 6				1										
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						-	-7 -		-		1				11111						
						-	-		8 7												
	9														11111						
	8					Ε.	- 1						ş								
		-55		100	50/3		-		58			à									
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		~	ď	700			- 5		Y								Slotted p	pe and	sand: 7	7 m - 1	0.7 m
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						<del>-</del> 10	-10 —		ġ			i	į	ļ							
						-	-						1								
	6						-				1	i									
											1										
	-10.7 End of Borehole 10.7	-66	10	(S) 1-10	50/0	-			50				1								
	Borehole BC-3W was advanced next to this borehole by augering and a monitoring well was installed in it.									0.000					化物物 化丁烷酸 医皮肤 医皮肤 医皮肤 化苯酚 医皮肤						

1000		OF MONIT	ORING	WE	LL N	No.	BC	03	10000	i. Garage				am	ec®
		TT93042								Location:		Mississauga Road		Logged by:	JF
	ect Client:	AMEC Infrastruct								Method:	2000	olld Stem Augering			
DAY!	ect Name:	Geotechnical Inv						tudy		And the second	Truck Moun			Reviewed by:	
Pro		Boundary at Cas	eley Drive, Br	ampto	n, ON.			_	Date S	started:	Oct 26, 09	_ Date Completed: Oct 2	6, 09	Revision No.:	0, 2/9/10
	штн	OLOGY PROFIL	E	SC	HL SA	MPLI	NG		-	FIELD	TESTING	LAB TESTING  ★ Rinse pH Values	-	COMMEN	rre
Lithology Plot		DESCRIPTION	2	Sample Type	Sample Number	Recovery (%)	SPT N' Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact Δ Remoded * Undrained Shi	tionTesting  PPT   DCPT  Nitcon Vane*  O Intact  Remould  ser Strength (kPa)  60   80	2 4 6 8 10 12 Soil Vapour Reading Δ parts per mellion (ppm) 100 200 300 400 Δ Lower Explosive Limit (LEL) W, W W, Plastic Liquid 20 40 60 80	INSTALLATION  6	GRAIN SI DISTRIBUT (%)	ZE
	This borehole	was advanced next to	Borehole BC					-							
	See B	3 by augering, orehole BC 3 for soil	-4.6 -4.6					3	-1				Bent	onite: 0.3 m - 3.0 r	
AME	C Earth & Envir	onmental	7					_							
A din 104 Scar	rision of AMEC A Crockford Boule borough, Ontari	mericas Limited vard	¥ No freest	anding	groundw	vater me	asured	in oper	n boreho	le on completi	on of drilling.				
Can Tel -	ada M1R 3C3 -1(416) 751-656	5	a qualified Geote	chnical 6	Engineer.	Also, bo	rehole in	dormatic	on should	nding of all pote be read in cons	ential conditions pr unction with the or	resent and require interpretative a sotechnical report for which it was	selstance from		Scale: 1:32
	+1(416) 751-759 .amec.com	2	commissioned ar	nd the ac	company	ying Expl	anation o	d Boreh	ole Log'.					1	age: 1 of 1

Proj	ect Number:			o. <u>!</u>	BC (	<u>04</u>				Location:		f Mississauga Road		Am Logged by:	ec®
	ect Client: ect Name:	AMEC Infrastruct Geotechnical Inv		Douale	d Ddu	- Class	EAG			Method:	150 mm So	olid Stem Augering		Compiled by: Reviewed by:	SN
		Boyaird Drive fro		THE CO			7	tudy		started:	Oct 14, 09	_ Date Completed: Oct 14, 0	19	Revision No.:	
		Boundary at Case OLOGY PROFIL	eley Drive, Bra	mptor	, ON.	MPLI			T		TESTING	LAB TESTING		TTO VISION TYOU	5,24.0
Lithology Plot		DESCRIPTION	-	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	Penetro O SPT D MTO Vane*     intect    Remould ' Undramed SP	ationTesting PPT • DCPT		INSTALLATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE
▩		brown land and Gravel FILL moist					100000	-				3	25.00		
		brown Silty Sand FILL trace to some gravel moist	-0.6 0.6	ss ss	1 2	83	13	-1	-1-	0		0			
				SS	3	89	38	-2	-2-	o		<b>.</b> 5			
		grey Clayey Sift FILL trace sand moist	-2.1 2.1 -2.9 2.9	SS	4	83	12			0		∆38.	Bento	nite: 0.3 m - 3.0 m	
		grey Sitty Sand FILL trace clay moist to wet	29	ss	5	94	10	-3	3-	0		Δ <sup>40</sup>			
		reddish brown CLAY/ CLAYEY SIL' ace gravel, trace shal hard moist						4	4-				Slotter	t pipe and sand:	3.0 m - 4.6 m
				ss	6	100	74	- 5	-5-		o	∆10			
A div		Americas Limited	¥ Groundwa	iter dep	th on co	vmpletio	n of dril	ling on	10/14/2	009 at a depth	not: 32m	Cave in depth after removal	al of augers:	32m	
Scar Can Tel - Fax	Crockford Boule torough, Ontari ada M1R 3C3 +1(416) 751-656 +1(416) 751-759 camec.com	vard o	Borehole details a qualified Geotec commissioned an	es prese chnical E d the so	nted, do i ingineer. company	not const Also, bo ing Expli	itute a ti rehole in snation o	horough formation of Boreh	understa on should tole Log'.	nding of all pot be read in con	ential conditions pr junction with the gr	recent and require interpretative assistant sotscheidal report for which it was	ance from		Scale: 1:32 ge: 1 of 2

#### RECORD OF BOREHOLE No. BC 04



Project Number: TT93042 Drilling Location: 30 m East of Mississauga Road Logged by: LITHOLOGY PROFILE SOIL SAMPLING LAB TESTING FIELD TESTING Rinse pH Values 4 6 8 10 12 COMMENTS INSTRUMENTATION INSTALLATION PenetrationTesting O SPT PPT • DCPT GRAIN SIZE Sample Numbe DESCRIPTION Recovery (%) SPT 1/ Value MTO Vane\* Nilcon Vane\* Δ Intact Φ Intact ▲ Remould ◆ Remould Sample Type DISTRIBUTION DEPTH (m) uthology (%) Undrained Shear Strength (kPa) 20 40 60 80 SA SI CL reddish brown SILTY CLAY / CLAYEY SILT TILL trace sand, trace gravel, trace shale fragments hard SS 91 50/13 moist reddish brown WEATHERED SHALE 10 50/13 SS 8 100 9 100 50/5 -10 End of Borehole

Pro	ject Number:	OF BOREH		o. <u>!</u>	ВС	<u>05</u>					cation	- 15	Entrano								_ Logged by	у:	ec <sup>6</sup>	9
	ject Client:	AMEC Infrastructu		Daniel I		- Cl	- 540		Drillin	_			150 mr				ugerir	ng	2100	10000	_ Compiled		SN	
	ject Name: ject Location:	Geotechnical inve Bovaird Drive from						tudy	Date				Truck M Oct 15,				molete	ed: Oct	15.00		_ Reviewed Revision I			
FIG		Boundary at Case	ley Drive, Br	ampto	n, ON.			_	Date						_				15,09	_	Nevision	10	0, 231	_
Lithology Plot		DLOGY PROFILE		Sample Type	Sample Number	Recovery (%)	SPT W Value	DEРТН (m)	ELEVATION (m)	O:	Penel SPT I O Vani Intact Remouli	tratic	on Testing PT   Nilcon V  Intact Rem r Strength	DCPT 'ane'	SK Par Sk par 10 A Lo W	oil Vap	6 6 bour Re million ig 0 300 blosive L W	10 12 nading port) 400 and (LEL) W,	INSTRUMENTATION		GRAII	& N SIZ BUTI %)	ZE ION	CL.
2	abo	out 110 mm ASPHAL	-0.1	S	S	-	S	-	- w	+	20	40	60 8	10	26	3 40	0 60	80	22	+	J			-
	s	grey and and Gravel FILL moist	0.1					ŀ		1		l												
		moss						F		-	-	i i												
				SS	1	89	29	ţ		1.	0	i.,	.i		5			i	1					
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			7.00					F		}		ļ.,												
		reddish brown		ss	2	100	32	F'	-1 -	7					0		- 8							
	San	dy Silt / Silty Sand Fil moist		33	-	100	JE.	Ė		1		ŧ.												
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			<del>2.1</del>				Talent et	Fʻ	-2	7		š.,												
***	tr	brown Clayey Silt FILL ace sand, trace gravel	2	_				ţ		1	1						-							
₩								Ŀ		<u> </u>	. <u>į</u>				5									
₩				SS	4	100	42	F		7		0		1	1		1		1					
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<b>7</b>		brown	2.9					Ł.,	- 2-	1									1	1				
W		CLAYEY SILT TILL ace sand, trace gravel hard	i					- 3 Z	₹ -3 -	7	÷	÷						····	1					
Ш		moist		SS	5	100	36	ţ		1		5			10		- 3		1					
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M								Ė		1										1				
88								Ł.		·	ļ	į.,												
14		reddish brown	<del>4.1</del>					-	-	1	1			1			1		1					
P		D SAND / SILTY SAN ace clay, trace gravel	DTILL					ţ.		1	i.	į.,												
9		very dense moist to wet						Ł		1							1		1					
HU				-	-	-	-	F		}	· •	-					••••		1	1				
Ш			40	SS	6	100	50/15	Ė		1	1	50 15	)	1	<sup>5</sup>		- 1		1					
911		End of Borehole	4.9							T	1	1							1					
																			1					
											3								1					
												-					-							
											-						-							
												1					1							
L											1													
A d 104	EC Earth & Envir ivision of AMEC A Crockford Boule urborough, Ontario	mericas Limited vard	⊋ Groundw	ater dep	oth on c	ompletic	on of dri	ling on	10/15/2	2009	at a dep	pth o	t: 3.0	m.	8	Cave	in dep	oth after n	emoval o	of auger	rs: <u>3.5 m</u> .			
Car	nada M1R 3C3 +1(416) 751-656	93	Borehole details a qualified Goots	as press	ented, do	not cons	stitute a t	horough	underst	tandin	g of all p	octent	tial condit	tions pr	ceent a	nd required	utre inte	rpretative which it wa	nseistano	e from		S	icale: 1 :	32
Fax	(+1(416) 751-759 w.amec.com		commissioned a	nd the ac	compan	ying Exp	lanation	of Boreh	noie Log														ge: 1 o	

R	ECORD	OF BORE	IOLE N	o. j	вс	<u>06</u>								am	ec®	)
Pro	ject Number:	TT93042							Drilling	Location:	30 m West o	of Petro Canada Gas		Logged by:	JF	_
Pro	ject Client:	AMEC Infrastruct								Method:	150 mm Sc	olid Stem Augering		Compiled by:	SN	-
	ject Name:	Geotechnical inve						itudy			Truck Moun			Reviewed by:		_
Pro		Bovaird Drive from Boundary at Case	eley Drive, Bra	ampto	n, ON.			_	Date S	tarted:	Oct 14, 09		4, 09	Revision No.:	0, 2/9/10	_
Lithology Plot		DESCRIPTION	E	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION (m)	Penet O SPT ( MTO Vane Δ Intact ▲ Remould * Undrained S	<ul> <li>Intact</li> </ul>	LAB TESTING  ★ Rane pH Values 2 4 6 8 10 12  Soil Vapour Reading Δ parts per million (ppm) 100 290 300 400  ★ Lower Epicistre Limit (LEL) W, W W, B	INSTRUMENTATION INSTALLATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE	
		brown Sand / Sand and Grav	vel FILL	- GS	- 05	- u	0)	- "		- 20 -	60 80	2 40 60 80				-
		moist		ss	1	79	13			0		5				
ø		brown ND SAND / SILTY SAN to some clay, trace gr		ss	2	56	7	- 1	-1-	0		<u>.</u> 5				
		loose to dense moist		ss	3	100	32			0		<u>.</u> 5		8 38	44 10	
,								- 2	-2			△35				
				ss	4	100	26	- 3	3-3-	0		<u> </u>				
,				SS	5	100	10			0		∆35				
•			42					-4	4-							
0 0 0		brown GRAVELLY SAND trace silt very dense wet	- — — <u>-4.3</u> 4.3													
0 1				SS	6	100	73	-	-		٥	△30				
		End of Borehole	-5.0 5.0					5_	·5 —							
A di 104 Sca	Crockford Boule rborough, Ontari	Americas Limited ward									th of: <u>2.9 m</u> .	Cave in depth after ren				_
can	ada M1R 3C3		Borehole details	ns orene	nted, do	not cons	ettude a ti	horough	understa	eding of all or	dential conditions o	resent and require interpretative as	salatance from			

	ECORD O		IOLE N	0.	ВС	<u>07</u>			_ Drillin	g Location:	Driveway #2	2055 (Pro G	olf)		_ Logged by:	ec®
Pro	oject Client: Al	MEC Infrastructe	ure Group						Drillin	g Method:	150 mm Sc	olld Stem Au	gering		Compiled by:	SN
		otechnical Inve	order or a second second		COMPLETE S			tudy			Truck Moun				Reviewed by:	РВ
Pro	oject Location: Bo	ovaird Drive from oundary at Case	n Lake Louis ley Drive, Br	e Drive ampto	n, ON.	eVHalt	on		Date	Started:	Oct 15, 09	_ Date Cor	npleted: Oct 1	5, 09	Revision No.:	0, 2/9/10
Lithology Piot		OGY PROFILE		Sample Type	Sample Number	Recovery (%)	'N' Value	DЕРТН (m)	ELEVATION (m)	Penetra O SPT   MTO Vane*  A intact A Remould	TESTING  ationTesting PPT	Rinse pH 1 2 4 5 Soil Vap A parts per n 100 200	Values 5 8 10 12 Our Reading milion (ppm) 5 300 400 losse Limit (LEL) W W, 0 Upuid	INSTRUMENTATION INSTALLATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE
3	Local Ground Surface E about	100 mm ASPHAL	T -01	Sa	Sa	8	SPT	8	ᆸ	20 40		20 40		22	GR SA	SI CL
	Sand	brown d and Gravel FILL moist	<u>-0.1</u> 0.1													
		brown		ss	1	100	17					٩				
		clayey Silt FILL ome sand, trace gr moist		ss	2	100	18	-,	-1 -			∆5 o <sup>19</sup>				
		brown AYEY SILT TILL sand, trace gravel								]						
		hard moist		ss	3	100	34	- 2	-2 -	0		Δ <sup>2</sup> δ <sup>15</sup>				
								- 1	•							
				ss	4	100	32			0		△1813				
								- - 3	-3 -							
				ss	5	100	30					∆ <sup>5</sup> o <sup>14</sup>				
								Ē.								
0		brown SAND / SILTY SAN e clay, trace gravel very dense moist to wet						- • - - •	-4 - Z							
90				ss	6	100	61				o	Δ <sup>15</sup>				
	E	nd of Borehole	-5.0 5.0					- 5	-5 -							
Ad	EC Earth & Environs ivision of AMEC Ame Crockford Boulevan	ricas Limited	⊈ Groundwa	ater dep	oth on o	ompletio	n of drilli	ing on	10/15/2	009 at a depth	of: <u>4.4 m</u> .					
Sca Car Tel Fax	rcfocklord Bodievan arborough, Ontario nada M1R 3C3 +1(416) 751-6565 x +1(416) 751-7592 w.amec.com		Borehole details a qualified Geote commissioned ar	chnical E	ngineer	Also, bo	rehole int	formati	ion should	d be reed in con-	ential conditions p junction with the g	resent and requ sotschnical repo	ire interpretative a ort for which it was	ssistance from	1	Scale: 1 : 32 age: 1 of 1

R	ECORD	OF BOREH	IOLE N	o.	вс	<u>08</u>											ć	me	ec	9
Pro	ject Number:	TT93042							Drilling	Location:	75 n	n West o	f Drivewa	y #2055	(Pro Go	olf)	Logge	ed by:	<u>JF</u>	_
Pro	ject Cllent:	AMEC Infrastruct	ure Group						Drilling	Method:	150	mm So	IId Stem A	Augering	9		Comp	iled by:	SN	
Pro	ject Name:	Geotechnical Inve	estigation for	Boval	rd Driv	re Clas	s EAS	tudy	Drilling	Machine:	True	ck Moun	ted Drill				Revie	wed by:	PB	_
Pro	ject Location:	Bovaird Drive from Boundary at Case	m Lake Louis	e Drive	e to Pe	el/Halt	ton		Date S	Started:	Oct	15, 09	_ Date Co	omplete	d: Oct 1	5, 09	Revisi	ion No.:	0, 2/9/10	
	штн	OLOGY PROFIL			AL SA		NG			FIELD	TES	ΠNG		TESTI	NG					
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT D MTO Varie Δ Intact Δ Remould ' Undrained S	Nilci	DCPT on Varie* Intact Remould ingth (kPa)	△ parts per 100 2 ▲ Lower E W <sub>r</sub> Plastic	pour Rear rmillion (pp 90 300 xplosive Lin W	m) 400	INSTRUMENTATION	GF	MMENT & RAIN SIZ TRIBUTI (%)	ZE ION	CL.
▩		brown Sand and Gravel FILL						-				Ī								
		trace to some silt moist		ss	1	83	34			0			gs							
		Silty Sand FILL trace gravel moist		ss	2	78	21		-1 -	0			<u>4</u> 510							
	tr	ace cobbles / boulders		ss	3	100	50/13				50 13		<b>3</b> 0							
								-2	-2 -											
m		brown		ss	4	100	5			0			△4818							
		CLAY / CLAYEY SILT race sand, trace gravel very stiff moist		ss	5	67	21	- 3 - \frac{7}{2}	-3 -	٥			∆ <sup>3§17</sup>							
								-4	-4-					0.000						
•		reddish brown by SILT / SILTY SAND race clay, trace gravel very dense moist																		
þ	tr	ace cobbles / boulders		SS	6	100	50/15				50 15									
		End of Borehole	4.7																	
	EC Earth & Envi		⊈ Groundwa	ater deg	oth on o	ompletic	on of drill	ling on ;	10/15/20	009 at a dept	th of:	3.3 m.			:					_

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		OF BOREHO	DLE N	<b>o.</b> !	вс	<u>09</u>												an	76	SC <sub>C</sub>	•
	oject Number:	TT93042								g Location:	_	50 m West						Logged by:	2	)F	_
	oject Client:	AMEC Infrastructure								g Method:	_	50 mm Sc			Auger	ing		Compiled b	_	SN	
	oject Name:	Geotechnical Invest						tudy				ruck Mour						Reviewed b			-
Pro	ject Location:	Boundary at Caseler	Lake Louis y Drive, Bra	e Drive ampto	e to Pe n, ON.	el/Hait	on		Date S	Started:	0	ct 15, 09	_ D	ate C	omple	ted: Oct 1	5,09	Revision No	).: <u>0</u>	, 2/9/10	_
	штн	OLOGY PROFILE				MPLI	NG			FIELD	TE	STING				TING				_	
Lithology Plot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT C MTO Vane ∆ Intact ▲ Remould	PP 0	Testing  T DCPT  Bloom Vane* Intact Remould  Brength (kPa)	A 1	Soil Va	million 00 30	10 12 Reading	INSTRUMENTATION INSTALLATION	COMME & GRAIN DISTRIB (%)	SIZI UTIC	E ON	
æ		brown		Š	- võ	č	35	ă	ŭ	20 4	0	60 80	$\vdash$	20 -	0 6	0 80	22	GR SA	SI	0	_
	,	Sand and Gravel FILL some sit moist	-0.6	SS	1	94	27			0			5								
	trace sar	brown  CLAYEY SILT TILL  Id, trace gravel, trace oxid  very stiff to hard  moist		ss	2	89	24	-1	-1 -	0			<b>5</b>								
				ss	3	100	67	- 2	-2 -			0	5								
•		brown  ND SILT / SANDY SILT  avel, some cobbles / bould very dense moist		ss	4	100	50/15				50 15		5								
•				ss	5	100	50/13	3	-3 -		50 13		5								
0		grey						4	4-												
l þ	1		-4.7	SS	6	100	50/10	-			58	<del> </del>									
-		End of Borehole	4.7								10										
	EC Earth & Envi	ironmental Americas Limited	목 Groundwa	ater dep	oth on co	ompletic	n of dril	ing on ;	10/15/2	009 at a dept	h of:	3.5 m.		-							

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	ECORD	OF BOREHOLE N	lo.	BC	10			Drillin	g Location:	470 m West	of Driveway #2055		amec <sup>9</sup>
Pro	oject Client:	AMEC Infrastructure Group						Drillin	g Method:	150 mm So	ild Stem Augering		Compiled by: SN
Pro	oject Name:	Geotechnical Investigation fo	r Bova	ird Driv	re Clas	s EAS	Study	Drillin	g Machine:	Truck Moun	ted Drill		Reviewed by: PB
Pro	oject Location:	Bovaird Drive from Lake Loui Boundary at Caseley Drive, B	se Driv	e to Pe	eVHalt	ton		Date :	Started:	Oct 15, 09	_ Date Completed: Oct 1	5, 09	Revision No.: 0, 2/9/10
	ЦТН	OLOGY PROFILE		OIL SA		NG		T	FIELD	TESTING	LAB TESTING		AND
Lithology Plot	Local Ground Surh	DESCRIPTION  Kee Elevation: 9.0 m	Sample Type	Sample Number	Recovery (%)	SPT N' Value	DЕРТН (m)	ELEVATION (m)	O SPT □ MTO Vane' Δ Intact ▲ Remould	♦ Intact ♦ Remould hear Strength (kPa)	the Finne pH Values		GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
		brown Sand and Gravel FILL trace sift moist -0.6	ss	1	78	22			0		△30		
	trace sar	brown 0.6  Clayey Silt FILL  nd, trace gravel, trace organics moist	ss	2	78	21		-1 -	o		Δ25		
	E	dentonite: 0.3 m - 3.0 m	ss	3	56	16	- 2	-2 -	o		Δ25	Ве	intonite: 0.3 m - 3.0 m
			ss	4	67	12			0		△35		
9		brown 2.9  AND SILT / SANDY SILT TILL  trace clay, trace gravel dense to very dense moist	ss	5	100	46	- 3	-3 -		0	Δ <sup>50</sup>		
0	Sar Peri	nd: 3.0 m - 4.6 m orated Pipe: 3.0 m - 4.6 m					- - - Ş	-4 - Z				Sk	otted pipe and sand: 3.0 m - 4.6 m
9	s	orne cobbles / boulders  End of Borehole	- 88		100	50-1	-			58			
A d 10- Sci	IEC Earth & Envi fivision of AMEC 4 Crockford Boule arborough, Ontan nada MTR 3C3	Americas Limited avard	nesero se							not: 4.1m.			

a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log<sup>2</sup>.

Scale: 1:32

		OF BOREHOLE NO	<b>o.</b>	ВС	<u>11</u>			Deillio	g Location:	250 m Fost	of Driveway #2472		amec
	ject Client:	AMEC Infrastructure Group							g Method:		olld Stem Augering		Logged by: JF  Compiled by: SN
	ject Olleni.	Geotechnical Investigation for	Rovai	ed Delv	e Clas	o FA S	turk			Truck Moun			Reviewed by: PB
	***********	Boyaird Drive from Lake Louis					lucy	•	Started:		Date Completed: Oct 1	5.00	Revision No.: 0, 2/9/10
FIC		Boundary at Caseley Drive, Bro	ampto	n, ON.			_	Date				5,09	nevision No 0, 2910
_	штн	OLOGY PROFILE	SC	IL SA	MPLI	NG	_	-		TESTING	LAB TESTING  ★ Ringe pH Values	z	COMMENTS
Uthology Plot	Local Ground Surfi	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT N' Value	DEРТН (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ intact Δ Remould	◆ Intact ◆ Remould hear Strength (kPa)	2 4 6 6 10 12	INSTRUMENTATION INSTALLATION	& GRAIN SIZE DISTRIBUTION (%)
		brown Sand and Gravel FILL moist	ss	1	83	27			0		JF.		
		Drown 0.6 Silty Sand FILL wet	ss	2	0	31	- 1	-1 -	0		<b>7</b> 88		
	trace sand,	brown 1.4  CLAYEY SILT TILL trace gravet, trace rootlets, trace oxidation very stiff moist	ss	3	100	23	-2	-2 -	0		<b>4</b> <sup>0</sup> o <sup>14</sup>	Bent	onite: 0.3 m - 3.0 m
•		-2.1 2.1 ND SILT / SANDY SILT TILL ice gravel, trace cobbles / boulders very dense moist to wet	ss	4	100	66				0	4 <sup>0</sup> 011		
, , ,			ss	5	100	50/15	- 3	-3 -		50 15	<b>₽</b> ₽9		
		End of Borehole 4.7	SS	6	100	50/15	-4	Z		<b>30</b>	4 <sup>0</sup> 011	Slotts	ed pipe and sand: 3.0 m - 4.6 m
A di 104	EC Earth & Envi vision of AMEC Crockford Boule rborough, Ontari	Americas Limited = Groundwin	ater deg	oth on c	ompletic	on of drill	ing on	10/15/2	009 at a depth	not: <u>3.5 m</u> .	1		

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Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assis a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

Scale: 1:32

		OF BOREH	OLE N	<b>o.</b> ,	BC	12			-					am	ec®
	ject Number:	TT93042								Location:		of Driveway #2472		Logged by:	JF
	ject Cllent:	AMEC Infrastructu								Method:		olld Stem Augering		Compiled by:	
	ject Name:	Geotechnical Inves						tudy			Truck Moun			Reviewed by:	
Pro	ject Location:	Boundary at Casek	ey Drive, Br	ampto	n, QN.			_	Date S	Started:		Date Completed: Oct 1	5, 09	Revision No.:	0, 2/9/10
_	штн	OLOGY PROFILE		SC	NL SA	MPLI	NG		ـ	FIELD	TESTING	LAB TESTING  * Rinse pH Values	_	COMMEN	TO
Lithology Plot	Local Ground Surfa	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT ☐  MTO Vane*  Δ Intact  Δ Remould  * Undrained Sh	<ul> <li>Intact</li> </ul>	2 4 6 8 10 12 Soil Vapour Reading  Δ parts per million (ppm) 100 200 300 400  Δ Lower Explosive Limit (LEL) W, W W, Plastic Liquid 20 40 60 80	INSTALLATION	COMMEN & GRAIN SIZ DISTRIBUT (%)	ZE
		brown Silty Sand FILL trace to some gravel moist		ss	1	89	12			0		o			
	tr	ace day, trace organics		ss	2	56	12	-	-1-	0		.0			
•		brown ND SILT / SANDY SILT race clay, trace gravel dense to very dense moist to wet		ss	3	89	37			o		0			
0				ss	4	100	62	- 2	-2		o	<b>.</b> 5			
				ss	5	100	75	-3	-3 -		o	<u>.</u> 5			
								- 4 - <u>5</u>	4 2						
0		End of Borehole	-5.0 5.0	ss	6	100	65	-	.5 –		0	<u>,</u> 5			
		ronmental		ater dep	oth on c	ompletic	on of drill	ling on	10/15/20	XO9 at a depth	of: 43m.				
AMEC Earth & Environmental A division of AMEC Americas Limited 104 Crockford Boulevard  Groundwater depth on completion of drilling on 10/15/2009 at															

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	ECORD	OF BOREHOLE N	ło.	вс	<u>13</u>			Drillin	ng Location:	150 m East	of Drive	way #2475		am Logged by:	ec <sub>®</sub>
	ject Cllent:	AMEC Infrastructure Group							ng Method:	150 mm Sc				Compiled by:	SN
	ject Name:	Geotechnical Investigation for	or Bovai	rd Driv	ve Clas	s EAS	Study		-	Truck Moun				Reviewed by:	
Pro	ject Location:	Bovaird Drive from Lake Lou				ton		Date	Started:	Oct 15, 09	_ Date	Completed: Oct	15, 09	Revision No.:	0, 2/9/10
-	LITH	Boundary at Caseley Drive, I OLOGY PROFILE	_		AMPLI	NG		_	FIELD	TESTING	LA	B TESTING	П		
Lithology Plot		DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT W Value	ОЕРТН (m)	ELEVATION (m)	Penetra O SPT   MTO Vane*      intact     Remould	PPT • DCPT Nilcon Vane* o intact Remould ear Strength (kPa)	★ Rinse 2 4 Soil A parts 100	PH Values  6 8 10 12  Vapour Reading per million (ppm) 200 300 400  or Explosive Limit (LEL)  W W,	INSTRUMENTATION INSTALLATION	COMMEN & GRAIN SE DISTRIBUT (%)	ZE
		Silty Sand FILL trace to some gravel moist	ss	1	83	22					0				
0	tr	ace clay, trace organics	ss	2	78	17		-1 -	0		Δ <sup>35</sup>				
	trace sar	brown 1. Sithy Clay FILL  d, trace gravel, trace organics moist	ss ss	3	94	19					Δ <sup>25</sup>				
φ    -  -  -  -  -		brown 2  ND SILT / SANDY SILT TILL  trace clay, trace gravel  dense to very dense  moist to wet	SS	4	100	47	-2	-2 -		0	Δ <sup>25</sup>				
0	s	ome cobbles / boulders	ee		100	ENIE	-3 -3	-3 -	] ] ] 6	9.	Δ <sup>15</sup>				
		End of Borehole 4.		6	100	50/15		-4 - 		2					
A d 104	EC Earth & Envi ivision of AMEC Crockford Boule intorough, Ontar	Americas Limited = Glound	twater de	pth on c	ompleti	on of dri	ling on	10/15/2	2009 at a depth	of: <u>4.7 m</u> .					

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Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Logi.

Scale: 1:32

R	ECORD	OF BOREH	IOLE N	<b>)</b> . !	BC	14											amec
Pro	ject Number:	TT93042							Drilling	Locatio	n: <u>7</u>	0 m East o	f Drive	way #2	2475		Logged by: JF
Pro	ject Client:	AMEC Infrastructu	ure Group						Drilling	Method	k _1	150 mm S	olid Ste	m Aug	gering		Compiled by: SN
Pro	ject Name:	Geotechnical Inve	etigation for	Boval	rd Driv	e Clas	s EAS	tudy	Drilling	Machin	e: <u>T</u>	ruck Mour	ted Dr	111			Reviewed by: PB
Pro	ject Location:	Bovaird Drive from Boundary at Case	n Lake Louis	e Drive	e to Pe	el/Halt	on		Date S	Started:	0	ct 15, 09	_ Dat	e Com	pleted: Oc	15, 09	Revision No.: 0, 2/9/10
	ЦТН	OLOGY PROFILE		SC	AL SA	MPLI	NG			FIE	LDΤΕ	STING			ESTING	Τ_	
Lithology Plot	Local Ground Surfix	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT MTO Va ∆ Intact ▲ Remo	ne* Nowad 4	Testing  T • DCP1  Allcon Vane* Intact Remould Strength (kPa) 60 80	Sc A par 10 A Lo	eer Explo	β 10 12 ur Reading Son (spm) 300 400 sive Limit (LEL V W, Liquid 60 80	INSTRUMENTATION	COMMENTS &  GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
▓		brown Sand and Gravel FILL						-	-							T	
		grey Clayey Silt FILL d, trace gravel, trace o	- — — <u>- 0.6</u> 0.6 rganics	SS	2	100	10		-1 -	0			∆ <sup>15</sup>				
				SS	3	100	15	- 2	-2 -	0			Δ <sup>45</sup>				
•		brown  ND SAND / SILTY SANI race clay, trace gravel hard moist	- — — - <u>-2.4</u> D TILL	ss	4	100	43				0		Δ <sup>35</sup>				
				ss	5	100	50/15	-3 -	-3		59 15		Δ <sup>15</sup>				
			-4.7	SS	6	100	50/15	4	-4-		59,						
-110		End of Borehole	4.7								15						
AMI	EC Earth & Envi		☑ No freest	anding (	groundv	vater me	asured	in open	boreho	le on com	pletion	of drilling.					

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	ECORD OF BOR	EHOLE N	o.	ВС	<u>15</u>								amed	0
	eject Number: TT93042		_	-					g Location:	Driveway #2			gged by: JF	_
		tructure Group  Investigation for	Royal	rd Delv	n Class	FAS	turk		g Method:	Truck Moun	ted Ddil		ompiled by: SN eviewed by: PB	
	ject Location: Bovalrd Drive						tuay		Started:	Oct 15, 09			evision No.: 0, 2/9	710
-	Boundary at LITHOLOGY PRO	Caseley Drive, Br	ampto	n, ON.	MPLI		_	T		TESTING	LAB TESTING			
Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT W Value	DЕРТН (m)	ELEVATION (m)	Penetra O SPT   MTO Vane*  Δ Intact  A Remould	tionTesting PPT • DCPT Nilcon Vane* • Intact • Remould ser Strength (kPa)	# Rinse pH Values  2 4 6 8 10 12  Soil Vapour Reading parts per million (ppm) 100 200 300 400  A Lower Explosive Limit (LEL) W, W W, Pustic Liquid	STALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)	
5	Local Ground Surface Elevation: 6.0 m about 100 mm ASI	PHALT -0.1	Sa	Sa	å	S	-	i ii	20 40		20 40 60 80	ŽŽ GA	SA SI	a
	brown Sand and Gravel some silt moist	0.1	ss	1	94	33			0		<u>√</u> 5			
	brown Clayey Silt Fli trace sand, trace of moist		ss	2	100	14	- 1	-1 -	0		<b>5</b> 10			
	brown CLAYEV SILT 1 trace sand, trace (hard moist		ss	3	100	32			0		<b>4</b> 5			
			SS	4	100	36	-2	-2 -	0		<b>1</b> 15			
			33		100		- - - 3	-3 -						
			ss	5	100	51				0	Δ <sup>36</sup>			
0	SILT AND SAND / SILT trace clay, trace yery dense	gravel					-4	-4 -						
9	moist  End of Boreho	-4.9	ss	6	100	50/15			5	ş	△15			
A d 104 Sca	EC Earth & Environmental ivision of AMEC Americas Limited Crockford Boulevard arborough, Ontario	¥ No frees	tanding	ground	water me	asured	in ope	n boreh	ole on completi	on of drilling.				
Tel Fax	nada MTR 3C3 +1(416) 751-6565 x+1(416) 751-7592 w.amec.com	Borehole details a qualified Geot commissioned a	as prese schnical I and the ac	ented, do Engineer ocompan	not cons . Also, bo ying Expl	titute a tr rehole in anation o	formeti f Borel	h underst ion shouk hole Log'.	anding of all pote d be read in conj	ential conditions p unction with the g	resent and require interpretative a sotschnical report for which it was	salatance from	Scale: 1 Page: 1	

													-
RECORD	OF BOREHOLE N	o.	BC	16								am	ec
Project Number:	TT93042						Drilling	Location:	Driveway #2	472		Logged by:	JF
Project Client:	AMEC Infrastructure Group						Drilling	Method:	150 mm So	olld Stem Augering		Compiled by:	SN
Project Name:	Geotechnical Investigation for	Boval	rd Driv	e Class	s EAS	tudy	Drilling	Machine:	Truck Moun	ted Drill		Reviewed by:	PB
Project Location	Bovaird Drive from Lake Louis	e Driv	e to Pe	el/Halt	on		Date S	Started:	Oct 15, 09	Date Completed: Oct 1	5, 09	Revision No.:	0, 2/9/10
LITT	Boundary at Caseley Drive, Br HOLOGY PROFILE			MPLI	NG	_		FIELD.	TESTING	LAB TESTING	Т		
									ionTesting	★ Rinse pH Values 2 4 6 8 10 12	8	COMMEN	TS
_	DECODIDITION		ž	_			E	O SPT	PPT • DCPT	Soil Vapour Reading A parts per million (ppm) 100 200 300 400	E S	& GRAIN SI	ZE
P P	DESCRIPTION	Ę,	2	80	'N' Value	Ê	ĕ	MTO Vane*  Δ Intact	Nilcon Vane*	▲ Lower Explosive Limit (LEL)	F F	DISTRIBUT (%)	ION
Difference Prof		Sample Type	Sample Number	Recovery (%)	SPT 'N'	DEPTH	ELEVATION	<ul> <li>Remould</li> <li>Undrained She</li> </ul>	<ul> <li>Remould er Strength (kPa)</li> </ul>	W, W W,	INSTRUMENTATION		
Local Ground Su	tage Elevation: 0.0 m about 40 mm TOPSOIL 8,8	- S	33	- E	Š	-	_ =	20 40		20 40 60 80	ZZ	GR SA	SI CL
₩`	Silty Sand FILL	ss	,	89	16	ļ.				, 15	1 1		
₩	trace to some gravel moist	33	١.	69	16	ŀ				f			
<b>**</b>		-		-	_	ļ.					1 1		
₩						ŀ					1 1		
₩		-	-		_	-		1 1 1					
**		ss	2	56	15	ŀ.				10			
₩.		33	*	"	15	Γ'	-1 -	] ~			1 1		
₩		-	-		_	Ł							
<del>  </del>						-							
	CLAYEY SILT TILL trace sand, trace gravel	-	-			t							
	hard moist	ss	3	100	35	F				10			
		33	ľ		33	t		1		f	1 1		
阳		$\vdash$			-	- 2	-2 -	1			1 1		
						t							
		<u> </u>	-		-	-		1 1 1			1 1		
		ss	4	100	61	t			0	A <sup>20</sup>			
		"	`		٠.	ŀ		1 1 1	Ĭ				
<b>1</b>		-	-	-	_	Ė							
						<b>-</b>		1 1 1			1 1		
		_	-		-	- 3	-3 -						
捌		ss	5	100	37	ŀ				5			
		"	1		٠.	-				F			
		├─	_			t							
						F							
14			l			t							
						- 4	-4 -						
		l				t					1 1		
						-							
<b>14</b>						t		1 1 1					
		_				-					1 1		
		ss	6	100	36	į.				5			
<b>3</b> 49	grey					-							
и.	-5.0 End of Borehole 5.0	_	_			-5	-5 -				1		
AUEO E- et a E	IEC Earth & Environmental  Select of AMEC American Limited  No freestanding groundwater measured in open borehole on completion of drilling.												
A division of AMEC 104 Crockford Bou	Americas Limited	tanding	ground	vater me	asured	in open	boreho	ole on completi	on of drilling.				

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															- 60
RI	ECORD	OF BOREH	OLE N	o. !	BC	<u>17</u>								ame	ec~
Pro	ject Number:	TT93042							Drilling	Location:	25 m East H	eritage Road		Logged by:	JF
Pro	ject Client:	AMEC Infrastructur								Method:	150 mm So	lid Stem Augering		Compiled by:	<u>SN</u>
Pro	ect Name:	Geotechnical Inves						tudy	Drllling	Machine:	Truck Mount	ted Drill		Reviewed by:	<u>PB</u>
Pro	ject Location:	Bovaird Drive from Boundary at Casele	Lake Louis	e Drive	n, ON.	el/Halt	on		Date S	Started:	Oct 15, 09	_ Date Completed: O	ct 15, 09	Revision No.:	0, 2/9/10
	LITH	OLOGY PROFILE				MPLI	<b>VG</b>			FIELD	TESTING	LAB TESTING	$\Box$		
									-		tionTesting	# Rinse pH Values 2 4 6 8 10 1	2 6	COMMEN &	18
JO.		DESCRIPTION		8	Number	8	901	_	E z	MTO Vane*	PPT • DCPT Nilcon Vane*	Soil Vapour Reading A parts per million (ppm) 100 200 300 400	INSTRUMENTATION	GRAIN SIZ DISTRIBUT	ZE
Lithology Plot				Sample Type	ole Ne	Recovery (%)	N' Value	E E	ELEVATION	Δ Intact ▲ Remould	<ul> <li>Intact</li> <li>Remould</li> </ul>	Lower Explosive Limit (LE W, W W	, MAA	(%)	
5	Local Ground Surfa	ce Elevation: 0.0 m		Same	Sample	Reco	SPT	рертн	EE	* Undrained Shi 20 40	ear Strength (kPa) 60 80	Plastic Liquid 20 40 60 80	INST	GR SA	SI CL
		brown Sand and Gravel FILL						-	_						
▓		moist		SS	1	83	18	t		0		5			
▓								ŀ		1					
▓			0.6					ļ.							
▓		Silty Clay FILL race sand, trace gravel	0.6					ŀ					1 1		
▓		moist						-				25			
▓				SS	2	0	22	-1	-1 -	0		Δ <sup>25</sup>			
▓								ŀ							
▩								ļ.							
▓				-				ł							
▓		trace organics		ss	3	100	23	-		0		10			
▓				33	,		23	t		l					
▓					_			- 2	-2 -						
œ,		brown	<u>-2.1</u> 2.1					ļ.							
Ш	tr	CLAYEY SILT TILL race sand, trace gravel hard			-			ŀ		1 1 1					
21		moist		ss	4	100	33	Ė		0		Δ <sup>25</sup>			
H								Ł							
H								-							
Ш								-3	-3 -						
M		trace oxidation						-							
1				SS	5	100	46	F			<b>o</b>	Δ <sup>30</sup>			
H								ŀ							
И								ŀ							
W								ļ							
倂								Ŀ.							
11			<del>4.1</del>					- 1	٠.						
1	SILT AN	grey ND SAND / SILTY SAND race clay, trace gravel	TILL					Ė		<u> </u>  -		ļ <u>.</u>			
9		very dense moist						ŀ							
Ш				_	_	_		-							
				ss	6	100	61	t			0	Δ <sup>45</sup>	1 1		
9				33	"	100	0,	-							
111		End of Borehole	-5.0 5.0		_	_		5	-5				$\dashv$ $\vdash$		
АМ	EC Earth & Envi	roomental	∇ No tracet												

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 $\frac{\nabla}{2}$  No freestanding groundwater measured in open borehole on completion of drilling.

	ECORD OF BORE	IOLE No.	B	<u>C 18</u>			Drillin	g Location:	Intersection	at Heritage Road		Logged by: _JF	0
	pject Client: AMEC Infrastruct							g Method:		Ild Stem Augering		Compiled by: SN	_
	oject Name: Geotechnical Investigat Legation: Revenied Dates for	Const. District Addition				tudy			Truck Moun		7.00	Reviewed by: PB	
Pro	oject Location: Bovalrd Drive fro Boundary at Case	eley Drive, Bramp	oton, C	ON.		_	Date :	Started:	Oct 27, 09		7,09	Revision No.: 0, 2/9	10
Lithology Plot	DESCRIPTION  Local Ground Surface Elevation: 00 m	Sample Tune	T	Sample Number Recovery (%)	SPT 'N' Value	DEРТН (m)	ELEVATION (m)	Penetra O SPT □ MTO Vane* Δ intect Δ Remould	◆ Intact ◆ Remould ear Strength (kPa)	LAB TESTING  ★ Rinee pH Values 2 4 6 8 10 12  Soil Vapour Reading A parts per million (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL) W, W, Plastic Digid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)	α
988	about 110 mm ASPHAL					ŀ		1					
	Sand and Gravel FILL moist brown Silty Sand FILL trace gravel moist		s	1 94	27			0					
	grey Clayey Silt FILL trace sand, trace grave moist	-	s :	2 22	23	-1	-1 -	0					
	brown to grey SILTY CLAY / CLAYEY SILT hard damp	TTILL S:	s	3 83	49/15			,	8				
	reddish brown trace gravel, trace shale frag	ments S	s	4 100	50/15	-2	-2 -		80 15				
						-3	-3 -						
		S	S	5 100	52/15				58 15				
						-4	-4 -						
	End of Borehole	4.7 S	S	6 100	50/13				3				
Ad	EC Earth & Environmental Invision of AMEC Americas Limited	¥ No freestandi	ing grou	undwater m	neasured	in ope	n boreh	ole on complet	ion of drilling.				
Sca	4 Crockford Boulevard arborough, Ontario nada M1R 3C3 +1(416) 751-6565	Borehole details as p	resented	d, do not con	etitute a t	horougi	h underst	anding of all pot	ential conditions pr	recent and require interpretative a sotechnical recort for which it was	selstance fro	m Scale:	1:32

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Project Number:	OF BOREHOLE I	No.	BC	<u>19</u>				g Location:		of Heritage Road		Logged by: JF Compiled by: SN	Ö
	Geotechnical Investigation f	or Bova	Ird Driv	ve Clas	s EAS	Study	M		Truck Moun			Reviewed by: PB	
Project Location:	Bovaird Drive from Lake Lo				ton		Date	Started:	Oct 15, 09		5, 09	Revision No.: 0, 2/9	V10
	Boundary at Caseley Drive.  DLOGY PROFILE			MPLI	NG		Т	FIELD	TESTING	LAB TESTING			
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT W Value	DEPTH (m)	ELEVATION (m)	O SPT   MTO Vane*  A Intact  A Remould	ntionTesting PPT	# Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading A parts per million (sport) 100 200 300 400  Lover Explosive Limit (LEL) W, W W, Plastic Liquel 20 40 60 80	INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)	CL.
	xrt 200 mm ASPHALT					F		-					
s	grey — — — — — 0	2	_	_		ţ	- 3	1		L			
	brown 0	SS .8	1	78	26			٥		<b>3</b> 30			
	Silty Sand FILL moist	ss	2	94	20	-1	-1 -	0		ar .			
		ss	3	28	17			0		<b>6</b> 65			
trace sand	grey 2 Clayey Silt FILL trace rootlets, trace organics	1				-2	-2 -						
	moist	ss	4	56	12			0		295			
		.0				-3	-3 -	1					
	grey 3 Silty Sand FILL organics, trace rootiets moist	ss	5	100	11			0		A\$***			
						-4	4-						
trace sand, tra	reddish brown 4  CLAYEY SILT TILL be gravel, trace cobbles / boulders hard moist	11											
		SS	6	100	50/10	-	-5 -		8	2 <sup>30</sup>			
trace sand, trai						-	-3-						
						Ē		]					
AMEC Earth & Environ A division of AMEC A 104 Crockford Bouley	mericas Limited	estanding	ground	water m	easured	in ope	n boreh	ole on complet	ion of drilling.				
Scarborough, Ontario Canada M1R 3C3 Tel +1(416) 751-6565 Fax +1(416) 751-759 www.amec.com	Borehole deta	ails as pres totechnical d and the a	ented, do Engineer ccompen	not com r. Also, b lying Exp	stitute a t orehole li lanation	horoug nformat of Bore	h underst ion shouk hole Log'.	anding of all pot d be read in con	ential conditions pr junction with the gr	resent and require interpretative a sotechnical report for which it was	ssistance from	Scale: Page: 1	

### RECORD OF BOREHOLE No. BC 19



Project Number: TT93042 Drilling Location: 20 m West of Heritage Road Logged by: JF

DESCRIPTION    Part   P		LITHOLOGY PROFILE	SC	IL SA	MPLI	VG.			FIELD TESTING	LAB TESTING		
6.1 55 7 100 500 - 58 4								_	PenetrationTesting	2 4 6 8 10 12	NO.	
6.1 55 7 100 500 - 58 4	_	DESCRIPTION	_	ě	_				O SPT □ PPT ● DCPT	Soil Vapour Reading  A parts per million (ppm)	E S	
6.1 55 7 100 500 - 58 4	8	DESCRIPTION	Type	5	30	Valu	ε	ĕ	MTO Vane* Nilcon Vane*	▲ Lower Explosive Limit (LEL)	AE.	DISTRIBUTION
6.1 55 7 100 500 - 58 4	8		ejd	pje	over	ż	Ĕ	V.	▲ Remould ◆ Remould	•	TE I	(%)
God of Bownholm 6.1 5 7 800 807 5 5 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	£		San	San	Bec	S	DE	ELE			SS	GR SA SI CL
	щ	-6.1	- 55	7	100	50/3				ρ		
	- 1	End of Borenoie 6.1							3			
	- 1											
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	- 1											
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	- 1											
	- 1											
	- 1										- 1	
	- 1											
	- 1											
	- 1										- 1	
	- 1											
											- 1	
	- 1										- 1	
											ı	

		OF BORE	HOLE N	o.	BC :	<u>20</u>																m	ec	0
	ect Number:	TT93042	C						Drilling			-	veway #			•					Logge		JF.	
	ect Client:	AMEC Infrastruct			404	- 01			Drilling				0 mm S			Auger	ing				Compi		SN	
	ect Name:	Geotechnical Inv						tudy					ck Mou									ed by:		
Proj	ect Location:	Bovaird Drive fro Boundary at Cas	eley Drive, Bra	ampto	n, ŌN.				Date S				26, 09	_ `		omple			5, 09	_	Hevisk	n No.:	0, 2/9	710
Plot	шн	OLOGY PROFIL  DESCRIPTION	.E		NL SA	MPLI (%)		(m)	(m) NOI	O SP	Penetro	PPT Nik	esting  DCP  con Vane*	Γ	Rinse p 2 4 Soil V parts p 100	H Values 6 6 apour F er million 200 3 Explosive	10 Reading (ppm) (pp 40	12	INSTRUMENTATION		GR	MMEN & AIN SI RIBUT	ΖE	
Lithology Plot				Sample Type	Sample	Recovery (%)	SPT 'N' Value	DEPTH	ELEVATION	▲ R	emould	٠	Remould ength (kPa)		W, Plastic	w	v	,	TALL			(%)		
5	Local Ground Surf	oe Elevation: 0.0 m bout 50 mm TOPSOI		Sar	Sar	ě	Sp	B	3		30 40			+		40 6	D 80		N N	GA	s s	Α	SI	α
	·	brown Sand and Gravel FILL trace to some sit moist		ss	1	58	15			0				5										
		brown Silty Clay FILL race sand, trace grave		ss	2	56	8	-1	-1-	0				Δ	35									
		very stiff moist		ss	3	100	22				0			Δ2	5									
		Sandy Silt FILL trace clay, trace grave moist	<del>2.1</del> 2.1					- 2	-2 -															
		reddish brown	<u>-29</u>	SS	4	100	26				0			Δ	35.									
о ) Д		ND SAND / SILTY SAI trace clay, trace grave very dense moist	NDTILL	ss	5	67	81	- 3 - -	-3 <del>-</del>				0	Δ.	40									
•								-4	4-															
111		reddish brown										-			0									
		WEATHERED SHALE	-4.7	SS	6	100	50/10	-				8		-	. i		0.03							
		End of Borehole	4.7																					
	C Earth & Envi		☑ No freesta	anding	groundw	vater me	asured	in oper	n boreho	e on c	complet	ion of	drilling.			_	_							
104	Crockford Boule		=																					
Tel 4	4 Crockford Boulevard arrborough, Ontario nada MTR 3C3 l+1(416) 751-6565 x +1(416) 751-7592 commissioned and the accompanying Explanation of Borehole Log.													cale: 1	1:32 of 1									

		OF BOREH	IOLE N	<b>)</b> .	BC :	<u>21</u>			Dellin	-1	elaa.	Datuman (	NJ	#05	20				an	16	c	9
	oject Number: oject Client:	TT93042  AMEC Infrastruct	ure Group						Drilling	g Loca		150 mm						_	ogged by: ompiled by	r: Si	N	
	oject Client: oject Name:	Geotechnical Inve		Royal	rd Driv	e Clas	e FAS	turty		-		Truck Mou			ogern	·9			eviewed b	_		
	eject Location:							tooj	Date 9	-		Oct 26, 09			molete	ed: Oct	26.09		evision No	_		0
-		Boundary at Case	eley Drive, Bra	ampto	n, ON.			_	T								1		01131011110		23.	_
Lithology Plot		DESCRIPTION  see Develops: 9.0 m	E	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	<b>DEPTH (m)</b>	ELEVATION (m)	O SP1  MTO  Δ Int  A Re	Penetra T D Vane* sact emould	○ Intact ◆ Remould ear Strength (kP)	PT	Rinee pH Soil Var parts per 100 20 Lower Ex W,	6 8 pour Re mi≣on (p po 300	10 12 lading pm) 400 imit (LEL) W,	INSTRUMENTATION INSTALLATION	GR GR	COMME & GRAINS DISTRIBI (%)	SIZE		a
	a	brown  brown  brown  Send and Gravel FILL  some sit  moist	<del>02</del>	ss	1	63	4			0			0									
	trace sar	grey Silty Clay FILL nd, trace gravel, trace of moist	0.7	ss	2	o	7	-1	-1-	0			<u>_</u> 10									
	t	brown  CLAYEY SILT TILL race sand, trace gravel very stiff moist	1.4	ss	3	67	26	- 2	-2 -		o		△15									
0		reddish brown ND SAND / SILTY SAN trace clay, trace gravel very dense moist		ss	4	100	50/13					8 <b>9</b> .	10									
0		some shale fragments		SS	5	91	50/13	3	-3 -			50 13	Δ <sup>20</sup>									
		reddish brown WEATHERED SHALE	<del>-4.0</del>					-4	-4 -													
			-		1		50															
	Auş	End of Borehole ger refusal at 4.7 m deg	-4.6 4.6 bth.	22	6	100	50/5					5	5	-5								
A d	IEC Earth & Envi fivision of AMEC 4 Crockford Boule arborough, Ontari nada M1R 3C3	Americas Limited evard	No freesta												ules let-	manush.	anistano f					

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	ECORD OF BOREHOLE N	о.	BC:	22								am	ec®
	ect Number: TT93042			-				Location:		f Driveway #2578		Logged by:	JF
	ject Client: AMEC Infrastructure Group							Method:		Ild Stem Augering		Compiled by:	SN
	ect Name: Geotechnical Investigation for					tudy			Truck Mount			Reviewed by:	
Pro	ect Location: Bovaird Drive from Lake Louis Boundary at Caseley Drive, Bo	rampto	n, ON.			_	Date S	Started:	Oct 26, 09	_ Date Completed: Oct 2	6, 09	Revision No.:	0, 2/9/10
	LITHOLOGY PROFILE	sc	AL SA	MPLI	NG		├—	FIELD	TESTING	LAB TESTING  * Rinse pH Values	,	COMMEN	Te
Lithology Plot	DESCRIPTION  Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	<b>DEPTH (m)</b>	ELEVATION (m)	O SPT □ MTO Vane* Δ intact Δ Remould	<ul> <li>♦ Intact</li> <li>♦ Remould</li> </ul> near Strength (kPa)	2 4 6 8 10 12 Soll Vapour Reading A parts per million (pm) 100 200 300 400 A Lover Explosive Limit (LEL) W, W W Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	& GRAIN SI DISTRIBUT (%)	ZE
	brown Silty Sand FILL trace to some gravel moist -0.7	ss	1	71	18	-		0		,0			
	brown 0.7  Clayey Silt FILL  trace sand, trace rootlets moist	ss	2	56	12	-1	-1-	0		△15			
	brown  SILT AND SAND / SILTY SAND TILL  trace clay, trace gravel compact to very dense moist	ss	3	89	28	- 2	-2-	o		Δ <sup>25</sup>			
		ss	4	78	36			٥		∆ <sup>15</sup>			
		ss	5	100	50/15	3	-3 -		80 15	∠10			
0.00						4	4-						
9	trace shale fragments	ss	6	83	50/15	ŀ	-		58 15	∆ <sup>10</sup>			
ld l	End of Borehole 4.9	-	-		-	-							
A di 104	C Earth & Environmental vision of AMEC Americas Limited Crockford Boulevard torough, Ontario	tanding	groundw	vater me	asured	in open	boreho	le on complet	ion of drilling.				

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Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Lucy.

Scale: 1:32

ı	ECORD OF BOREHOLE No ject Number: TT93042	о.	вс	<u>23</u>			Drilling	g Location:	Driveway #2	578		and	ec®
	ject Client: AMEC Infrastructure Group							g Method:		ilid Stern Augering			SN
	ject Name: Geotechnical Investigation for	Boval	rd Driv	re Clas	s EAS	tudy			Truck Moun			Reviewed by:	
	ect Location: Boyaird Orive from Lake Louis	e Driv	e to Pe	e/Halt				Started:	Oct 26, 09	Date Completed: Oct 2	6, 09	Revision No.:	
-	Boundary at Caseley Drive, Br	ampto	n, ON. NL SA			_	1		TESTING	LAB TESTING			
	DINOLOGY PHOPILE	30		MPLI	NG.		Ê	Penetra	tionTesting	★ Rinee pH Values 2 4 6 8 10 12 Soil Vapour Reading	INSTRUMENTATION INSTALLATION	COMMEN &	
Piot	DESCRIPTION	98	Sample Number	3	'N' Value	Ê		MTO Vane* Δ Intact	Nilcon Vane*	A parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL)	ATIO	GRAIN SI	
Lithology Plot		Sample Type	a eldu	Recovery (%)	ź	ОЕРТН (m)	ELEVATION	▲ Remould	Remould ear Strength (kPa)	W, W W	TALL	(%)	
£	Local Ground Surface Elevation: 0.0 m brown	ß	Sa	ě	SPT	B	3	20 40		Plastic Liquid 20 40 60 80	SS.	GR SA	SI CL
	Sand and Gravel FILL moist	ss	1	75	30					<u>.</u> 5			
	-0.9												
9 9 9	brown 0.9  SILT AND SAND/ SILTY SAND TILL  trace clay, trace gravel compact to very dense moist	ss	2	100	19	-1	-1 -	0		A <sup>10</sup>			
•		ss	3	100	51				0	Δ <sup>35</sup> .			
						- 2	-2 -						
		ss	4	100	47				0	Δ <sup>25</sup>			
0	some cobbles / boulders	ss	5	100	50/15	- 3	-3 -		g B	Z <sup>10</sup>			
•													
0 0 0						-4	-4 -				н	ard augering	
0								]					
Ш	-4.6 End of Borehole 4.6	ss	6	100	50/3	-			<u>8</u>	0			
Adi	EC Earth & Environmental vision of AMEC Americas Limited Crockford Boulevard	tanding	ground	water me	easured	in ope	n boreho	ole on complete	on of drilling.				

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		OF BORE	HOLE N	o.	BC :	24			Deller			00 W			******				am	ec	0
	ject Number:	TT93042	hum Croum							Location		20 m West							ogged by:	JF CN	
	ject Client:	AMEC Infrastruct		D		- 01	- 54.0			Method		150 mm S			ugering	1			ompiled by:	SN	
	ject Name:	Geotechnical Inv						tuay		) Macnir Started:	10:	Truck Mour							eviewed by:		
PIO	ject Location:	Boundary at Cas	eley Drive, Bra	ampto	n, ON.				Dates		_	Oct 26, 09				i: Oct 2	5, 09	. "	evision No.:	0, 2/9	10
Lithology Plot	шн	OLOGY PROFIL DESCRIPTION	E	Sample Type	Samble Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Per OSPT MTOV Δ Intact ▲ Rem	netrat	onTesting  PPT	S A pi	oil Vap oil Vap ors per r xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	cour Rea million (ppr 0 300 skostve Lim W	10 12 ding m)	INSTRUMENTATION INSTALLATION		COMMEN & GRAIN SI DISTRIBUT (%)	ZE TON	
5	Local Ground Surfa	ce Elevation: 0.0 m bout 100 mm TOPSO	L -0.1	Sa	Sa	å	ß	ä	<u> </u>	20	40	60 80		0 40		80	žž	GR	SA	SI	α
		brown Gravel and Sand FILL moist		ss	,	63	7			0			5								
	t	brown Silty Clay FILL race sand, trace grave moist	0.7	SS	2	67	8	- 1	-1	0			∆ <sup>15</sup>								
		brown Sendy Sift FILL trace clay moist		ss	3	78	9			0			Δ <sup>15</sup>								
	SILT A	brown ND SAND / SILTY SAN trace gravel very dense moist	— — — <del>-2.4</del> ND TILL	SS	4	100	50/15	- 2	-2		56	}	Δ <sup>25</sup>								
0 0 0	ti	race cobbies / boulder	s	SS	5	100	50/15	-3	-3 -		50	>	<b>A</b> 5								
		reddish brown WEATHERED SHALE	4,0 4.0					-4	4-												
		End of Borehole	-4.6 4.6	SS	5	100	50/5				5		5								
A dir 104 Sca	Crockford Boule rborough, Ontari	Americas Limited ward	꽃 No freest																		
Tel -	ada MTR 3C3 +1(416) 751-656 +1(416) 751-759 xamec.com		Borehole details a qualified Geote commissioned at	as press chnical I nd the ac	nted, do Engineer. compeny	not cons Also, bo ying Expl	titute a th rehole in anation o	orough formatik f Boreh	understa on should tole Log'.	nding of all be read in	l poter conju	tial conditions p action with the g	resent a potechni	nd requ Ical rep	ire interp ort for wh	retative as ich it was	elstance fr	om	- 1	Scale: 1 age: 1	

R	ECORD	OF BORE	IOLE N	o. !	BC :	<u> 25</u>								amec	,
Pro	ject Number:	TT93042							Drilling	Location:	170 m West	of Driveway #2594		Logged by: JF	_
Pro	ject Client:	AMEC Infrastruct	ure Group						Drilling	Method:	150 mm So	id Stem Augering		Compiled by: SN	_
Pro	ject Name:	Geotechnical inve	estigation for	Bovai	rd Driv	e Clas	s EA S	tudy	Drilling	Machine:	Truck Moun	ted Drill		Reviewed by: PB	_
Pro	ject Location:	Bovaird Drive from	m Lake Louis	e Drive	to Pe	el/Halt	on		Date S	started:	Oct 28, 09	Date Completed: Oct 2	8, 09	Revision No.: 0, 2/9/10	_
	ЦТН	OLOGY PROFIL				MPLI	NG	Г	Т	FIELD	TESTING	LAB TESTING			_
Lithology Ptot		DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact Δ Removald * Undrained Sh	♦ Intact ♦ Remould ear Strength (kPa)	Darts per melon (ppm) 100 200 300 400  ▲ Lower Explosive Limit (LEL) W, W, W, Plastic Liquid	INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CI	L
▩		brown brown Sand and gravel FILL		- vo	- vo	u.	- 00	-		20 40	w w	20 40 60 80	==		_
	,	trace silt moist		ss	1	67	30			0		0			
				ss	2	78	18	- 1	-1	o		0			
	t	reddish brown Silty Clay FILL race sand, trace grave moist		ss	3	67	13			o		٥			
								- 2	-2 -						
				SS	4	56	12			0		0			
				SS	5	67	6	-3	-3-	o		٥			
GI)		orown to reddish brown	4.0					- - -	4-						
		trace sand stiff to hard moist													
				SS	6	56	14	- 5	-5 -	О		o			
								-							
	EC Earth & Envi		☑ No freest	anding	grounde	vater me	asured	in one	n boreho	le on complet	ion of drilling				_
104	Crockford Boule		=						-						
Car	rborough, Ontar ada M1R 3C3	0	Borehole details	as prese	nted, do	not cons	titute a ti	horough	understa	nding of all pote	ential conditions p	resent and require interpretative as	elstance fro	om I a	_

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Continued on Next Page

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log.

# RECORD OF BOREHOLE No. BC 25

amec®

Project Number: TT93042 Drilling Location: 170 m West of Driveway #2594 Logged by: JF

	LITHOLOGY PROFILE	SC	IL SA	MPLI	NG			FIELD TESTING	LAB TESTING		
							(E)	PenetrationTesting	* Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading	INSTRUMENTATION INSTALLATION	COMMENTS &
Jot.	DESCRIPTION	8	m per	(%)	3	·		O SPT PPT • DCPT  MTO Vane* Nilcon Vane*	100 200 300 400	FINTA	GRAIN SIZE DISTRIBUTION
99		Sample Type	Sample Number	Recovery (%)	SPT Nº Value	DEРТН (m)	ELEVATION	Δ Intact ♦ Intact  Δ Remould ♦ Remould	Lower Explosive Limit (LEL) W, W W,	ALLA	(%)
5		Samp	Samo	Явсо	SPT	DEP	ELE	* Undrained Shear Strength (kPa) 20 40 60 80	Plastic Liquid 20 40 60 80	INST	GR SA SI CL
Lithology Plot	trace shale fragments	ss	7	100	50/15	-	-	58 18	5		
nn	End of Borehole 62	33	<u> </u>	100	50/15		_	15			

R	ECORD	OF BORE	HOLE N	o. !	BC:	<u> 26</u>														a	m	ec	V
Pro	ject Number:	TT93042							Drilling	Location:	50	m East o	of Dri	veway	#270	2			l	ogged	by:	JF	
Pro	ject Cllent:	AMEC Infrastruct	ure Group						Drilling	Method:	1	50 mm S	olld S	Stem	Augeri	ing			(	Compile	d by:	SN	_
Pro	ject Name:	Geotechnical Inv	estigation for	Boval	rd Driv	e Clas	s EAS	tudy	Drilling	Machine:	T	uck Mour	nted	Drill					F	Reviewe	d by:	PB	
Pro	ject Location:	Bovaird Drive fro Boundary at Case	m Lake Louis	e Drive	to Pe	el/Halt	on		Date 9	Started:	0	ct 28, 09	_ D	ate C	omple	ted: C	Oct 28	3, 09	. F	Revision	No.:	0, 2/9/	10
	LITH	OLOGY PROFIL				MPLI	NG		T	FIELD	TE	STING	I		TES						_		
												Testing		4	6 8	10		NOIL		COM	MEN &	rs	
ğ		DESCRIPTION		8	mper	3	3		E z	O SPT D		● DCP1	ΙΔ.	parts pe	apour P r million 100 30	(pppm)	* I	NOT			IN SIZ		
P Vgo				te Tyj	S S	Recovery (%)	'N' Value	E H	E	Δ Intact ▲ Remould	0		-	Lower E W,	xplosive W	Limit (LI W		LEA.		DISTR	(%)	ON	
Lithology Plot	Local Ground Surfa	ce Elevation: 0.0 m		Sample Type	Sample Number	Reco	SPT '	DEPTH	ELEVATION			trength (kPa) 50 80		Plastic 20	40 6	Liqui 80		INSTRUMENTATION INSTALLATION	GR	SA		a	α
		brown Sand and Gravel FILL						-	-				Т										
		moist		ss	1	75	30	t			l		5	.i									
				33		,,,	~	-					Ī										
								ţ				<u>ii</u>	ļ	.i									
								ŀ		1			1										
		trace clay						F			ļ	ļļ		ļ	į								
				SS	2	100	20	-1	-1 -	0			ł°										
								-				ļ <u>i</u>	ļ	.i	i								
								ţ															
					_	_	_	ł				ļļ			ļ								
				ss	3	100	30	F					lo										
		trace asphalt debris		33	3	100	30	t				ļ <del>ļ</del>	Ť	ļ	-								
				_			-	- 2	-2 -														
		grey						Ė				<u> </u>	ļ										
	trace sand,	Clayey Sift FILL trace organics and ye moist	ellow stains					ŀ					ı										
		most		SS	4	100	18	F	- 3	0			0	·	:								
								t					1				- 1						
			-2.9					ŀ					1										
H		CLAYEY SILT TILL						- 3	-3 -														
		trace sand hard						ŀ															
Ж		damp		SS	5	100	32	-		0		ļļ	ł°.	į									
批								ļ					1										
섺								ŀ				ļļ	ļ	ļ	1								
M								F					1										
Ж								Ļ₄	-4-					.j									
批								-					1										
輧		reddish brown						F				inning	1	ģ.									
N								t															
Ж			-4.7	SS	6	100	50/13	ŀ			50		0										
- COLOR		End of Borehole	4.7								13		Τ	-									
													1			-							
													1			0	- 1						
													ı			i							
													1			-	- 1						
			☑ No freest	andina	atounde	rater me	asured	in one	n boreho	ie on comoin	etion :	of drilling	_	_	-	-	_						
AMEC Earth & Environmental A division of AMEC Americas Limited 104 Crockford Bouldward  The Procedure of Control of Contr												a urang.											
Car	rborough, Ontari ada M1R 3C3 +1/416) 751-656		Borehole details	as press	nted, do	not cons	Citute a ti	horough	understa	nding of all po	tentia	conditions	resent	and re	guire int	erpretal	tive as	sistance f	rom	$\neg$		calo: 1	. 22

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a qualified Geotechnical Engineer. Also, borehole information should commissioned and the accompanying Explanation of Borehole Log.

RI	ECORD OF BOREHOLE	No.	вс	27												am	ec®
Pro	ject Number: TT93042						Drilling	Location	: !	Driveway #2	702					Logged by:	JF
Pro	ect Client: AMEC Infrastructure Group						Drilling	Method:		150 mm So	lid St	em A	ugering			Compiled by:	SN
Pro	ect Name: Geotechnical Investigation	or Bova	ird Driv	re Clas	s EAS	tudy	Drilling	Machine	: :	Truck Moun	ted Dr	111				Reviewed by:	PB
Pro	ect Location: Bovaird Drive from Lake Lo Boundary at Caseley Drive,	ulse Driv	e to Pe	el/Halt	on		Date S	Started:	!	Oct 28, 09	_ Dat	e Cor	mpleted: 6	Oct 2	8, 09	Revision No.:	0, 2/9/10
	LITHOLOGY PROFILE			MPLI	NG			FIEL	DΤ	ESTING	_		TESTING				
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT  MTO Van  Δ Intact  A Remoul  * Undrained	Pi Hd Sheer	nTesting PT   DCPT Nilcon Vane* O Intact Remould Strength (kPa)	Sc ps 10	wer Exp	5 8 10 cour Readin million (ppm) 0 300 40 closive Limit (L W V	O EL) V	INSTALLATION	COMMEN & GRAIN SI DISTRIBUT (%)	ZE
2.2	Local Ground Surface Elevation: 0.0 m about 100 mm TOPSOIL .0	.1	5	-	S		<u> </u>	20	40	60 80	20	9 40	60 8	0	==	uri uri	J
	brown Sand and Gravel FILL trace to some sit, trace rootlets moist	SS SS	,	75	8			0	÷		0						
	reddish brown Silty Clay FILL trace sand, trace gravel, trace oxidation moist	ss	2	0	12	-1	-1	0			0						
	reddish brown CLAYEY SILT TILL trace shale fragments hard damp	ss	3	100	38	- 2	.2 -		0		o						
		ss	4	100	50/15				50 15	,	o						
		SS	5	100	50/13	-3	-3 -		50 13	)	5						
						4	4-		<u>.</u>								
		6.6 SS	Б	100	50/5				50	,	5						
	EC Earth & Environmental																
A di 104	vision of AMEC Americas Limited Crockford Boulevard rborough, Ontario	estanding	ground	water me	easured	n oper	n boreho	le on comp	letion	of drilling.							

R	ECORD	OF BORE	HOLE N	o.	BC	28											am	ec®
Pro	ject Number:	TT93042							Drllling	Location	n: <u>C</u>	riveway #2	719				Logged by:	JF
Pro	ject Client:	AMEC Infrastruct	ure Group						Drilling	Method:		50 mm Sc	lid Sten	Auger	ing		Compiled by:	<u>SN</u>
Pro	ject Name:	Geotechnical Inve	estigation for	Bovai	rd Driv	e Clas	s EA S	tudy	Drilling	Machine	: <u>T</u>	ruck Moun	ted Drill				Reviewed by:	PB
Pro	ject Location:	Boundary at Case	m Lake Louis eley Drive, Bra	e Drive	e to Pe	el/Halt	on		Date S	Started:	2	ct 28, 09	_ Date	Comple	ted: Oct 2	8, 09	Revision No.:	0, 2/9/10
	ЦТН	OLOGY PROFIL				MPLI	NG			FIEL	DΤ	STING		B TES		,	COMMEN	me
Lithology Plot	Local Ground Surb	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT  MTO Var  Δ Intact  Δ Remox  'Undrained	ne" i	Filcon Vane* Intact Remould Strength (kPa)	Soil A parts 100	Vapour F per million 200 30 Explosive W	10 12 Reading	INSTRUMENTATION	GRAIN SI DISTRIBUT (%)	ZE
8		brown	0.1					-										
		Sand and Gravel FILL moist		ss	1	100	29			o			o					
			<u>1.4</u>	ss	2	100	16	-,	-1-	٥			0					
		grey Sitty Clay FILL trace sand moist  reddish brown CLAY / CLAYEY SILT trace shale fragments hard	<u>1.8</u> 1.8	ss	3	100	82	-2	-2 -			0	o					
		damp		SS	4	100	50/13				50 13		o					
				SS	5	100	50/5	-3	-3		505		0					
								-4	4-									
		End of Borehole	-4.6 4.6	-55	•	100	503	-	-		59 <u>.</u>		5					
	EC Earth & Envi	ronmental Americas Limited	No freest	anding (	groundv	vater me	nasured	in open	boreho	le on comp	eletion	of drilling.						

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		OF BORE	HOLE N	o.	BC:	<u>29</u>										а	m	ec	0
	ject Number:	TT93042								Location		Driveway #2				Logged	-	JF_	_
	ject Cllent:	AMEC Infrastruct			404	01				Method		150 mm So				Compile		SN	_
	ject Name: ject Location:	Geotechnical Inv Boyalrd Drive fro						tudy		machine Started:		Truck Moun Oct 28, 09		Completed: Oct :		Revisio	ed by:		
FIO		Boundary at Cas	eley Drive, Br	ampto	n, ON.			_	Date						T T	Hevisio	11140	0, 23	
Lithology Plot	шн	OLOGY PROFIL DESCRIPTION	Æ	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DЕРТН (m)	ELEVATION (m)	Pend O SPT MTO Var Δ Intact Δ Remov	etration P	ESTING  onTesting  PT	Soil A parts	Vapour Reading per million (ppm) 200 300 400 r Explosive Limit (LEL) W.	INSTRUMENTATION	GR/ DIST	MMEN & AIN SIZ RIBUT (%)	ZE ION	
. <del>5</del>		brown		Sa	S.	æ	S.	-	<u> </u>		40		20	40 60 80	22	GR S	. :	St	CL
		Sand and Gravel FILL moist	-0.6	ss	1	79	32			c	,		0						
	tra	dark grey Clayey Silit FILL ace sand, trace organi moist	0.6 cs	ss	2	78	14	- 1	-1-	0			o						
		reddish brown CLAYEY SILT TILL trace shale fragments hard damp		ss	3	100	50/15				50 15	,	o						
								- 2	-2 -										
				SS	4	100	50/13				50 13	,	o						
				ss	5	100	50/10	-3	-3 -		50		o						
											:								
								-4	.4-										
CK)		End of Borehole	-4.6 4.6	SS	6	100	50/5				50		0						
A di 104	Crockford Bould	Americas Limited ward	Ÿ No freest	anding (	groundw	vater me	asured	in oper	n boreho	le on comp	pletion	of drilling.							
Tei - Fax	rborough, Ontari ada M1R 3C3 +1(416) 751-656 +1(416) 751-75 x.amec.com	55	Borehole details a qualified Geote commissioned as	chnical E	inginger.	. Aleo, bo	rehole in	formatic	on should	nding of all be read in o	potent	fal conditions pr ction with the gr	esent and otechnical	require interpretative a i report for which it was	esistance fro	m		cale: 1 ge: 1	

R	ECORD	OF BOREH	OLE N	o.   !	ВС	<u>30</u>													amec
Pro	ject Number:	TT93042			_		_	-	Drillin	g Loca	ation:	35 1	m East o	f Driv	eway	#277	4		Logged by: JF
-	ject Client:	AMEC Infrastructure	e Group						Drillin	g Meth	nod:	150	mm Sc	olld S	tem A	lugeri	ng		Compiled by: SN
Pro	ject Name:	Geotechnical Invest	tigation for	Boval	rd Driv	re Clas	s EAS	tudy	Drillin	g Mac	hine:	Tru	ck Moun	nted D	rill		-		Reviewed by: PB
Pro	ject Location:	Bovaird Drive from Boundary at Casele	Lake Louis	e Drive	to Pe	el/Halt	ton		Date :	Starte	d:	Oct	28, 09	_ Da	te Co	omple	ted: Oct 2	28, 09	Revision No.: 0, 2/9/10
	LITH	OLOGY PROFILE	y Dilve, Di	SC	IL SA	MPLI	NG		T	F	IELD	TES	TING	T	LAB	TES	TING		
Lithology Piot	Local Connect Surfa	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SP MTO △ In ▲ R	Vane* tact emould	PPT Nilc	esting  DCPT  on Vane* Intact Remould  ength (kPa)	4 p	oil Va arts per 00 2 ower E	million (	10 12 leading ppm) 0 400 Limit (LEL) W, Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		con Elevation: 0.0 m court 120 mm ASPHALT	-0.1					-				i							
▓		Sand and Gravel FILL	-0.3	3				ŀ	8	1									
*		reddish brown Sitty Clay FILL	0.3					Į.		1				-				1 1	
▓		moist	-0.6	SS	1	56	10	ŀ	6	0				Į°.					
SP.	SILTY	reddish brown CLAY / CLAYEY SILT T	0.6							1				1				1 1	
117		sand, trace shale fragme hard						ŀ	9	ł									
И		damp						Ļ,	-1 -	1		50	ender.	1.				1 1	
K				SS	2	83	50/15	-		1		8		†°					
挧							_	t	59										
PAR								-		1		-		1					
W				SS	3	100	50/8	ł	- 8			8		0					
	1							F	- 5	1		8						1 1	
扰								ŀ				eri)							
d.								L 2	-2 -	1		-	1						
112								-		ł			İ						
		grey to reddish brown WEATHERED SHALE	21					ŧ		1		20							
		damp		SS	4	100	50/13	F		-		803		ł°.				1 1	
								ŀ	8	1		1						1 1	
								[		1									
								ŀ	- 3	1				1					
				- 3				L3	-3 -	1		_ :		1					
				SS	5	100	50/8	1				8		10				1 1	
								t	- 5	1		2 1		1					
								ŀ		1		~~!		1			man from		
			- 1					t	3	1				1				1 1	
								F				•••••					•••••	1 1	
								ŀ		1								1 1	
								-4	-4 -			]							
								ŀ		1		- 1		1					
										1								1 1	
								ŀ	8	1		- 1							
		5-1-15	-4.6	ss		100	503	_				8		0				1 1	
		End of Borehole	4.6									3							
												-							
												- 8		1					
						1						- 1						1 1	
												-							
												-							
												-							
												-							
_	E0 E		_								:	:		1_	_		-		
Ad		Americas Limited	¥ No freest	anding	ground	water m	easured	in ope	n boreh	ole on o	complet	ion of	drilling.						
Sca	Crockford Bouk arborough, Ontar nada M1R 3C3				110000			21.07	_									DESCRIPTION OF THE PROPERTY OF	

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		OF BOREH	IOLE N	<b>o.</b>	вс	<u>31</u>			-								am	eď	9
	ject Number:		0							Location		Driveway #		Ausadas			Logged by:	JF CN	
	ject Cllent:	AMEC Infrastructu		D	-40-	- 0	- 540			Method		150 mm S		Augering				SN	
	ject Name:	Geotechnical Inve						tuay				ruck Mour		Completed		0.00	Reviewed by:		
PIO	ject Location:	Boundary at Case	ley Drive, Br	ampto	n, ON.			_	Date	Started:		Oct 28, 09		Completed		0, 09	Revision No.:	0, 2/9/1	
	штн	OLOGY PROFILE	E	SC	OIL SA	MPLI	NG		<b>├</b>			STING		B TESTIN	VG	z	COMMEN	TS	
Lithology Plot	Local Ground Surf	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT N' Value	DEРТН (m)	ELEVATION (m)	O SPT MTO Va Δ Intact Δ Remo	ne"	nTesting  T	100	/apour Rea er million (ppr 200 300 Explosive Lim W	400	INSTRUMENTATION	GRAIN SI DISTRIBUT (%)	ZE	cı.
***	~a	bout 70 mm ASPHALT brown	<del>%</del> +					-											
	!	Sand and Gravel FILL trace to some sit moist		ss	1	56	12			0	-		o						
<b>**</b>		reddish brown	<del>-0.8</del>					-			1								
	trace	CLAYEY SILT TILL sand, trace shale fragm hard damp		ss	2	78	58	- 1	-1 -			0	0						
		grey WEATHERED SHALE	1.4	SS	3	100	50/10	-			50	<u>.</u>	5						
		limestone seams damp			Ť	100	50.10				10								
								_2	-2 -										
								ŀ				1-1-	ļi	t					
				SS	4	100	50/8	-			50		5						
								-											
								-											
				SS	5	100	50/5	- 3	-3 -		50	de la	0	+					
												-ll	ļ						
								-			1								
								Ė											
								-4	-4 -		Ť		1						
								ŀ				ļļ	ļ						
		reddish brown						Ė			. 59		10						
		End of Borehole	-4.6 4.6	SS	6	100	305				5								
A di 104	EC Earth & Envi ivision of AMEC Crockford Bouk irborough, Ontar	Americas Limited evard	☑ No freest	anding	groundv	water me	easured	in oper	n boreho	ie on com	pletion	of drilling.							

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R	ECORD	OF BOREHO	LE No	o.	BC :	<u>32</u>								amec
Pro	ect Number:	TT93042							Dritting	Location:	40 m West o	of Driveway #2774		Logged by:JF
Pro	ect Client:	AMEC Infrastructure	Group						Dritting	Method:	150 mm Sc	olid Stem Augering		Compiled by: SN
Pro	ject Name:	Geotechnical investig	ation for	Boval	rd Driv	e Class	EA S	tudy	Dritting	Machine:	Truck Moun	ted Drill		Reviewed by: PB
Pro	ject Location:	Bovaird Drive from La Boundary at Caseley	ke Louis	e Drive	e to Pe	eVHalt	on		Date 9	tarted:	Oct 28, 09	Date Completed: Oct 28	, 09	Revision No.: 0, 2/9/10
	LITH	OLOGY PROFILE	Drive, Dra			MPLI	VG			FIELD	TESTING	LAB TESTING	Т	
Lithology Plot	Local Ground Surh	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	<b>DEPTH</b> (m)	ELEVATION (m)	OSPT □ MTO Vane* Δ Intact ▲ Remould	♦ Intact ♦ Remould hear Strength (kPa)	# Rree pH Values 2 4 9 10 12 Soil Vapour Reading A parts per million (ppm) 100 200 300 400  Lower Explosive Limit (LEL) W, W W, B 0 Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS &     GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
		brown Sand and Gravel FILL moist		ss	2	79	25			0		0		
		reddish brown CLAYEY SILT TILL trace shale fragments hard damp	<u>-1.4</u> 1.4	ss	3	100	50/5	- 2	-2-		<b>8</b>	0		
8 6 7 6 8				SS	4	100	50/5				80	0		
				SS	5	100	50/5	-3	-3 -		50 5	.86		
				SS	6	100	50/5	4	-4		<b>9</b>	<b>3</b>		
Au	EC Earth & Envi	End of Borehole	4.6								5			
		Americas Limited =	No freesta	anding	groundy	vater me	asured	in oper	n boreho	e on complet	tion of drilling.			

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1	ECORD	OF BOREI	HOLE N	0.	вс	33			Drillin	g Location:	Driveway #	2838			<b>a</b>	me	c <sub>©</sub>
	ject Client:	AMEC Infrastruc	ture Group							g Method:	150 mm Sc		Augering		Compile		SN
Pro	oject Name:	Geotechnical Inv	restigation for	Boval	rd Driv	re Clas	s EA S	tudy	Drillin	g Machine:	Truck Mour	nted Drill			Reviewe	d by: P	В
Pro	ect Location:	Bovaird Drive fro					on		Date :	Started:	Oct 27, 09	_ Date 0	Completed: Oct 2	7, 09	Revision	No.: 0	, 2/9/10
	ЦТН	OLOGY PROFIL				MPLI	NG			FIELD	TESTING		BTESTING				
Lithology Plot	Local Ground Burk	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact ▲ Remould	ppT ● DCPT Nilcon Varie* ○ Irsact ● Remould ear Strength (kPa) 60 80	Soil V A parts p	pH Values 6 8 10 12 /apour Reading er million (ppm) 290 390 490 Explosive Limit (LEL) W Liquid 40 60 80	INSTRUMENTATION	GRA DISTR	MENTS & IN SIZE IBUTIO (%)	E
			-0.2							1							
	,	brown Sand and Gravel FILI trace to some sit moist	0.2	ss	1	83	18			0		<b>Å</b> °					
			.14	ss	2	78	17	- -1 -	-1 -	O		ļ.					
	,	brown Sandy Silt FILL race clay, trace grave moist	7 ·	SS	3	56	12	- 2	-2 -	0		°					
		brown CLAY / CLAYEY SIL id, trace gravel, trace salf moist		ss	4	100	12			0		<u></u>					
m n				ss	5	100	18	- 3 - 3	-3 -	o		∆ <sup>10</sup>					
	SILTA	orown to reddish brow ND SAND / SILTY SAI clay, trace shale frage hard wet	ND TILL					- - - - 4 - <u><u>-</u> -</u>	-4 - Z Z								
φ. •			-5.0	ss	6	100	70	- - - - - 5	-5 -		o	<b>₽</b> 10					
		End of Borehole	5.0														
Ad	EC Earth & Envi	Americas Limited	⊈ Groundwa	ater dep	oth on co	ompletio	n of drilli	ng on	10/27/2	009 at a depth	of: <u>4.1 m</u> .						
Sca Car Tel	rborough, Ontari nada M1R 3C3 +1(416) 751-656	5	a qualified Geote	christal 8	Engineer.	Also, bo	rehole int	ormetic	on should	ending of all pote	ential conditions p	resent and re	equire interpretative as report for which it was	elstance from		Sca	ale: 1 : 32
	(+1(416) 751-75 w.amec.com	92	commissioned ar	nd the ac	company	ying Expir	enetion of	Boreho	ole Log'.								e: 1 of 1

R	ECORD	OF BOREHOLE	No	o.	BC	<u>34</u>								amec
Pro	ject Number:	TT93042				7-20-	_		Dritting	Location:	Driveway #2	2809		Logged by: JF
Pro	ject Client:	AMEC Infrastructure Grou	up	_					Dritting	Method:	150 mm So	olid Stem Augering		Compiled by: SN
Pro	ject Name:	Geotechnical Investigatio	n for	Boyal	rd Driv	re Clas	8 EAS	Study	Drilling	Machine:	Truck Moun	ted Drill		Reviewed by: PB
Pro	ject Location:	Bovaird Drive from Lake I Boundary at Caseley Driv	Louis	e Drive	e to Pe	el/Halt	on		Date S	Started:	Oct 27, 09	_ Date Completed: Oct 2	7, 09	Revision No.: 0, 2/9/10
	ЦТН	OLOGY PROFILE	0,01			MPLI	NG			FIELD	TESTING	LAB TESTING		I STATE OF THE STA
Lithology Plot	Local Ground Surf.	DESCRIPTION  See Birection: 0.0 m  out 200 mm ASPHALT		Sample Type	Sample Number	Recovery (%)	SPT W Value	DЕРТН (m)	ELEVATION (m)	O SPT □ MTO Vane* Δ insect Δ Remould	etionTesting PPT   DCPT Nilcon Vane*    Infact    Pernoud eer Strength (kPa) 60 80	# Pirse pH Values 2	INSTRUMENTATION INSTALLATION	GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
			-0.2 0.2					t	- 8					
		brown Sand and Gravel FILL some sit moist		ss	1	83	13			0		<b>5</b> 5		
	tra	brown Silty Sand FILL ce gravel, trace organics moist	-0.8 0.8	ss	2	78	7	-,	-1	o		<b>7</b> ₽10		
	Sin trace sar	brown to dark grey y Clay / Clayey Silt FILL d, trace gravel, trace organics moist	-1.7 1.7	ss	3	67	12	- 2	-2-	o		Δ2814		
				ss	4	89	11			0		∆ <sup>25</sup> o <sup>23</sup>		
	SILTY	Drown CLAY/CLAYEY SILT TILL	-3.4 3.4	ss	5	56	6	- - 3 - -	-3 -	o		∆ <sup>2</sup> 5 <sup>17</sup>		
		ace sand, trace cobbles firm moist	-43					-4	4-					
0		brown ND SAND / SILTY SAND TILL trace clay, trace gravel loose wet	4.3					1	Z - -					
		End of Borehole	-5.0 5.0	ss	6	100	8	- - - 5	-5 -	0		∆ <sup>3</sup> 816		
A d 104	EC Earth & Envi vision of AMEC Crockford Boule urborough, Ontar	Americas Limited = Gro	oundw	ater dep	oth on c	ompletio	on of drift	lling on	10/27/20	109 at a depth	ot: 43m.			

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Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative as a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log'.

Scale: 1:32

R	ECORD	OF BOREH	OLE No	o. !	BC :	<u>35</u>									amec
Pro	ject Number:	TT93042						_	Drilling	Location:	15 m West o	of Driveway #	2838		Logged by: JF
Pro	ject Client:	AMEC Infrastructure	e Group			_			Drilling	Method:	150 mm Sc	olid Stem Aug	ering		Compiled by: SN
Pro	ject Name:	Geotechnical Invest	tigation for	Bovali	rd Driv	e Clas	EA St	udy	Dritting	Machine:	Truck Moun	nted Drill			Reviewed by: PB
Pro	ject Location:	Bovaird Drive from Boundary at Casele	Lake Louise	e Drive	to Pe	el/Halt	on	_	Date S	Started:	Oct 27, 09	_ Date Com	pleted: Oct 2	7, 09	Revision No.: 0, 2/9/10
	ПТН	OLOGY PROFILE	, one			MPLI	NG			FIELD	TESTING		STING		
Lithology Plot	Local Ground Suffi	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	<b>DEPTH (m)</b>	ELEVATION (m)	O SPT □ MTO Vane* Δ Intact Δ Remould *Undrained Sh	tionTesting PPT   DCPT Nilcon Vane*    Intact    Remould eer Strength (kPa)    60   80	A parts per mil 100 200	6 10 12 ur Reading ion (ppm) 300 400 sive Limit (LEL)	INSTRUMENTATION INSTALLATION	GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
	~at	brown	88											2626	
	1	Sand and Gravel FILL trace sift, trace clay moist		A	1			- 1 - 1	-1-					35555	
	trac	e organics, trace rooflets		<b>A</b>	2			- 2	-2 -						
								- 3 - 3 	.3 -						
		brown to grey Clayey Silt FILL race sand, trace gravel moist						-4	-4-					Be	intonite: 0.3 - 11.3 m
				A	3			- - - - - - - - -	-5 -						
AM	EC Earth & Envi	ronmental	☑ No freest	andica		unter	age and a	6	herek	in on correlati	ion of delice				Hulsi- Edinasis
Ad		Americas Limited	= NO ITEEST	anuing	ground	water me	asured i	oper	Doreno	-c on complet	on animng.				
Sca	rborough, Ontari ada M1R 3C3	0	lorehole detaile	as press	nted, do	not cons	titute a the	orough	understa	nding of all pot	ential conditions p	present and require	interpretative se	eletance from	Paula 1 22

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Geotechnical Engineer. Also, borshole information should ned and the accompanying Explanation of Borehole Log.

### RECORD OF BOREHOLE No. BC 35

Project Number: TT93042

Dellina Laurena

Drilling Location: 15 m West of Driveway #2838

amec<sup>(1)</sup>

4-76	LITHOLOGY PROFILE	SC	AL SA	MPLI	NG			FIELD TESTING	LAB TESTING	V	222223333333
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	ОЕРТН (m)	ELEVATION (m)	PenetrationTesting  ○ SPT □ PPT ● DCPT  MTO Vane* Nilcon Vane* △ Intact ○ Intact ▲ Remould ● Remould  *Uncrianed Shear Strength (APa) 20 40 60 60	Firme pH Values	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey Clayey Sift FILL trace sand, trace gravel moist	A	4			7	-7 -				
		^	5			8	-8				
						10	-10 -				
	reddish brown 11.0  WEATHERED SHALE  Imestone seams damp	ss	6	56	32	-11	-11 -	٥			
		SS	7	100	50/5	12	-12	90 8			Slotted pipe and sand: 11.3 m - 12.9 m

Borshole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Explanation of Borehole Log:

#### RECORD OF BOREHOLE No. BC 35

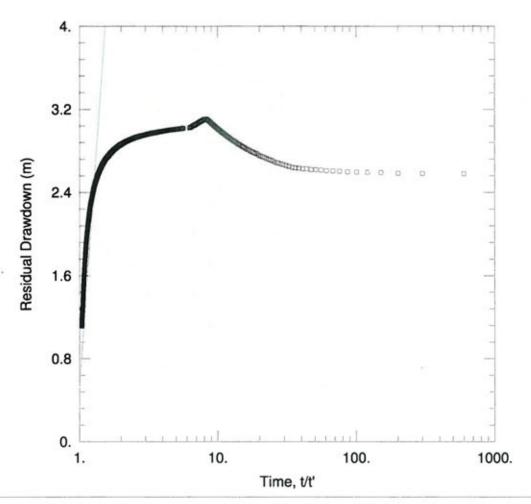
Drilling Location: 15 m West of Driveway #2838 Logged by: JF

Project Number: TT93042 Rinse pH Values
2 4 6 8 10 12
Soil Values part Specific (ppm)
100 200 300 400
Lower Explosive Limit (EL)
W, W, Liquel LITHOLOGY PROFILE SOIL SAMPLING FIELD TESTING LAB TESTING COMMENTS INSTRUMENTATION INSTALLATION PenetrationTesting & GRAIN SIZE DISTRIBUTION O SPT PPT • DCPT DESCRIPTION MTO Vane\* Nilcon Vane\*
Δ Intact Φ Intact
Δ Remould Φ Remould Lithology Plot Recovery (%) DEPTH (m) Sample Type (%) Undrained Shear Strength (kPa) 20 40,0 60 80 GR SA SI End of Borehole Auger refusal at 13.0 m depth.

Scale: 1:32

## **APPENDIX B**

# SINGLE WELL RESPONSE TEST ANALYSES



#### WELL TEST ANALYSIS

Data Set: \...\BC11 pump&recover test.aqt

Date: 04/06/10

Time: 12:52:25

#### PROJECT INFORMATION

Company: AMEC Client: Peel Region Project: SW1309037 Location: Brampton ON Test Well: BC11

Test Date: 16 March 2010

#### AQUIFER DATA

Saturated Thickness: 2.5 m

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA

P	umping Wells		Observation Wells			
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)	
BC11	0	0	□ BC11	0	0	

#### SOLUTION

Aquifer Model: Confined

 $= 7.7E-8 \text{ m}^2/\text{sec}$ 

Solution Method: Theis (Recovery)

S/S' = 0.9386

#### AQTESOLV for Windows

Data Set: \\WAT-FS1\ProjectF\$\2007-2009\2009\Environmental Projects 2009\SW1309037 Bovaird Drive EA\EA W Date: 04/06/10 Time: 12:53:15

#### PROJECT INFORMATION

Company: AMEC Client: Peel Region Project: SW1309037 Location: Brampton ON Test Date: 16 March 2010 Test Well: BC11

#### **AQUIFER DATA**

Saturated Thickness: 2.5 m Anisotropy Ratio (Kz/Kr): 1.

#### PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: BC11

X Location: 0. m Y Location: 0. m

Casing Radius: 0.0255 m Well Radius: 0.0255 m

Partially Penetrating Well Depth to Top of Screen: 0.9 m Depth to Bottom of Screen: 2.5 m

No. of pumping periods: 2

Time (sec)

Pumping Period Data Rate (L/min)

Time (sec) 600.

Rate (L/min)

#### **OBSERVATION WELL DATA**

No. of observation wells: 1

Observation Well No. 1: BC11

X Location: 0. m Y Location: 0. m

Radial distance from BC11: 0. m

Partially Penetrating Well Depth to Top of Screen: 0.9 m Depth to Bottom of Screen: 2.5 m

No. of Observations: 14682

	Observation	on Data	
Time (sec)	Displacement (m)	Time (sec)	Displacement (m)
1.	0.0204	7356.	1.668
2.	0.061	7357.	1.668
3.	0.1039	7358.	1.668
4.	0.1475	7359.	1.668
5.	0.2023	7360.	1.668
6.	0.1703	7361.	1.668
7.	0.1695	7362.	1.668
8.	0.1802	7363.	1.668
9.	0.1865	7364.	1.668

Time (sec)	Displacement (m)	Time (sec)	Displacement (m)	
7327.	1.672 1.672	1.467E+4	1.114	
7328.	1.672	1.467E+4 1.467E+4	1.114	
7329.	1.672	1.467E+4	1.114	
7330.	1.672	1.467E+4	1.114	
7331.	1.672	1.467E+4	1.114	
7331. 7332.	1.672 1.672	1.467E+4	1.114	
7333.	1.671	1 467F+4	1.114	
7334.	1.671	1.467E+4 1.468E+4	1.114	
7335.	1.671	1.468E+4	1:114	
7336	1.671	1.4000.4		
7336. 7337.	1.671	1.468E+4	1.114	
7338.	1.071	1.468E+4	1.114	
7330.	1.671	1.468E+4	1.114	
7339.	1.671	1.468E+4	1.113	
<u>7</u> 340.	1.671	1.468E+4	1.114	
<u>7341</u> .	1.67	1.468E+4	1.113	
7342.	1.671	1.468E+4	1.113	
<u>7</u> 343.	1.67	1.468E+4	1.114	
7344.	1.67	1.469E+4	1.114	
7345.	1.67 1.67	1.469E+4	1.113	
7346.	1.67	1.469E+4	1.114	
7347.	1.67	1.469E+4	1.113	
7348.	1.67	1.469E+4	1.113	
7349.	1.669	1.469E+4	1.113	
7350.	1.669	1.469E+4	1.113	
7351.	1.669 1.669	1.469E+4	1.113	
7352.	1.669	1.469E+4	1.113	
7353.	1.668	1.469E+4	1.113	
7354.	1.669	1.47E+4	1.113	
7355.	1.669	1.47E+4	1.113	
7333.	1.009	1.47644	1.113	

#### SOLUTION

Pumping Test Aquifer Model: Confined Solution Method: Theis (Recovery)

#### VISUAL ESTIMATION RESULTS

#### **Estimated Parameters**

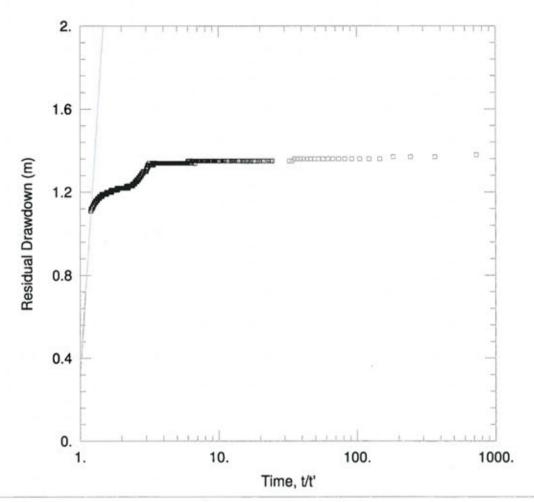
Parameter |

Estimate 7.7E-8 0.9386

m<sup>2</sup>/sec

S/S'

K = T/b = 3.08E-8 m/sec (3.08E-6 cm/sec)



#### WELL TEST ANALYSIS

Data Set: \...\BC35 pump&recover test.aqt

Date: 04/06/10

Time: 13:23:46

#### PROJECT INFORMATION

Company: AMEC Client: Peel

Project: SW1309037

Location: Bovaird Rd. W., Brampton ON

Test Well: BC35

Test Date: 27 January 2010

#### AQUIFER DATA

Saturated Thickness: 1.91 m

Anisotropy Ratio (Kz/Kr): 1.

#### WELL DATA

P	umping Wells		Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
BC35	0	0	□ BC35	0	0

#### SOLUTION

Aquifer Model: Confined

 $T = 1.313E-7 \text{ m}^2/\text{sec}$ 

Solution Method: Theis (Recovery)

S/S' = 0.9347

#### AQTESOLV for Windows

Data Set: \\WAT-FS1\ProjectF\$\2007-2009\2009\Environmental Projects 2009\SW1309037 Bovaird Drive EA\EA W Date: 04/06/10 Time: 13:24:12

#### PROJECT INFORMATION

Company: AMEC Client: Peel Project: SW1309037

Location: Bovaird Rd. W., Brampton ON Test Date: 27 January 2010 Test Well: BC35

#### AQUIFER DATA

Saturated Thickness: 1.91 m Anisotropy Ratio (Kz/Kr): 1.

#### PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: BC35

X Location: 0. m Y Location: 0. m

Casing Radius: 0.0255 m Well Radius: 0.075 m

Partially Penetrating Well Depth to Top of Screen: 0.3 m Depth to Bottom of Screen: 1.9 m

No. of pumping periods: 2

Time (sec)

Pumping Period Data Rate (L/min) 0.43

Time (sec) 1456.

Rate (L/min)

#### OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: BC35

X Location: 0. m Y Location: 0. m

Radial distance from BC35: 0. m

Partially Penetrating Well Depth to Top of Screen: 0.3 m Depth to Bottom of Screen: 1.9 m

No. of Observations: 4395

Observation		
Displacement (m)	Time (sec)	Displacement (m)
0.	4430.	1.19
0.16	4432.	1.19
0.15	4434.	1.19
0.19	4436.	1.19
0.2	4438.	1.19
0.2	4440.	1.19
0.2	4442.	1.19
0.2	4444.	1.19
0.22	4446.	1.19
	Displacement (m) 0. 0.16 0.15 0.19 0.2 0.2 0.2 0.2 0.2	0. 4430. 0.16 4432. 0.15 4434. 0.19 4436. 0.2 4438. 0.2 4440. 0.2 4442. 0.2 4444.

Time (sec)	Displacement (m)	Time (sec)	Displacement (m)	
4340.	1.19	8736.	1.11	
4342.	1.19 1.19	8738.	1.11	
4344.	1 19	8740.	1.11	
4346	1 19	8742.	1.11	
4348	1.19 1.19	8744	1.11	
4350	1.19	8746	1:11	
4348. 4350. 4352. 4354.	1.19	8748	1.11	
4354	1.19	8750	1:11	
4356.	1.19	8752	1.11	
4358.	1.19	8754	1.11	
4360	1.19	8744. 8746. 8748. 8750. 8752. 8754. 8756. 8758. 8760. 8762.	1.11	
4362. 4364. 4366.	1.19	8758	1.11	
4364	1.19	8760	1.11	
4366	1.19	8762	1:11	
4368.	1.19	8764.	1.11	
4370	1.19	8766	1.11	
4370. 4372. 4374.	1.19	8766. 8768. 8770.	1.11	
4374	1.19	8770	1:11	
4376	1.19	8772	1.11	
4378. 4380. 4382.	1.19	8772. 8774.	1.11	
4380	1.19	8776	1.11	
4382	1.19	8776. 8778.	1:11	
4384.	1.19	8780	1.11	
4386	1.19	8780. 8782. 8784. 8786. 8788. 8790. 8792. 8794. 8796. 8798.	1.11	
4386. 4388.	1.19	8784	1.11	
4390	1.19	8786	1.11	
4390. 4392.	1.19	8788	1.11	
4394.	1.19	8790	1.11	
4396.	1.19	8792	1.11	
4398.	1.19	8794	1.11	
4400.	1.19	8796	1.11	
4402.	1.19	8798	1.11	
4404.	1.19	8800	1.11	
4406.	1.19	8802. 8804. 8806.	1.11	
4408.	1.19	8804.	1.11	
4410.	1.19	8806.	1.11	
4412.	1.19	8808.	1.11	
4414.	1.19	8810.	1.11	
4416.	1.19	8812.	1.11	
4418.	1.19	8814.	1.11	
4420.	1.19	8816.	1.11	
4422.	1.19	8818.	1.11	
4424.	1.19	8820.	1.11	
4426.	1.19	8822.	1.11	
4428.	1.19			
,,,, <u></u> ,				

#### SOLUTION

Pumping Test Aquifer Model: Confined Solution Method: Theis (Recovery)

#### VISUAL ESTIMATION RESULTS

#### **Estimated Parameters**

Parameter

Estimate 1.313E-7 0.9347

m<sup>2</sup>/sec

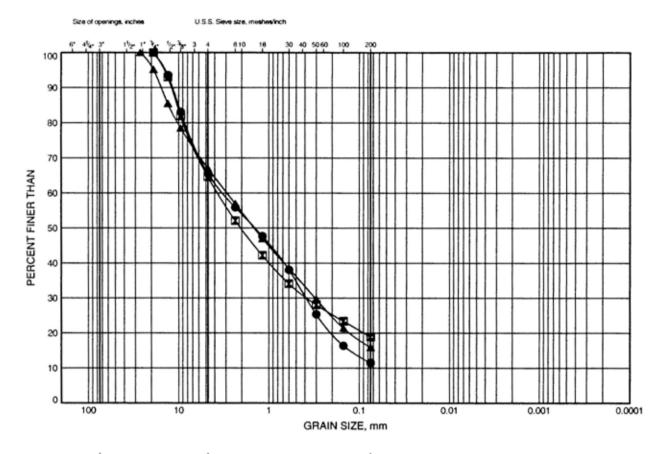
K = T/b = 6.877E-8 m/sec (6.877E-6 cm/sec)

# APPENDIX C GRAINSIZE ANALYSES



# GRAIN SIZE DISTRIBUTION Gravelly Sand

FIGURE No. B1



COBBLE	BLE COARSE FINE		COARSE MEDIUM FINE		FINE	SILT and CLAY	
SIZE	IZE GRAVEL		SAND			FINE GRAINED	

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
•	B 01	SS1	0.00	0.00
<b>x</b>	B 09	SS1	0.00	0.00
•	B 18	SS1	0.00	0.00

Date February 2010

Project TT93042

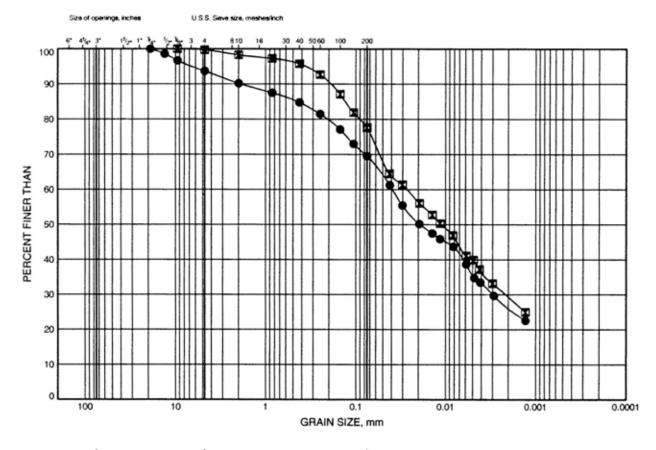
Prep'd .....

Chkd. .....



# GRAIN SIZE DISTRIBUTION Clayey Silt, Sandy

FIGURE No. B2



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
SIZE	GRA	VEL		SAND		FINE GRAINED

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
•	B 01	SS5	3.05	-3.05
•	B 07	SS2	0.76	-0.76

Date February 2010

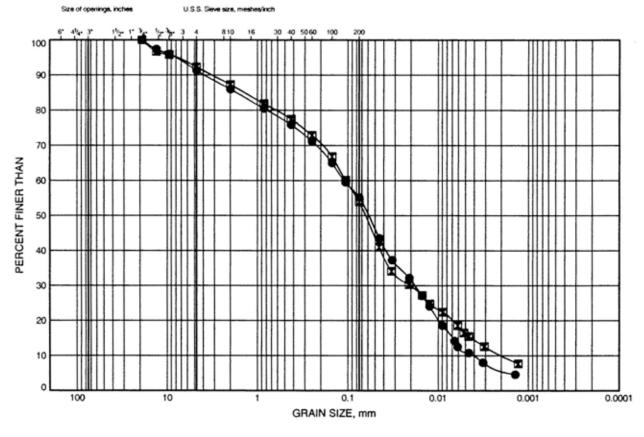
Project TT93042

Prep'd ......



# GRAIN SIZE DISTRIBUTION Silt and Sand

FIGURE No. B3



						L
COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
SIZE	GRA	VEL	Ī	SAND		FINE GRAINED

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)				
•	B 10	SS2	0.76	-0.76				
<b>x</b>	BC 06	SS3	1.52	-1.52				

Date February 2010

Project TT93042

Prep'd ......

# APPENDIX D WATER BUDGET ANALYSIS

#### Appendix D

Project Number

SW1309027

Location

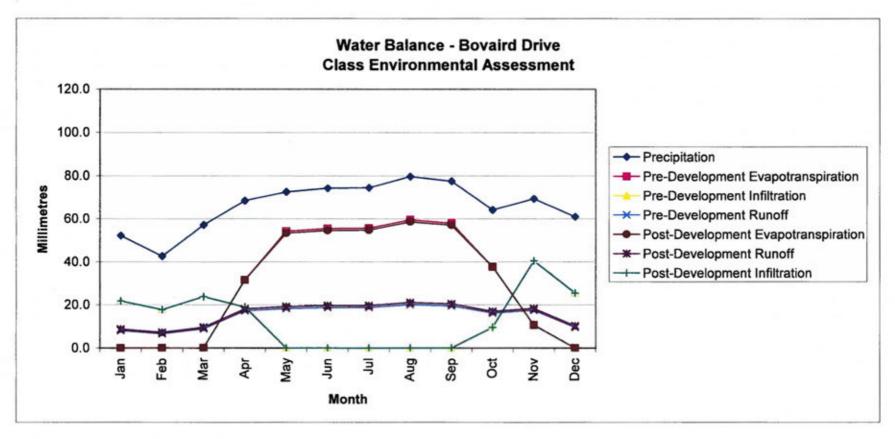
Hydrogeologic Investigation - Bovaird Drive Class Environmental Assessment

Owner

Regional Municipality of Peel

Site Elevation

235 masl



Data Source: Environment Canada Canadian Climate Normals 1971-2000

Station: Toronto International Airport

# APPENDIX D

# SW1309027: Regional Municipality of Peel - Bovaird Drive Class Environmental Assessment

Project Number	SW1309027		1	1							1			_				-	
Regional Municipa;	ity of Peel - Hy	drogeologic	Investigation	n Bovaird Dri	ve Class E	nvironmental Assessr	nent												
w	1-41										1			-					
Water Balance Calc	ulation												-	-					
	Land Use		1	Area (ha)	To	pography/Soil	Runoff C	oefficient											
Total Area	Lana Ost		1	579	-	родиарнуюон	T>0°C												
I Otal Alea			Un	developed			1200	1400						_					
Cultivated/Pasture			T		Flat/Silt CI	ay Loam	0.15	0.08						1					
Residential					Flat/SiltCla		0.35	E CONTRACTOR DE											
Industrial/Commerc	ial/Institutiona	ıl		30	Flat/Silt Cl	ay Loam	0.60	0.50						1					
Woodland					Flat/Silt Ci		0.35	- minutes in the last of		1									
Roadway					Flat/Silt Ci	ay Loam	0.85												
Wetland				15	Water		0.05												
Composite Runoff (	Coefficient						0.25	0.16											
Cultivate d/Desture			D	eveloped	Elet/Dertie	I Clay Leam	0.15	0.00						-					
Cultivated/Pasture Residential	-			58		I Clay Loam	0.15												
Industrial/Commerc	lal/Institutiona	d	1	30			0.6												
Woodland				72			0.35												
Roadway				39			0.85							1					
Wetland				15	Flat/Grass	shrubs-Clay Loam	0.1												
Composite Runoff (	Coefficient		- C				0.26	0.17											
Reference Location		mational Airpo	ort - Normals	1971 to 2000															
Latitude	43°41' N																		
Longitude	79°38' W																		
Elevation	173 m																		
	· ··· · · · · · · · · · · · · · · · ·	40 1/407##		11.00-140-1-		4050)			-	_				-				-	
Potential Evapotrans					ner and Hav	/ens, 1958)			-		-			-					
where:			nspiration in m perature in °C						-			-		-					
			Sum of mont							-			-	-					_
			en average T																
			nonthly sunshi								-			-					-
			00771 I <sup>2</sup> + 0.0											-					
	G - 0.40 · 0	01101-0.000	0.0						-										
URO = Pre-developn	nent runoff		1	·															
AET=Actual evapotra		er pre-develo	pment condition	ons															
					ure is < 0°C	, infiltration (UI*) is assi	umed to = 0.	5*(precipita	ation - runoff	f)				Tours of					v
US = Water surplus of	due to unaccou	ntable losses;	; such as subli	imation of sno	w	Academic and Academic Services Plans and Plans and Plans and Academic Services													
UR = Pre-developme		= UI x availa	ble area																
DRO = Post-develop				1															
DAET=Actual evapor																			
DS=Water surplus de											-			-	-				_
				air temperati	ure is < 0°C	infiltration (DI*) is assu	med to = 0.	5*(precipita	tion - runoff	)									
DR = Post developm	ent recharge =	UI x available	area	-					-			-			-		-		
Month	Mean Tec	Dress mm	Rain mm	Snow mm			DET	AFT	URO mm	UPO m3	UI mm	UI mm*	UR m³	DAET mm	DPO ===	DRO m³	DI mm	DI* mm	DRm <sup>3</sup>
Month January	Mean T °C -6.3				0.000	d	A STATE OF THE PARTY OF THE PAR						and the state of t		Control of the Contro		43.4	21.7	12565
February	-5.4																35.4	17.7	10254
March	-0.4	É	The second secon										139538				47.5	23.7	13745
April	6.3											A second of the second of the second	and the state of t			I removable of the second or compared a feet of	18.8	18.8	10914
May	12.9											the same and the same of the s					0.0	0.0	
June	17.8					1.3				Annual Control of Cont							0.0	0.0	
July	20.8				the state of the s					A reservoir contract the science and the science and the		A STATE OF THE PARTY OF THE PAR					0.0	0.0	
August	19.9	79.6	79.6	0.0	8.095			59.5	20.1	11641.5	0.0	0.0	C	58.6	21.0	121708	0.0	0.0	
September	15.3		and the second second second second			1.05	the trade formation as 'a facilitation for	A CONTRACTOR OF THE PARTY OF TH		and accommodes to be required in a solety, made	Contract to the second						0.0	0.0	
October	8.9		the second secon			0.92	the second of th	And the second s			Conditionable deal representations. Transport		59216			An annual transmission of the State of Angles	9.5	9.5	549
a distribution of the second		69.3	62.0	7.6	0.509	0.79	10.6	10.6	17.5	10135.1	41.2	41.2	238404	10.6	18.3	105960	40.4	40.4	23379
November	3.2										And the second s	and the second s	annual and the second s						
November December Year	-2.9 7.5	60.9	34.7	29.2	0.000			0.0	9.5	5496.2	51.4	25.7	148824	0.0	10.3		50.6 245.7	25.3 157.2	14660 91015