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
Transportation Division Public Works
9445 Airport Road 3rd floor
Brampton, Ontario
M4V 1L5

Submitted by:
AMEC Earth & Environmental,
a division of AMEC Americas Limited
6 – 405 Maple Grove Road
Cambridge, Ontario
N3E 1B6

April, 2010
SW1309037

Distribution:

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE NO.

LIST OF TABLES

TABLE NO.

LIST OF APPENDICES

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 3×10^{-8} m/s. The analysis of recovery from a very short pumping test in the bedrock at BC35 indicated a hydraulic conductivity of about 7×10^{-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 3×10^{-6} and 3×10^{-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 3×10^{-8} and 3×10^{-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 (^oC)
- I = annual thermal index = sum of the monthly indices (i)
- $i = (T/5)^{1.514}$ Note: i = 0 when average T (^oC) < 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_r) 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:

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

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°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-Development**		**Post Development**	
Month	**Infiltration mm**	**Recharge m^3**	**Infiltration mm**	**Recharge m^3**
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

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

PROVINCIAL GEOSCIENTIST
DIRK M. GEVAERT
PRACTISING MEMBER
0258
ONTARIO

9.0 REFERENCES

AMEC Earth and Environmental, *Initial Assessment of Impacts on Huttonville Creek and a Tributary from Dewatering of a Proposed Rail Underpass at Creditview Road and CNR Line, Brampton*, 1 October 2008.

Chapman, L.J. and Putnam, D.F., *The Physiography of Southern Ontario, 3rd Edition*, Ontario Ministry of Natural Resources, 1984.

Golder Associates Limited (Golder), *IWA Landfill Site Search, Peel Region, Step 6, Hydrogeological Report, Site B-21c*, December 1993.

Singer, S.N., Cheng, C.K. and Scafe, M.G., *The Hydrogeology of Southern Ontario, 2nd Edition*, Ontario Ministry of Environment, Toronto, Ontario, 2003.

FIGURES

amec

REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT
FOR BOVAIRD DRIVE

SITE LOCATION AND BOREHOLE LOCATIONS

SCALE:	DATE:
1:12,500	APRIL 2010
PROJECT No.	FIGURE No.
SW1309037	1

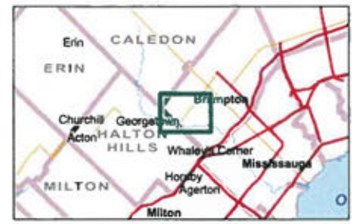
590000 591000 592000 593000 594000 595000 596000

4838000 4837000 4836000 4835000 4834000 4833000

Legend

ELC_CODE, TYPE

- AGI, Intensive agriculture
- AGN, Cultural meadow
- AGN, Non-intensive agriculture
- AGN, Rural development
- BBT, Treed beach/bar
- BLO, Open Bluff
- CIC, Commercial / Industrial
- CII, Educational / Institutional
- CON, Construction
- CON, Intensive agriculture
- CUM, Cultural meadow
- CUM, Intensive agriculture
- CUP3, Coniferous plantation
- CUS, Cultural savannah
- CUT, Cultural thicket
- CUW, Cultural woodland
- FOC, Coniferous forest
- FOD, Deciduous forest
- FOD, Mixed forest
- FOM, Coniferous forest
- FOM, Mixed forest
- MA, Marsh
- MOC, Commercial / Industrial Open Space
- MOI, Institutional Open Space
- MOO, Other Open Space
- MOP, Cultural meadow
- MOP, Private Open Space
- MOR, Recreational Open Space
- OAO, Aquatic
- RD, Rural development
- SWD, Deciduous swamp
- SWT, Thicket swamp
- TPC, Collector
- TPR, Regional Road
- TPX, Railroad
- URB, Urban
- URH, High Density Residential
- URL, Low Density Residential
- URM, Medium Density Residential
- URR, High Rise Residential
- URX, Mixed Residential
- WET, Wet meadow



Source: National Topographic Database (Canvec) base map shapefiles, 1:10 000 nominal scale.

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project # TB00000
Date: December 2009
Client:

Drawn by: RM
Checked by: SG
Revision No.: 2

0 0.5km 1km 1.5km

SCALE 1:25,000

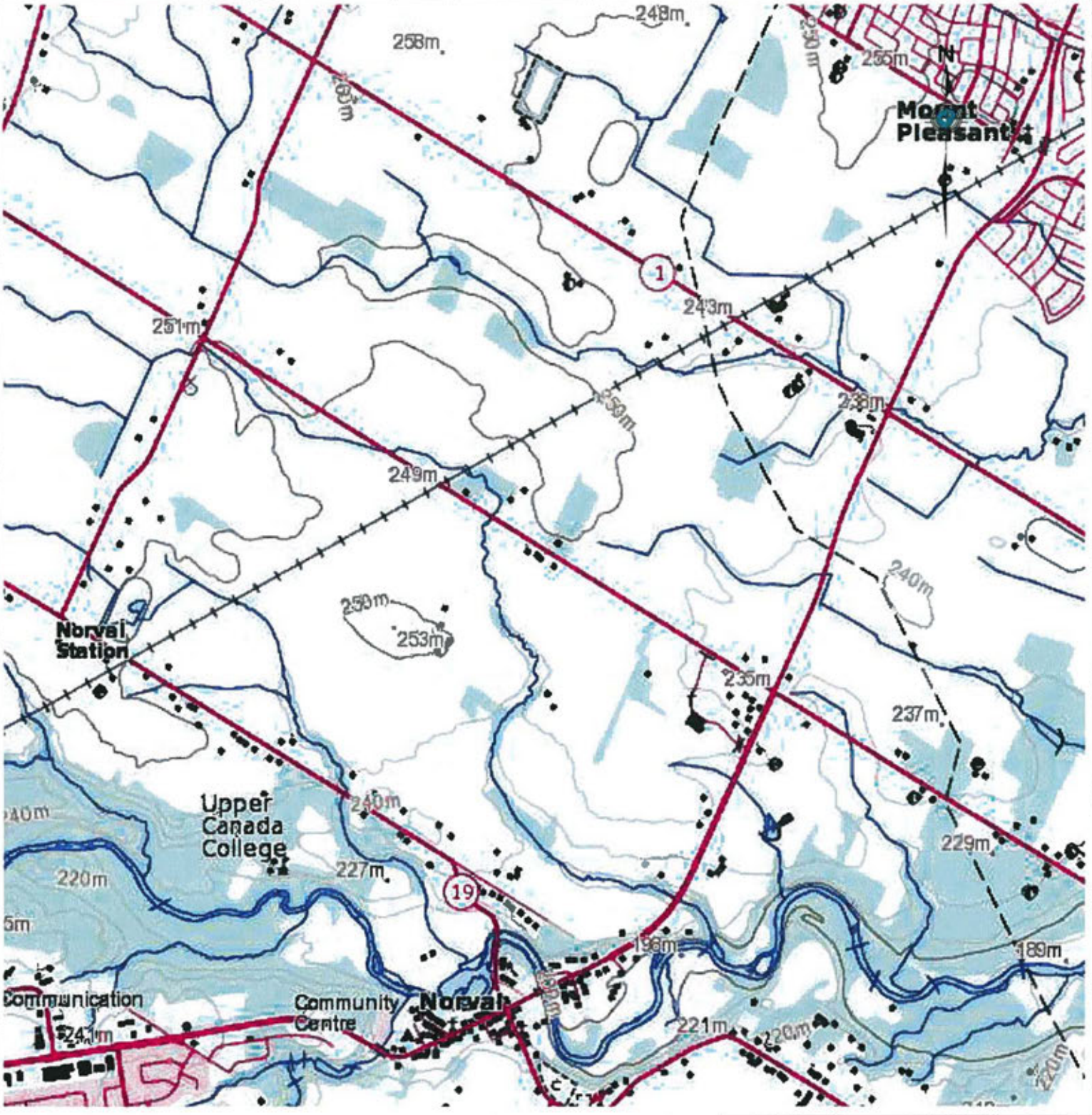
amec

REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT
FOR BOVAIRD DRIVE

LAND USE MAP

SCALE:	DATE:
1:25,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	2



0 300 900 1.5km

SCALE 1:30,000

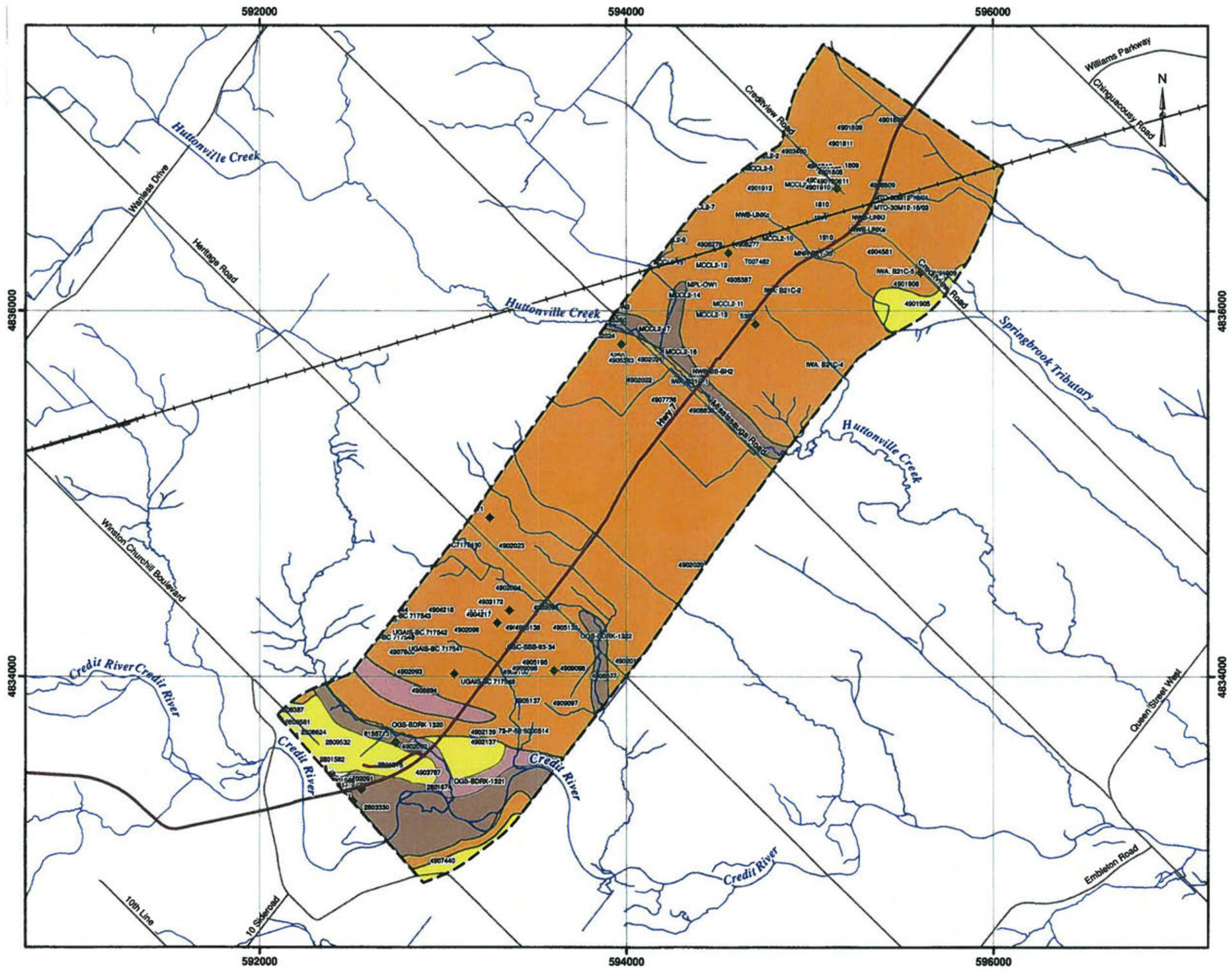
amec

REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT
FOR BOVAIRD DRIVE

TOPOGRAPHY AND DRAINAGE

SCALE	DATE
1:30,000	APRIL 2010
PROJECT No.	FIGURE No.
SW1309037	3



LEGEND

- Wells
- Highways
- Roads
- Railroads
- Rivers and Streams
- Approximate Study Area Boundary

Surficial Geology

- Alluvium
- Bedrock or bedrock drift
- Glaciolacustrine sands
- Organics
- Silt to clay till

AquaResource Inc.
Integrity • Technology • Solutions

Date: September, 2009
Projection: UTM NAD 83 Zone 17

Source: Ontario Ministry of Natural Resources and Credit Valley Conservation Authority

0 250 500 750 1km
SCALE 1:20,000

amec

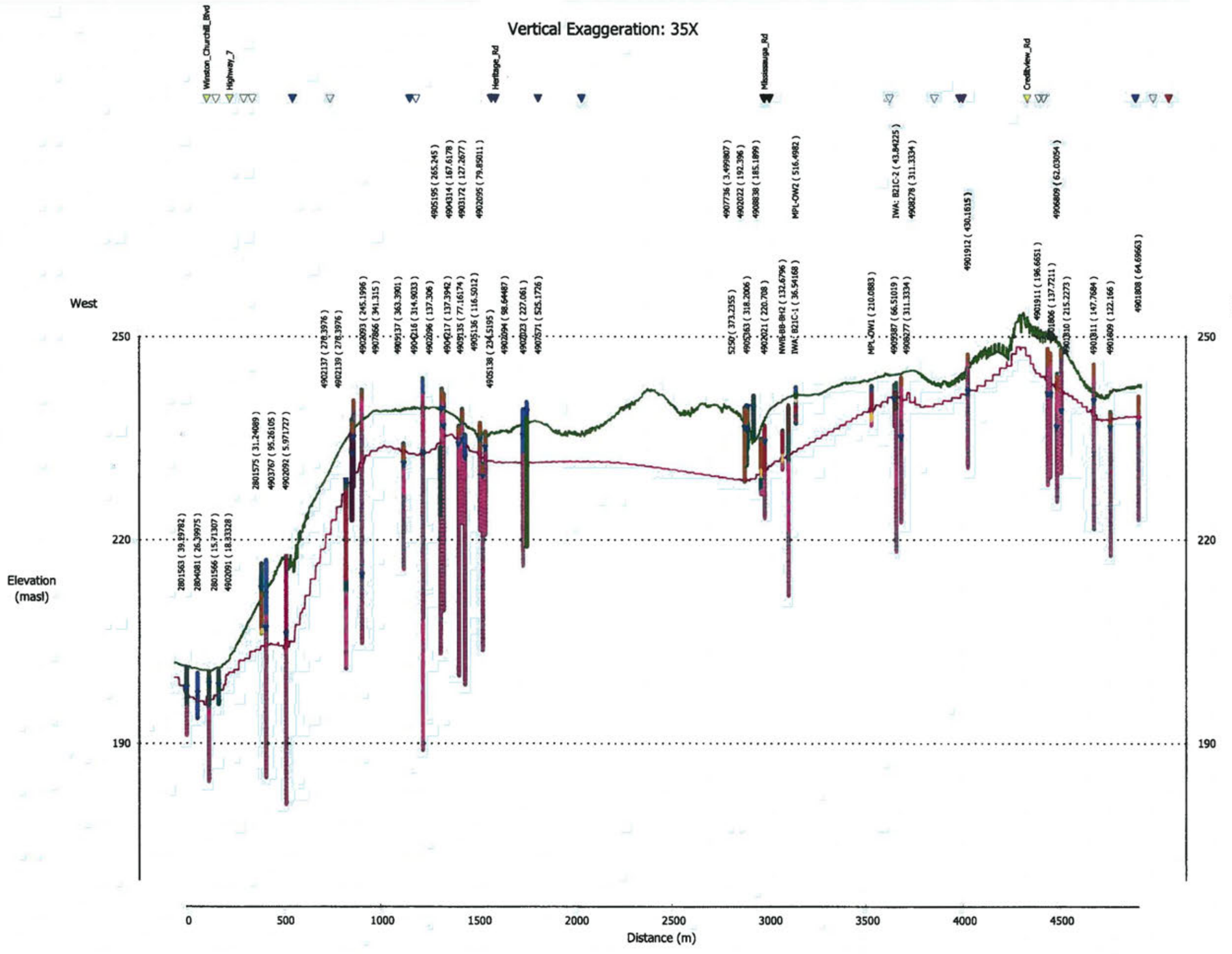
REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT FOR BOVAIRD DRIVE

QUATERNARY GEOLOGY

SCALE:	DATE:
1:20,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	4

Printed:9-Apr-10 FILE=P:\2007-2009\2009ENVironmental Projects 2009\SW1309037 Bovaird Drive EA\Drawings\SW1309037 Figure 4.dwg Tab=Figure 4



Surfaces
- Ground Surface
- Bedrock Surface
- Station (Name, Offset Distance)
- Waterlevel
- Well Screens

Intersecting Features
- Cross Section Lines
- Major Roads
- Rivers and streams

Lithologic Units

GSC_Code
- rock
- shale
- diamicton: si/sa to sa, stoney
- diamicton: si to sa/si matrix
- diamicton: cl to cl/si matrix
- gravel, gravelly sand
- sand, silty sand
- silt, sandy silt, clayey silt
- clay, silty clay
- organic, topsoil
- fill (incl topsoil, waste)

0 250 500 750 1km

SCALE 1:20,000

amec

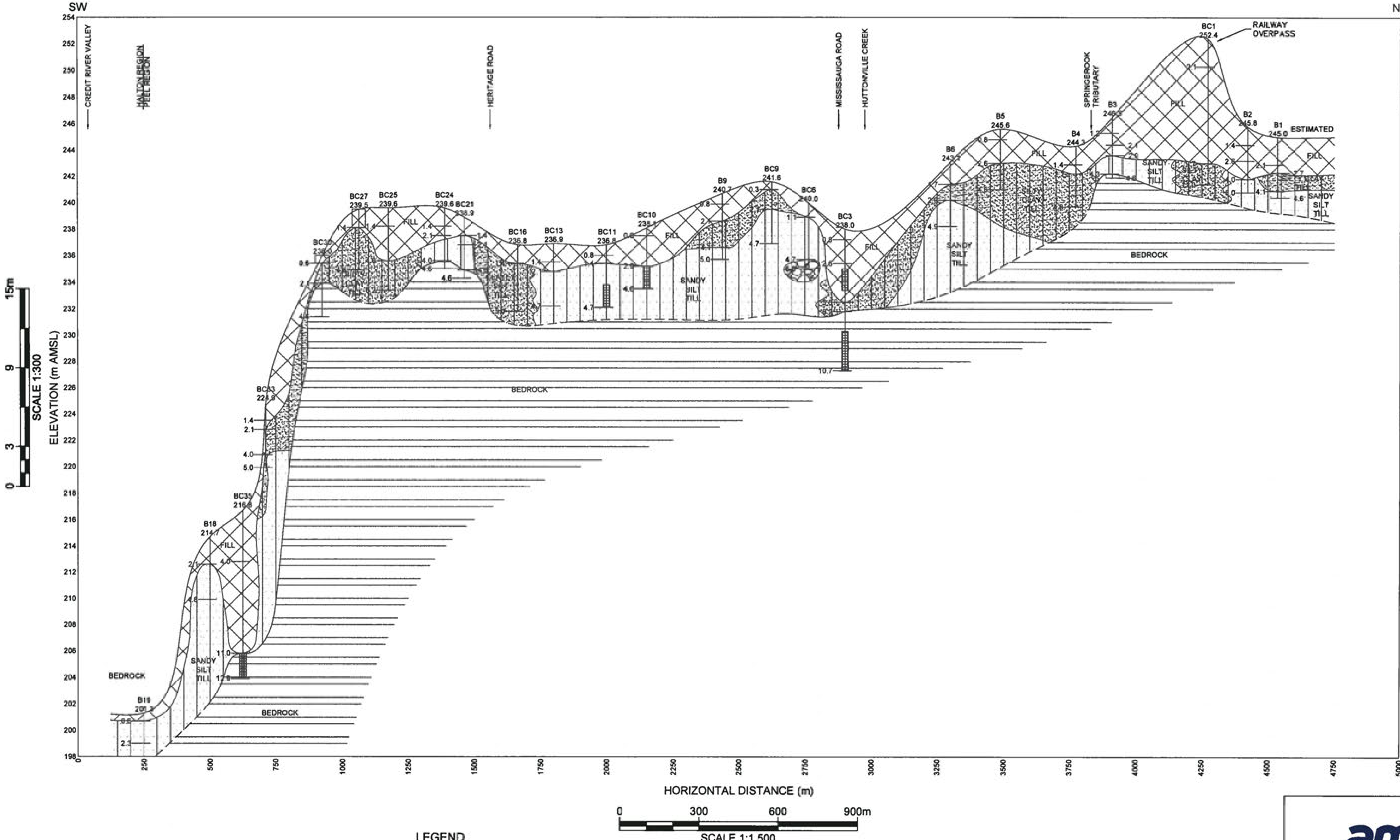
REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT
FOR BOVAIRD DRIVE

PROFILE BOVAIRD DRIVE FROM WINSTON CHURCHILL RD TO CREDIT VIEW ROAD

SCALE:	DATE:
1:20,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	5

Printed=9-Apr-10 FILE=P:\2007-2009\2009ENvironmental Projects 2009\SW\1309037 Bovaird Drive EA\Drawings\SW1309037 Figure 5.dwg Tab=Figure 5



LEGEND

FILL		SAND & GRAVEL	
TILL: SILTY SAND		BEDROCK	
TILL: CLAYEY SILT		SCREEN	

B18 214.7 — MONITOR NAME, GROUND ELEVATION (m AMSL)

2.1 — DEPTH OF STRATIGRAPHY CHANGE (m BGS)

SCREEN INTERVAL

4.8 — BOTTOM OF BOREHOLE

m AMSL — METERS ABOVE MEAN SEA LEVEL

m BGS — METERS BELOW GROUND SURFACE

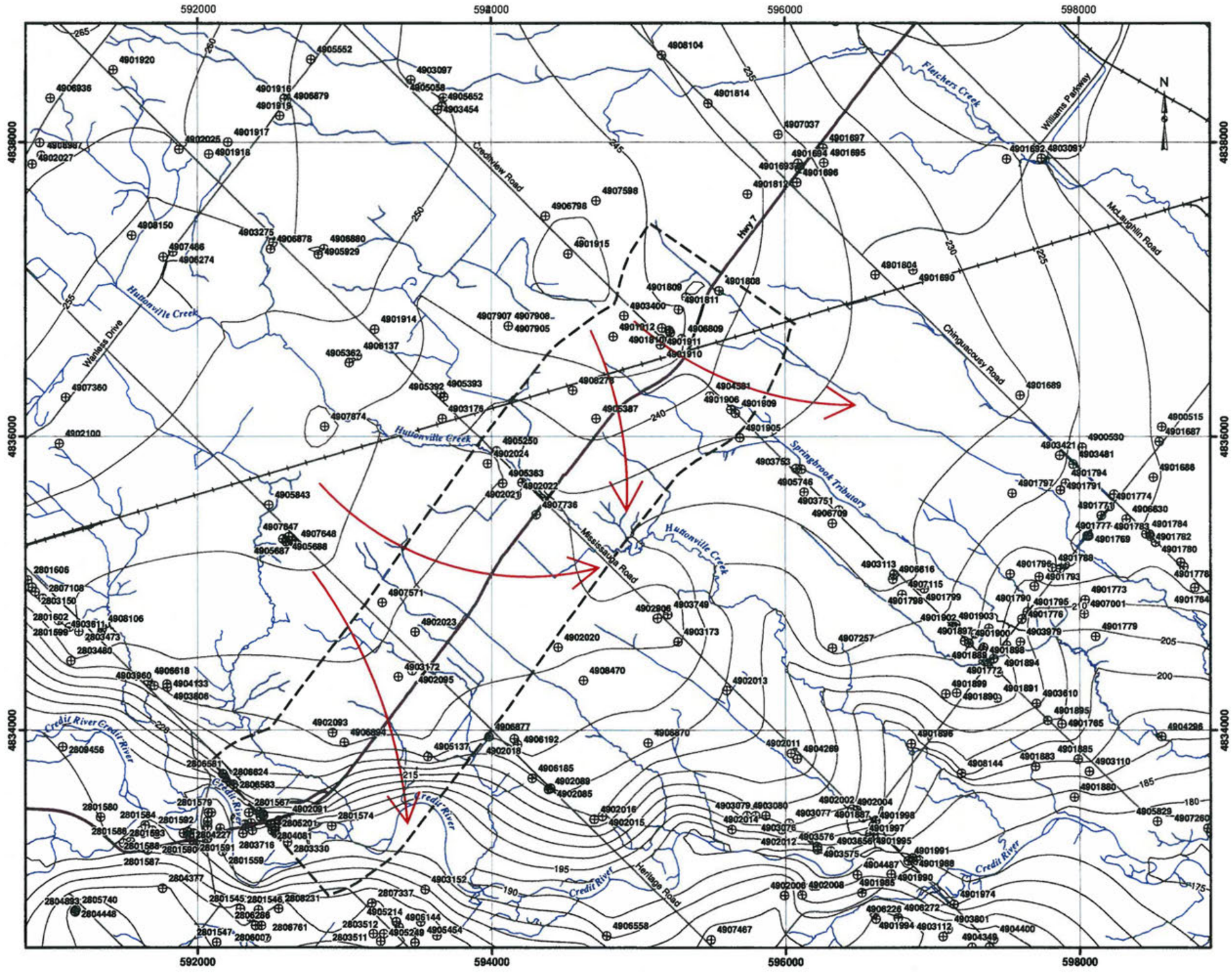
amec

REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT FOR BOVAIRD DRIVE

GEOLOGICAL PROFILE A-A' BOVAIRD DRIVE

SCALE:	DATE:
AS SHOWN	APRIL 2010
PROJECT No.: SW1309037	FIGURE No.: 6


592000
594000
596000
598000
4838000
4836000
4834000
N
Creditview Road
Hwy 7
Williams Parkway
McLaughlin Road
Chinguacousy Road
Mississauga Road
Heritage Road
Warhaus Drive
Fletchers Creek
Huttonville Creek
Springbrook Tributary
Credit River
Credit River Gredit River
LEGEND
Wells Used in Analysis
Highways
Roads
Railroads
Rivers and Streams
Shallow Groundwater Levels Interval - 5
Approximate Study Area Boundary
AquaResource Inc.
Integrity • Technology • Solutions
Date: September, 2009
Projection: UTM NAD 83 Zone 17
Source: Ontario Ministry of Natural Resources and Credit Valley Conservation Authority
0 0.5km 1km 1.5km
SCALE 1:25,000
amec
REGION OF PEEL
HYDROGEOLOGICAL ASSESSMENT FOR BOVAIRD DRIVE
SHALLOW GROUNDWATER ELEVATIONS
SCALE 1:25,000
DATE: APRIL 2010
PROJECT No. SW1309037
FIGURE No. 7

592000 594000 596000 598000

4838000 4836000 4834000

Mayfield Road
Wanless Drive
Hutsonville Creek
Creditview Road
Hwy 7
Fletchers Creek
Williams Parkway
McLaughlin Road
Chinguacousy Road
Springbrook Tributary
Mississauga Road
Heritage Road
10th Line
10 Sideroad
Credit River

N

LEGEND

- Overburden Wells
- Shallow Bedrock Wells (upper 10 meters of bedrock)
- Deep Bedrock Wells (deeper than upper 10 meters of bedrock)
- Highways
- Roads
- Railroads
- Rivers and Streams
- Approximate Study Area Boundary

AquaResource Inc.
Integrity · Technology · Solutions

Date: September, 2009
Projection: UTM NAD 83 Zone 17

Source: Ontario Ministry of Natural Resources and Credit Valley Conservation Authority

0 0.5km 1km 1.5km

SCALE 1:25,000

amec

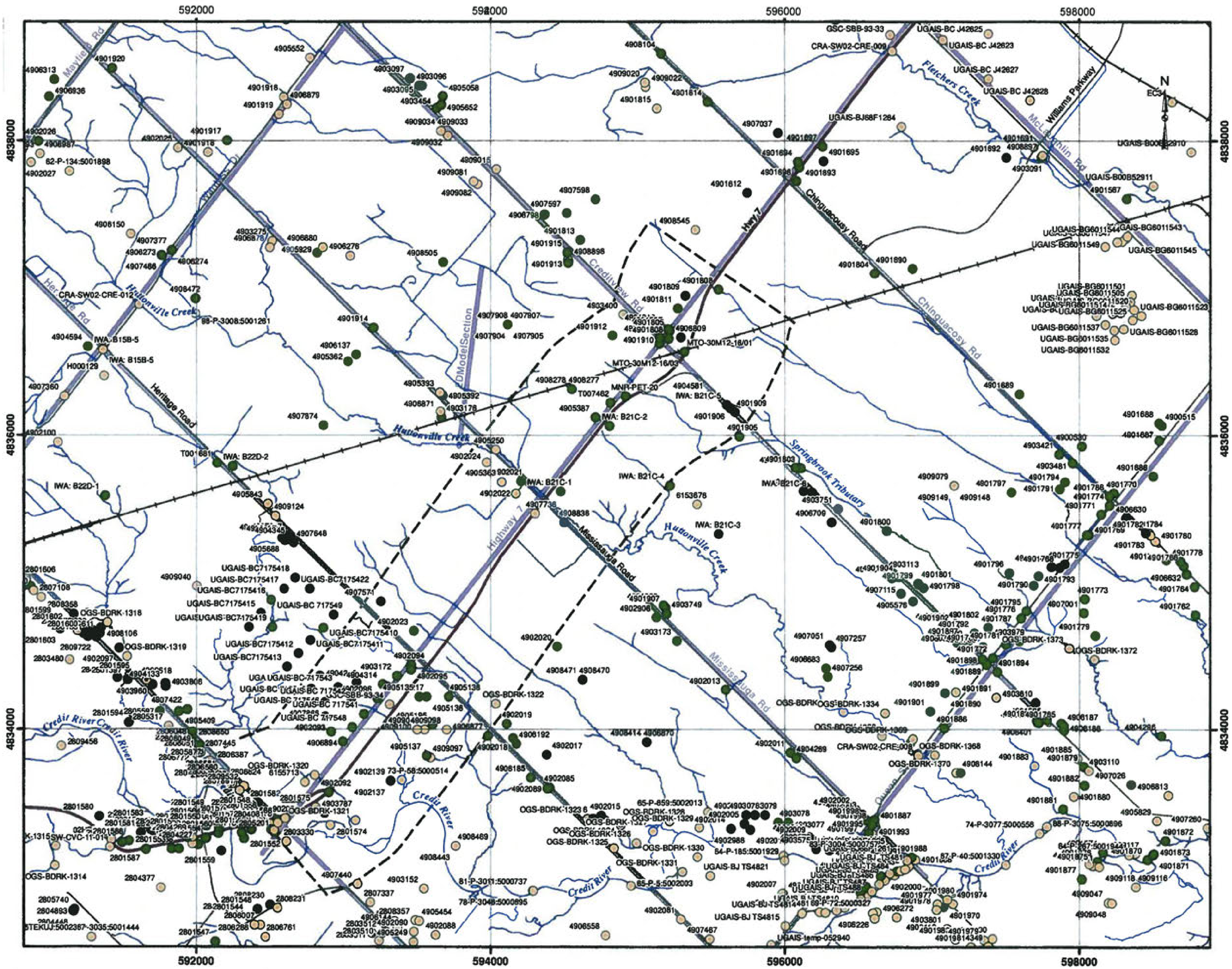
REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT FOR BOVAIRD DRIVE

ALL OVERBURDEN, SHALLOW AND DEEP BEDROCK WELLS

SCALE:	DATE:
1:25,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	8

Printed: 8-Apr-10 FILE: P:\2007-2009\2009\Environmental Projects 2009\SW1309037 Bovaird Drive EA\Drawings\SW1309037 Figure 8.dwg Tab: Figure 8



LEGEND

- Overburden Wells
- Bedrock Wells
- CrossSections
- Highways
- Roads
- Railroads
- Rivers and Streams
- Approximate Study Area Boundary

AquaResource Inc.
Integrity · Technology · Solutions

Date: September, 2009
Projection: UTM NAD 83 Zone 17

Source: Ontario Ministry of Natural Resources and Credit Valley Conservation Authority

0 0.5km 1km 1.5km
SCALE 1:25,000

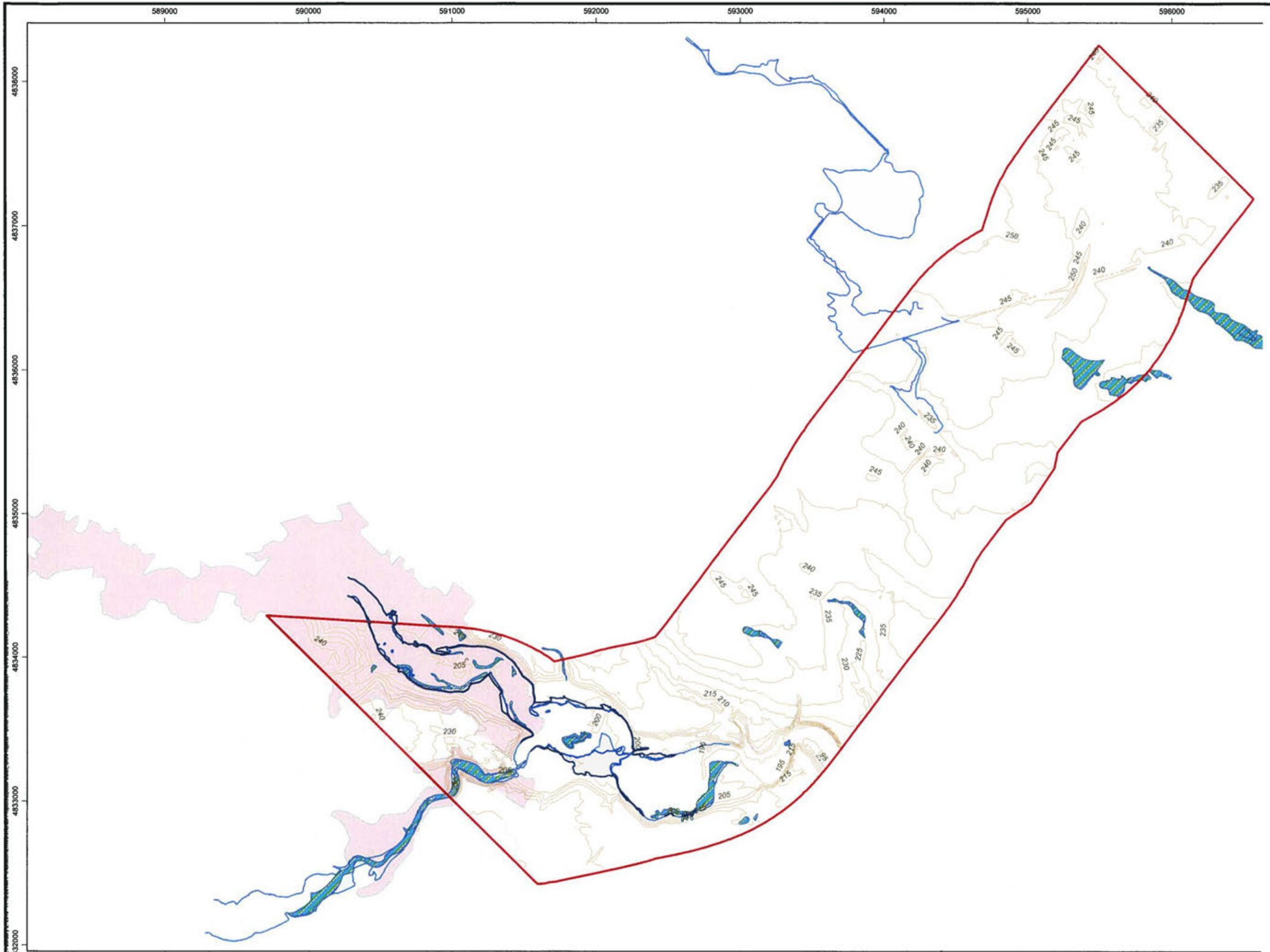
amec

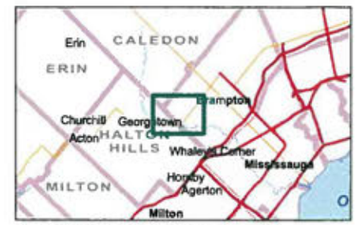
REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT FOR BOVAIRD DRIVE

WATERWELL LOCATIONS

SCALE:	DATE:
1:25,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	9





Source: National Topographic Database (Canvec) base map shapefiles, 1:10 000 nominal scale

Conditions encountered in the field may be different from the interpreted information presented on this figure.

Project # TB00000
Date: December 2009
Client:

Drawn by: RM
Checked by: SG
Revision No.: 2

0 0.5km 1km 1.5km

SCALE 1:25,000

amec

REGION OF PEEL

HYDROGEOLOGICAL ASSESSMENT
FOR BOVAIRD DRIVE

SENSITIVE AREAS (FROM CVC)

SCALE:	DATE
1:25,000	APRIL 2010
PROJECT No.:	FIGURE No.:
SW1309037	10

TABLES

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 Bovaird Drive W.	Completion Date	UTM Coordinates Zone 17 (NAD 83) Easting	Northing	Well ID (cm)	Top of Pipe Elevation (m AMSL)	Stickup (cm)	Ground Elevation (m AMSL)	Boring Depth (m BGS)	Well Depth (m BGS)	Screen Length (m)	Screened Interval (m BGS) Top	Bottom	Sand Pack Interval (m BGS) Top	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 Bell Tower	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
BC35	SHALE	Culvert East of 2868	27-Oct-09	592 899	4 833 605	5.1	217.53	76	216.77	12.9	12.9	1.6	11.3	12.9	11.3	12.9

NOTES:
UTM coordinates and ground elevations are from professional survey.
Remaining information is from borehole logs, except stickup and well ID, which were measured.
-- not available
ID - inside diameter of well
m BGS - metres below ground surface
m AMSL - metres above mean sea level
m BTOP - metres below top of pipe

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

Monitor Name	Screened Unit	Top of Pipe Elevation (m AMSL)	Ground Elevation (m AMSL)	Date Measured	Depth to Groundwater (m BTOP)	Depth to Groundwater (m BGS)	Groundwater Elevation (m AMSL)
BC03	SHALE	237.87	238.04	14-Oct-09	1.63	1.80	236.24
				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
				27-Jan-10	3.37	3.54	234.42
				16-Mar-10	2.49	2.66	235.30
BC10	SILT & SAND TILL	--	238.14	15-Oct-09	--	4.10	234.04
				27-Jan-10	not found		--
				16-Mar-10	not found		--
B11	CLAY & SILT TILL	--	237.95	15-Oct-09	--	2.40	235.55
				27-Jan-10	not found		--
				16-Mar-10	not found		--
BC11	SILT & SAND TILL	236.56	236.83	15-Oct-09	3.23	3.50	233.33
				27-Jan-10	not found		--
				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.
-- 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/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
		ODWS [1]	80 - 100 OG	500 AO	--	250 AO	1.5 MAC	10 (a) MAC	1 (a) MAC	500 AO	0.3 AO	0.05 AO	200
SITE B-22d													
B-15b-4C	Middle and Upper TILL	25-Mar-93	**320**	300	< 0.08	6	0.29	< 0.2	< 0.2	11	0.015	0.015	14
B-22d-1C		25-Mar-93	**250**	260	< 0.08	16	0.44	6.6	< 0.2	40	**0.7**	**0.096**	38
B-22d-PL7		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	Overburden and Shallow Bedrock	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		26-Mar-93	**240**	420	< 0.08	18	0.29	**11**	0.24	47	0.013	**0.11**	12
B-21c-4C		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	TILL and Shallow Bedrock	28-May-08	**645**	**1520**	5.3	**605**	0.2	< 0.1	< 0.1	317	**0.79**	0.049	**207**
GW-2		6-Jun-07	**430**	**580**	--	96	< 0.1	< 0.01	< 0.01	59	0.21	0.07	26
GW-3		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	Deep Bedrock	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		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
(1)	Ontario Drinking Water Standards (ODWS), Objectives and Guidelines (MOE 2003, revised June 2006).
<	Less than the Method Detection Limit (MDL)
<2	Method detection limit exceeds ODWS
10	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 01

amec

Project Number:	TT93042	Drilling Location:	150 m West of Lake Louise Drive	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09	Date Completed: Oct 13, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	about 170 mm ASPHALT													
	-0.2													
	grey 0.2 **Gravelly Sand / Sand and Gravel FILL** trace silt moist	SS	1	100	36			O	9		34	54	12	
						1	-1							
		SS	2	100	34			O	15					
		SS	3	83	50/15			50/15 O	16					
						2	-2							
	-2.1													
	grey 2.1 **Clayey Silt FILL** trace organics, trace rootlets moist	SS	4	100	21			O	40 20					
	-2.7													
	brown 2.7 **SILTY CLAY / CLAYEY SILT TILL** some sand to sandy, trace gravel very stiff moist					3	-3							
		SS	5	100	25			O	18		6	24	44	26
						4	-4							
	-4.1													
	brown 4.1 **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel, trace shale fragments very dense moist													
	-4.6	SS	6	100	50/3			50/3 O	9					
	End of Borehole 4.6													

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. B 02

Project Number:	TT93042	Drilling Location:	200 m East of CNR Crossing Bridge	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09	Date Completed: Oct 13, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ○ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	about 170 mm ASPHALT	-0.2													
	brown **Gravelly Sand / Sand and Gravel FILL** moist	0.2	SS	1	100	40			O	0					
	trace cobbles		SS	2	100	32	1	-1	O	5					
	brown **Silty Sand FILL** trace gravel moist	-1.4 1.4	SS	3	100	23			O	10					
	trace rootlets		SS	4	100	10	2	-2	O	5					
	brown **Clayey Silt FILL** trace sand, trace gravel moist	-2.6 2.6													
			SS	5	100	13	3	-3	O	5					
	brown and grey **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel dense moist	-4.0 4.0	SS	6	100	40	4	-4	O	10					
	End of Borehole	-5.0 5.0					5	-5							

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 03

amec

Project Number:	TT93042	Drilling Location:	200 m East of Ashby Field Drive	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09 Date Completed: Oct 13, 09	Revision No.:	0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 200 mm ASPHALT											
	-0.2											
	brown **Gravelly Sand / Sand and Gravel FILL** moist	0.2	SS	1	83	34			O	9		
							1	-1				
	-1.2		SS	2	67	9			O	0.9		
	grey **Silty Sand FILL** trace to some clay moist	1.2										
			SS	3	56	12			O	0.8		
							2	-2				
	-2.1											
	brown **Clayey Silt FILL** trace gravel, pocket of sand, trace brick debris moist	2.1	SS	4	56	18			O	5 O 16		
	-2.9											
	brown **SILT AND SAND / SILTY SAND** trace clay, trace gravel very dense moist	2.9	SS	5	92	50/15	3	-3	50/15	0.6		
							4	-4				
	-4.3											
	reddish brown **WEATHERED SHALE**	4.3										
	-4.6		SS	6	100	50/5			50/5	0.5		
	End of Borehole	4.6										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 04

Project Number:	TT93042	Drilling Location:	50 m East of Ashby Field Drive	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09	Date Completed: Oct 13, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (O SPT, □ PPT, ● DCPT); MTO Vane* (△ Intact, ▲ Remould); Nilcon Vane* (◇ Intact, ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Local Ground Surface Elevation: 0.0 m										
	about 220 mm ASPHALT										
	-0.2										
	brown 0.2 Gravelly Sand / Sand and Gravel FILL moist	SS	1	100	57			O	△ 0		
						1	-1				
		SS	2	100	65			O	△ 0		
	trace asphalt debris -1.4										
	brown 1.4 Clayey Silt FILL trace sand, trace gravel, trace organics, trace rootlets moist	SS	3	100	38			O	△ 0		
						2	-2				
	-2.1										
	reddish brown 2.1 CLAYEY SILT TILL trace sand, trace gravel hard moist	SS	4	100	71			O	△ 5		
						3	-3				
	trace cobbles	SS	5	100	50/15			50 15	△ 0		
						4	-4				
	-4.6	SS	6	0	50/1			50 1			
	4.6 pieces of shale End of Borehole										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 05

Project Number:	TT93042	Drilling Location:	250 m West of Ashby Field Drive	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09	Date Completed: Oct 14, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 220 mm ASPHALT									Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80		
		-0.2	0.2										
	brown **Gravelly Sand / Sand and Gravel FILL** moist			SS	1	100	37						
								1	-1				
				SS	2	89	38						
		-1.4	1.4										
	brown **Silty Sand FILL** trace clay, trace gravel, trace organics moist			SS	3	100	28						
								2	-2				
		-2.6	2.6	SS	4	100	35						
	reddish brown **CLAYEY SILT TILL** trace sand, trace gravel hard moist trace shale fragments			SS	5	100	85/23	3	-3				
		-4.6	4.6	SS	6	100	50/8	4	-4				
	End of Borehole												

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 06

amec

Project Number:	TT93042	Drilling Location:	450 m East of Mississauga Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09	Date Completed: Oct 14, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elev. (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Depth (m)	Elevation (m)	Field Testing: Penetration Testing (O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80)	Lab Testing: ★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	Instrumentation Installation	Comments & Grain Size Distribution (%) GR SA SI CL
	about 235 mm ASPHALT	-0.2										
	brown **Gravelly Sand / Sand and Gravel FILL** trace silt moist	0.2	SS	1	100	46			O	△ 3		
	brown to grey **Sandy Silt FILL** trace clay, trace gravel, trace organics moist	-0.8 0.8	SS	2	83	29	1	-1	O	△ 0 ○ 14		
	brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel hard moist	-1.7 1.7	SS	3	89	38	2	-2	O	△ 2 ○ 2		
			SS	4	100	40			O	△ 35 ○ 19		
	brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist to wet	-2.9 2.9	SS	5	100	68	3	-3	O	△ 25 ○ 18		
			SS	6	100	50/13	4	-4	50 O 13	△ 0 ○ 20		
		-4.9					▽					
	End of Borehole	4.9										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/14/2009 at a depth of: 4.9 m.

RECORD OF BOREHOLE No. B 07

amec

Project Number: TT93042 | Drilling Location: 80 m East of Mississauga Road | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 14, 09 | Date Completed: Oct 14, 09 | Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Depth (m)	Elevation (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Local Ground Surface Elevation: 0.0 m								Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80					
	about 80 mm ASPHALT	-0.1													
	brown **Gravelly Sand / Sand and Gravel FILL** some silt moist	0.1	SS	1	83	18			O	▲ 0					
		-0.8													
	brown **CLAYEY SILT TILL** some sand to sandy, trace gravel, trace oxidation stiff moist	0.8	SS	2	89	15	1	-1	O	▲ 5 ●—●		1	21	49	29
		-1.4													
	brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist	1.4	SS	3	100	69			O	▲ 10					
							2	-2							
	trace cobbles / boulders		SS	4	100	80			O	▲ 0					
							3	-3							
			SS	5	100	54/15			54 O 15	▲ 5					
							4	-4							
		-4.7	SS	6	100	50/15			50 O 15	▲ 0					
	End of Borehole	4.7													

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. B 09

amec

Project Number:	TT93042	Drilling Location:	25 m East of Driveway #2055 (Pro Golf)	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elev. (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Depth (m)	Field Testing: Penetration Testing (O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80)	Lab Testing: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	Instrumentation Installation	Comments & Grain Size Distribution (%) GR	SA	SI	CL
	brown **Sand and Gravel FILL** moist		SS	1	78	22		O	△ 0		35	46	19	
	-0.8													
	grey 0.8 **Silty Clay FILL** trace sand, trace organics moist	-1	SS	2	100	18	1	O	△ 25					
	--- trace rootlets		SS	3	100	21		O	△ 35					
	-2.1	-2					2							
	brown 2.1 **CLAYEY SILT TILL** trace sand, trace gravel hard moist		SS	4	100	31		O	△ 10					
		-3					3							
			SS	5	100	32		O	△ 0					
	-4.1	-4					4							
	brown 4.1 **SILT AND SAND / SILTY SAND TILL** trace gravel very dense wet		SS	6	100	58		O	△ 0					
	-5.0	-5					5							
	End of Borehole 5.0													

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.4 m.

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. B 10

amec

Project Number: TT93042
Project Client: AMEC Infrastructure Group
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: 320 m West of Driveway #2055
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	brown **Sand and Gravel FILL** trace to some silt moist	SS	1	83	34			O	8					
	-0.8													
	brown 0.8 **SILTY SAND / SILT AND SAND TILL** trace clay, trace gravel very dense moist	SS	2	100	70	1	-1	O	8		9	36	49	6
		SS	3	100	50/15			50/15	8					
	--- reddish brown					2	-2							
		SS	4	100	50/15			50/15	8					
	--- brown					3	-3							
		SS	5	100	50/13			50/13	7					
	--- trace cobbles / boulders wet					4	-4							
	-4.6	SS	6	100	50/5			50/5						
	End of Borehole 4.6													

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.4 m.

RECORD OF BOREHOLE No. B 11

amec

Project Number:	TT93042	Drilling Location:	500 m East of Driveway #2472	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	grey **Sand and Gravel FILL** some silt, trace organics moist	SS	1	100	12			○	65		
	--- trace clay ..... some cobbles	SS	2	100	18	1	-1	○	301		
	-1.4										
	grey 1.4 **Silty Clay FILL** trace sand, trace gravel, trace organics moist	SS	3	100	9			○	15 16		
	--- brown					2	-2				Bentonite: 0.3 m - 3.0 m
		SS	4	100	7	▽		○	5 29		
	-2.9										
	reddish brown 2.9 **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel, trace shale fragments hard damp	SS	5	100	71	3	-3	○	131		
						4	-4				Slotted pipe and sand: 3.0 m - 4.5 m
	-4.6	SS	6	100	50/8			50/8	9		
	End of Borehole 4.6										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 2.4 m.

RECORD OF BOREHOLE No. B 12

Project Number: TT93042 | Drilling Location: 250 m East of Driveway #2472 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 15, 09 | Date Completed: Oct 15, 09 | Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT); MTO Vane* (Intact / Remould); Nilcon Vane* (Intact / Remould); * Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values; Soil Vapour Reading parts per million (ppm); Lower Explosive Limit (LEL); Plastic / Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** trace silt moist	SS	1	100	19				0.9		
	-0.8										
	grey 0.8 **Silty Clay FILL** trace sand, trace organics moist	SS	2	100	16	1	-1		0 15		
	-1.8	SS	3	100	19				10 18		
	brown 1.8 **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel dense to very dense moist					2	-2				
		SS	4	100	48				52		
	trace yellow stains					3	-3				
		SS	5	100	64				21		
	grey					4	-4				
	-4.9	SS	6	100	50/15			50 15	33		
	End of Borehole 4.9										

AMEC Earth & Environmental
A division 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

Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 1.7 m.

Scale: 1 : 32

RECORD OF BOREHOLE No. B 15

Project Number:	TT93042	Drilling Location:	120 m West of Driveway #2594	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09	Date Completed: Oct 28, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	brown **Sand and Gravel FILL** trace to some silt moist	SS	1	71	31		
	-0.9 0.9 reddish brown **Clayey Silt FILL** trace sand, trace gravel moist	SS	2	100	16	1	-1
	--------- trace to some asphaltic concrete	SS	3	83	25		
		SS	4	33	30	2	-2
	-2.9 2.9 brown **Sand and Gravel FILL** trace silt, trace clay moist	SS	5	100	16	3	-3
	-4.0 4.0 grey **Silty Clay FILL** trace to some sand moist					4	-4
	-4.9 4.9 reddish brown **SILTY CLAY / CLAYEY SILT TILL** -5.0 5.0 trace sand hard moist	SS	6	100	70	5	-5
	End of Borehole						

FIELD TESTING: Penetration Testing — O SPT, □ PPT, ● DCPT; MTO Vane* — △ Intact, ▲ Remould; Nilcon Vane* — ◇ Intact, ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic / Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 18

Project Number: TT93042
Project Client: AMEC Infrastructure Group
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: 75 m West of Driveway #2868
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 27, 09 Date Completed: Oct 27, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (O SPT, □ PPT, ● DCPT); MTO Vane* (△ Intact, ▲ Remould); Nilcon Vane* (◇ Intact, ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 120 mm ASPHALT -0.1										
	brown 0.1 **Sand and Gravel FILL** trace to some silt moist	SS	1	100	25			O	○6		33 51 16
		SS	2	78	22	1	-1	O	○7		
	some gravel to gravelly	SS	3	100	50/15			50/15	○4		
	-2.1 brown 2.1 **SILT AND SAND / SILTY SAND TILL** trace gravel, trace clay, trace cobbles / boulders very dense moist	SS	4	100	52/15	2	-2	52/15	○6		
		SS	5	100	50/15	3	-3	50/15	○10		
	-4.8	SS	6	100	50/8	4	-4	50/8	○20		
	End of Borehole 4.8 Auger refusal on possible boulder at 4.8 m depth.										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. B 19

Project Number:	TT93042	Drilling Location:	20 m East of Caseley Drive	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	brown **Sand and Gravel FILL** some silt moist	SS	1	100	25			Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80		GR SA SI CL
	-0.6										
	reddish brown **SILT AND SAND / SILTY SAND TILL** some gravel, trace clay compact to very dense moist	SS	2	100	14	1	-1				
	trace cobbles / boulders	SS	3	100	50/15						
	-2.3					2	-2				
	End of Borehole 2.3	SS	4	100	50/5						

Auger refusal on possible boulder at 2.3 m depth.

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 01

Project Number:	TT93042	Drilling Location:	15 m East of CNR Crossing Bridge	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Complied by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09	Date Completed: Oct 13, 09	Revision No.: 0, 2/9/10

Local Ground Surface Elevation: 0.0 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	about 210 mm ASPHALT						
	-0.2 / 0.2 brown Sand and Gravel FILL moist	SS	1	100	50/15		
		SS	2	100	50/15	1	-1
	trace to some silt	SS	3	100	12		
	-2.1 / 2.1 brown Sandy Silt FILL trace clay , trace gravel moist	SS	4	100	23	2	-2
		SS	5	89	42	3	-3
		SS	6	100	59	4	-4
						5	-5
						6	

FIELD TESTING: Penetration Testing (O SPT, □ PPT, ● DCPT); MTO Vane* (△ Intact, ▲ Remould); Nilcon Vane* (◇ Intact, ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading, parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); W_p W W_l; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

Continued on Next Page

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 01

Project Number: TT93042 Drilling Location: 15 m East of CNR Crossing Bridge Logged by: JF

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sandy Silt FILL** trace clay , trace gravel moist	SS	7	100	43				0		
						7	-7				
		SS	8	100	42				0		
						8	-8				
						9	-9				
	-9.4	SS	9	83	21				0		
	grey **CLAYEY SILT TILL** trace sand, trace gravel very stiff to hard moist 9.4										
						10	-10				
	reddish brown										
	trace cobbles / boulders	SS	10	100	50/15			50/15	0		
	-11.0 **End of Borehole** 11.0										

Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 02

amec

Project Number:	TT93042	Drilling Location:	20 m West of CNR Crossing Bridge	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drillng Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 13, 09	Date Completed: Oct 13, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	Local Ground Surface Elevation: 0.0 m										
	about 180 mm ASPHALT										
	-0.2 / 0.2 brown **Sand and Gravel FILL** trace silt										
		SS	1	83	42			O	0.4		
						1	-1				
		SS	2	83	33			O	0.3		
		SS	3	78	20			O	0.5		
	trace cobbles					2	-2				
	-2.1 / 2.1 brown **Clayey Silt FILL** trace sand, trace gravel moist										
		SS	4	917	15			O	5.8		
						3	-3				
		SS	5	100	14			O	0 20		
	-4.1 / 4.1 brown **Silty Sand FILL** trace gravel, trace asphalt debris moist					4	-4				
		SS	6	100	33			O	5.9		
						5	-5				
	-5.5 / 5.5 brown **Clayey Silt FILL** trace sand, trace gravel moist										
						6					

Continued on Next Page

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 02

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

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Clayey Silt FILL** trace sand, trace gravel moist	SS	7	100	31			Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane*: △ Intact, ▲ Remould; Nilcon Vane*: ◇ Intact, ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80		
						7	-7				
		SS	8	100	23						
						8	-8				
						9	-9				
		SS	9	89	15						
						10	-10				
	-10.2										
	brown **Sand and Silt / Sandy Silt FILL** trace clay, trace gravel moist 10.2										
		SS	10	100	83	11	-11				
	-11.1 **End of Borehole** 11.1										

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 03

amec

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

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 14, 09 | Date Completed: Oct 14, 09 | Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* Δ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	about 320 mm ASPHALT										
	-0.3										
	brown 0.3 **Sand and Gravel FILL** trace silt moist	SS	1	78	29			O	▲0		
	-0.8										
	brown 0.8 **Silty Sand FILL** trace gravel moist	SS	2	83	19	1	-1	O	▲0		
	trace clay, trace organics	SS	3	100	51	▽ 2	-2	O	▲0		
	-2.6	SS	4	78	11			O	▲5		
	grey 2.6 **Silty Clay FILL** trace sand, trace gravel moist					3	-3				
		SS	5	100	12			O	▲5		
						4	-4				
		SS	6	100	20	5	-5	O	▲10		Bentonite: 0.3 m - 7.7 m
	-5.5										
	reddish brown 5.5 **CLAYEY SILT TILL** trace sand, trace gravel very stiff moist					6					

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/14/2009 at a depth of: 1.8 m. ■ Cave in depth after removal of augers: 4.4 m.

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BC 03

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	CLAYEY SILT TILL (continued) -6.2 reddish brown 6.2 **WEATHERED SHALE** trace limestone fragments damp	SS	7	100	50/13	7	-7	50/13	△ 5		
		~~SS~~	~~8~~	~~100~~	~~50/3~~	8	-8	50/3			
		~~SS~~	~~9~~	~~100~~	~~50/1~~	9	-9	50/1			Slotted pipe and sand: 7.7 m - 10.7 m
						10	-10				
	-10.7 **End of Borehole** 10.7 Borehole BC-3W was advanced next to this borehole by augering and a monitoring well was installed in it.	~~SS~~	~~10~~		~~50/0~~			50/0			

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'.

Scale: 1 : 32

RECORD OF MONITORING WELL No. BC 03 - W

Project Number:	TT93042	Drilling Location:	20 m East of Mississauga Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09	Date Completed: Oct 26, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	This borehole was advanced next to Borehole BC 3 by augering. See Borehole BC 3 for soil strata					0	0				
						1	-1				
						2	-2				Bentonite: 0.3 m - 3.0 m
						3	-3				
						4	-4				Slotted pipe and sand: 3.0 m - 4.6 m
	-4.6										
	4.6										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 04

amec

Project Number:	TT93042	Drilling Location:	30 m East of Mississauga Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09	Date Completed: Oct 14, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** moist										
	-0.6 0.6 brown **Silty Sand FILL** trace to some gravel moist	SS	1	83	13			○	△ 0		
		SS	2	78	9	1	-1	○	△ 0		
		SS	3	89	38			○	△ 5		
	-2.1 2.1 grey **Clayey Silt FILL** trace sand moist					2	-2				
		SS	4	83	12			○	△ 35		Bentonite: 0.3 m - 3.0 m
	-2.9 2.9 grey **Silty Sand FILL** trace clay moist to wet					3	-3				
		SS	5	94	10			○	△ 40		
						4	-4				Slotted pipe and sand: 3.0 m - 4.6 m
	-4.1 4.1 reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel, trace shale fragments hard moist										
		SS	6	100	74			○	△ 10		
						5	-5				
						6					

AMEC Earth & Environmental
A division 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

Groundwater depth on completion of drilling on 10/14/2009 at a depth of: 3.2 m. Cave in depth after removal of augers: 3.2 m.

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BC 04

Project Number: TT93042 | Drilling Location: 30 m East of Mississauga Road | Logged by: JF

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel, trace shale fragments hard moist	SS	7	91	50/13			50/13	0		
	-7.0					7	-7				
	reddish brown **WEATHERED SHALE** 7.0	SS	8	100	50/13			50/13	10		
						8	-8				
		SS	9	100	50/5			50/5	0		
						9	-9				
						10	-10				
	-10.7	SS	10	100	50/3			50/3			
	End of Borehole 10.7										

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 05

Project Number:	TT93042	Drilling Location:	Entrance to Petro Canada Gas	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (O SPT, □ PPT, ● DCPT); MTO Vane* (△ Intact, ▲ Remould); Nilcon Vane* (◇ Intact, ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 110 mm ASPHALT	-0.1										
	grey **Sand and Gravel FILL** moist	0.1	SS	1	89	29			O	5		
	reddish brown **Sandy Silt / Silty Sand FILL** moist	-1.1 1.1	SS	2	100	32	1	-1	O	0		
			SS	3	100	33			O	5		
	brown **Clayey Silt FILL** trace sand, trace gravel	-2.1 2.1					2	-2				
			SS	4	100	42			O	5		
	brown **CLAYEY SILT TILL** trace sand, trace gravel hard moist	-2.9 2.9					3	-3				
			SS	5	100	36			O	10		
	reddish brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist to wet	-4.1 4.1					4	-4				
			SS	6	100	50/15			50 15	5		
	End of Borehole	-4.9 4.9										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 3.0 m. ■ Cave in depth after removal of augers: 3.5 m.

RECORD OF BOREHOLE No. BC 06

amec

Project Number:	TT93042	Drilling Location:	30 m West of Petro Canada Gas	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 14, 09	Date Completed: Oct 14, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* Δ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	brown **Gravelly Sand / Sand and Gravel FILL** moist		SS	1	79	13			O	Δ 5					
		-1.1	SS	2	56	7	1	-1	O	Δ 5					
	brown **SILT AND SAND / SILTY SAND TILL** trace to some clay, trace gravel loose to dense moist	1.1													
			SS	3	100	32			O	Δ 5		8	38	44	10
							2	-2							
			SS	4	100	26			O	Δ 35					
							3	-3							
			SS	5	100	10			O	Δ 35					
		-4.3					4	-4							
	brown **GRAVELLY SAND** trace silt very dense wet	4.3													
			SS	6	100	73			O	Δ 30					
		-5.0					5	-5							
	End of Borehole	5.0													

AMEC Earth & Environmental
A division 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

Groundwater depth on completion of drilling on 10/14/2009 at a depth of: 2.9 m. Cave in depth after removal of augers: 2.9 m.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 07

amec

Project Number:	TT93042	Drilling Location:	Driveway #2055 (Pro Golf)	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT □ PPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading △ parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 100 mm ASPHALT	-0.1										
	brown **Sand and Gravel FILL** moist	0.1	SS	1	100	17			○	△ 8		
		-0.8										
	brown **Clayey Silt FILL** trace to some sand, trace gravel moist	0.8	SS	2	100	18	1	-1	○	△ 5 ○ 19		
		-1.4										
	brown **CLAYEY SILT TILL** trace sand, trace gravel hard moist	1.4	SS	3	100	34	2	-2	○	△ 25 ○ 15		
			SS	4	100	32	3	-3	○	△ 16 ○ 13		
			SS	5	100	30	4	-4	○	△ 5 ○ 14		
		-4.1										
	brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist to wet	4.1	SS	6	100	61	5	-5	○	△ 15		
		-5.0										
	End of Borehole	5.0										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.4 m.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 08

Project Number:	TT93042	Drilling Location:	75 m West of Driveway #2055 (Pro Golf)	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** trace to some silt moist	SS	1	83	34			○ 50	△ 105		
	-0.6 brown **Silty Sand FILL** trace gravel moist 0.6	SS	2	78	21	1	-1	○	△ 5 ○ 10		
	trace cobbles / boulders	SS	3	100	50/13			○ 50/13	● 30		
		SS	4	100	5	2	-2	○	△ 4 ○ 18		
	-2.9 brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel very stiff moist 2.9	SS	5	67	21	3	-3	○	△ 35 ○ 17		
	-4.1 reddish brown **SANDY SILT / SILTY SAND TILL** trace clay, trace gravel very dense moist 4.1					4	-4				
	trace cobbles / boulders -4.7 **End of Borehole** 4.7	SS	6	100	50/15			○ 50/15			

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 3.3 m.

RECORD OF BOREHOLE No. BC 09

Project Number:	TT93042	Drilling Location:	250 m West of Driveway #2055	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elev. (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Depth (m)	Field Testing	Lab Testing	Instrumentation Installation	Comments & Grain Size Distribution (%)
	brown **Sand and Gravel FILL** some silt moist		SS	1	94	27					
		-0.6									
	brown **CLAYEY SILT TILL** trace sand, trace gravel, trace oxidation very stiff to hard moist	0.6	SS	2	89	24	1	-1			
			SS	3	100	67					
		-2.1					2	-2			
	brown **SAND AND SILT / SANDY SILT TILL** trace gravel, some cobbles / boulders very dense moist	2.1	SS	4	100	50/15					
							3	-3			
			SS	5	100	50/13					
	--- grey										
		-4.7	SS	6	100	50/10	4	-4			
	End of Borehole	4.7									

Field Testing: Penetration Testing — O SPT, □ PPT, ● DCPT; MTO Vane* — △ Intact, ▲ Remould; Nilcon Vane* — ◇ Intact, ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Lab Testing: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic 20 40 60 80 Liquid

Comments & Grain Size Distribution (%): GR SA SI CL

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 3.5 m.

RECORD OF BOREHOLE No. BC 10

Project Number:	TT93042	Drilling Location:	470 m West of Driveway #2055	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09 Date Completed: Oct 15, 09	Revision No.:	0, 2/9/10

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	Local Ground Surface Elevation: 0.0 m							Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ○ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80		GR SA SI CL
	brown **Sand and Gravel FILL** trace silt moist	SS	1	78	22			O	△30		
	-0.6 / 0.6 brown **Clayey Silt FILL** trace sand, trace gravel, trace organics moist	SS	2	78	21	1	-1	O	△25		
	Bentonite: 0.3 m - 3.0 m	SS	3	56	16			O	△25		Bentonite: 0.3 m - 3.0 m
						2	-2				
		SS	4	67	12			O	△35		
	-2.9 / 2.9 brown **SAND AND SILT / SANDY SILT TILL** trace clay, trace gravel dense to very dense moist	SS	5	100	46	3	-3	O	△50		
	Sand: 3.0 m - 4.6 m Perforated Pipe: 3.0 m - 4.6 m					4	-4	▽			Slotted pipe and sand: 3.0 m - 4.6 m
	-4.6 / 4.6 some cobbles / boulders **End of Borehole**	SS	6	100	50/1			50/1			

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.1 m.

RECORD OF BOREHOLE No. BC 11

amec

Project Number:	TT93042	Drilling Location:	350 m East of Driveway #2472	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	brown **Sand and Gravel FILL** moist			SS	1	83	27
		-0.6					
	brown **Silty Sand FILL** wet	0.6		SS	2	0	31
		-1.4					
	brown **CLAYEY SILT TILL** trace sand, trace gravel, trace rootlets, trace oxidation very stiff moist	1.4		SS	3	100	23
		-2.1					
	brown **SAND AND SILT / SANDY SILT TILL** trace clay, trace gravel, trace cobbles / boulders very dense moist to wet	2.1		SS	4	100	66
				SS	5	100	50/15
		-4.7		SS	6	100	50/15
	End of Borehole	4.7					

FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

Bentonite: 0.3 m - 3.0 m

Slotted pipe and sand: 3.0 m - 4.6 m

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 3.5 m.

RECORD OF BOREHOLE No. BC 12

Project Number: TT93042
Project Client: AMEC Infrastructure Group
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: 240 m East of Driveway #2472
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 15, 09 Date Completed: Oct 15, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	brown **Silty Sand FILL** trace to some gravel moist	SS	1	89	12			○	0		
	-----										
	trace clay, trace organics	SS	2	56	12	1	-1	○	0		
	-1.4										
	brown 1.4 **SAND AND SILT / SANDY SILT TILL** trace clay, trace gravel dense to very dense moist to wet	SS	3	89	37			○	0		
						2	-2				
		SS	4	100	62			○	5		
						3	-3				
		SS	5	100	75			○	5		
						4	-4				
		SS	6	100	65			○	5		
	-5.0					5	-5				
	End of Borehole 5.0										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.3 m.

RECORD OF BOREHOLE No. BC 13

amec

Project Number:	TT93042	Drilling Location:	150 m East of Driveway #2475	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	grey **Silty Sand FILL** trace to some gravel moist		SS	1	83	22			O	△ 0		
	---- trace clay, trace organics		SS	2	78	17	1	-1	O	△ 35		
		-1.4										
	brown **Silty Clay FILL** trace sand, trace gravel, trace organics moist	1.4	SS	3	94	19			O	△ 25		
		-2.1					2	-2				
	brown **SAND AND SILT / SANDY SILT TILL** trace clay, trace gravel dense to very dense moist to wet	2.1	SS	4	100	47			O	△ 25		
	some cobbles / boulders						3	-3				
			SS	5	100	50/15			50 O 15	△ 15		
		-4.7	SS	6	100	50/15	4	-4	50 O 15			
	End of Borehole	4.7					▽					

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/15/2009 at a depth of: 4.7 m.

RECORD OF BOREHOLE No. BC 14

amec

Project Number:	TT93042	Drilling Location:	70 m East of Driveway #2475	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** some silt moist		SS	1	100	22			O	△15		
		-0.6										
	grey **Clayey Silt FILL** trace sand, trace gravel, trace organics moist	0.6	SS	2	100	10	1	-1	O	△30		
			SS	3	100	15			O	△45		
							2	-2				
		-2.4	SS	4	100	43			O	△35		
	brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel hard moist	2.4					3	-3				
			SS	5	100	50/15			50 O 15	△15		
		-4.7	SS	6	100	50/15	4	-4	50 O 15			
	End of Borehole	4.7										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 15

Project Number: TT93042
Drilling Location: Driveway #2475
Logged by: JF

Project Client: AMEC Infrastructure Group
Drilling Method: 150 mm Solid Stem Augering
Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Drilling Machine: Truck Mounted Drill
Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.
Date Started: Oct 15, 09
Date Completed: Oct 15, 09
Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Elevation	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Depth (m)	Elevation (m)	Field Testing	Lab Testing	Instrumentation Installation	Comments & Grain Size Distribution (%) GR SA SI CL
	about 100 mm ASPHALT	-0.1										
	brown Sand and Gravel FILL some silt moist	0.1	SS	1	94	33						
		-0.8										
	brown Clayey Silt FILL trace sand, trace gravel moist	0.8	SS	2	100	14	1	-1				
		-1.4										
	brown CLAYEY SILT TILL trace sand, trace gravel hard moist	1.4	SS	3	100	32	2	-2				
			SS	4	100	36	3	-3				
			SS	5	100	51	4	-4				
		-4.1										
	brown SILT AND SAND / SILTY SAND TILL trace clay, trace gravel very dense moist	4.1	SS	6	100	50/15						
	End of Borehole	-4.9 4.9										

Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 16

amec

Project Number:	TT93042	Drilling Location:	Driveway #2472	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* Δ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Δ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 40 mm TOPSOIL 0.0 brown Silty Sand FILL trace to some gravel moist	SS	1	89	16			O	Δ 15		
		SS	2	56	15	1	-1	O	Δ 10		
	-1.4 brown 1.4 CLAYEY SILT TILL trace sand, trace gravel hard moist										
		SS	3	100	35			O	Δ 10		
						2	-2				
		SS	4	100	61			O	Δ 20		
						3	-3				
		SS	5	100	37			O	Δ 5		
						4	-4				
	---- grey	SS	6	100	36			O	Δ 5		
	-5.0 End of Borehole 5.0					5	-5				

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 17

Project Number:	TT93042	Drilling Location:	25 m East Heritage Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	brown **Sand and Gravel FILL** moist		SS	1	83	18			O	△5		
	-0.6 0.6 brown **Silty Clay FILL** trace sand, trace gravel moist		SS	2	0	22	1	-1	O	△25		
	---- trace organics		SS	3	100	23			O	△10		
	-2.1 2.1 brown **CLAYEY SILT TILL** trace sand, trace gravel hard moist		SS	4	100	33	2	-2	O	△25		
	---- trace oxidation		SS	5	100	46	3	-3	O	△30		
	-4.1 4.1 grey **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist		SS	6	100	61	4	-4	O	△45		
	-5.0 **End of Borehole** 5.0						5	-5				

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 18

amec

Project Number:	TT93042	Drilling Location:	Intersection at Heritage Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT □ PPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 110 mm ASPHALT	-0.1										
	grey Sand and Gravel FILL moist	0.1 -0.3										
	brown Silty Sand FILL trace gravel moist	-0.3	SS	1	94	27			○			
	grey Clayey Silt FILL trace sand, trace gravel moist	-0.8 0.8	SS	2	22	23	1	-1	○			
	brown to grey SILTY CLAY / CLAYEY SILT TILL hard damp	-1.4 1.4	SS	3	83	49/15			49 15			
	reddish brown trace gravel, trace shale fragments		SS	4	100	50/15	2	-2	50 15			
			SS	5	100	52/15	3	-3	52 15			
		-4.7	SS	6	100	50/13	4	-4	50 13			
	End of Borehole	4.7										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 19

amec

Project Number:	TT93042	Drilling Location:	20 m West of Heritage Road	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 15, 09	Date Completed: Oct 15, 09	Revision No.: 0, 2/9/10

Local Ground Surface Elevation: 0.0 m

Depth (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Elevation (m)
	about 200 mm ASPHALT					
-0.2 / 0.2	grey **Sand and Gravel FILL** moist	SS	1	78	26	
-0.8 / 0.8	brown **Silty Sand FILL** moist	SS	2	94	20	-1
		SS	3	28	17	-2
-2.1 / 2.1	grey **Clayey Silt FILL** trace sand, trace rootlets, trace organics moist	SS	4	56	12	
-3.0 / 3.0	grey **Silty Sand FILL** trace organics, trace rootlets moist	SS	5	100	11	-3
-4.1 / 4.1	reddish brown **CLAYEY SILT TILL** trace sand, trace gravel, trace cobbles / boulders hard moist	SS	6	100	50/10	-4
						-5
						-6

FIELD TESTING: Penetration Testing — O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading ▲ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic — Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Continued on Next Page

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 19

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	-6.1	SS	7	100	50/3			50/3			
	End of Borehole 6.1										

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 20

Project Number: TT93042 | Drilling Location: Driveway #2534 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 26, 09 | Date Completed: Oct 26, 09 | Revision No.: 0, 2/9/10

Local Ground Surface Elevation: 0.0 m

Depth (m)	Description	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Elevation (m)
0.1	about 50 mm TOPSOIL					
0.1	brown Sand and Gravel FILL, trace to some silt, moist	SS	1	58	15	
1.1	brown Silty Clay FILL, trace sand, trace gravel, very stiff, moist	SS	2	56	8	-1
		SS	3	100	22	
2.1	brown Sandy Silt FILL, trace clay, trace gravel, moist	SS	4	100	26	-2
2.9	reddish brown SILT AND SAND / SILTY SAND TILL, trace clay, trace gravel, very dense, moist	SS	5	67	81	-3
4.4	reddish brown WEATHERED SHALE	SS	6	100	50/10	-4
4.7	End of Borehole					

FIELD TESTING: Penetration Testing — ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 21

amec

Project Number:	TT93042	Drilling Location:	Between Driveway #2538 and 2556	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09	Date Completed: Oct 26, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 150 mm TOPSOIL	-0.2										
	brown **Sand and Gravel FILL** some silt moist	0.2	SS	1	63	4			O	△ 0		
	grey **Silty Clay FILL** trace sand, trace gravel, trace organics moist	-0.7 0.7	SS	2	0	7	1	-1	O	△ 10		
	brown **CLAYEY SILT TILL** trace sand, trace gravel very stiff moist	-1.4 1.4	SS	3	67	26			O	△ 15		
	reddish brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel very dense moist	-2.1 2.1	SS	4	100	50/13	2	-2	50/13	△ 10		
	some shale fragments		SS	5	91	50/13	3	-3	50/13	△ 20		
	reddish brown **WEATHERED SHALE**	-4.0 4.0					4	-4				
	End of Borehole	-4.6 4.6	SS	6	100	50/5			50/5	△ 5		
	Auger refusal at 4.7 m depth.											

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 22

amec

Project Number: TT93042 | Drilling Location: 25 m West of Driveway #2578 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 26, 09 | Date Completed: Oct 26, 09 | Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80		GR SA SI CL
	brown **Silty Sand FILL** trace to some gravel moist	SS	1	71	18			O	0		
	-0.7										
	brown 0.7 **Clayey Silt FILL** trace sand, trace rootlets moist	SS	2	56	12	1	-1	O	15		
	-1.4										
	brown 1.4 **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel compact to very dense moist	SS	3	89	28			O	25		
						2	-2				
		SS	4	78	36			O	15		
						3	-3				
		SS	5	100	50/15			50 15	10		
						4	-4				
	trace shale fragments -4.9	SS	6	83	50/15			50 15	10		
	End of Borehole 4.9										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 23

amec

Project Number:	TT93042	Drilling Location:	Driveway #2578	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09	Date Completed: Oct 26, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	brown **Sand and Gravel FILL** moist	SS	1	75	30			O	△5		
	-0.9 brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel compact to very dense moist	SS	2	100	19	1	-1	O	△10		
		SS	3	100	51			O	△35		
		SS	4	100	47	2	-2	O	△25		
	some cobbles / boulders	SS	5	100	50/15	3	-3	50 O 15	△10		
						4	-4				Hard augering
	-4.6 **End of Borehole** 4.6	SS	6	100	50/3			50 O 3	▲0		

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 24

amec

Project Number:	TT93042	Drilling Location:	20 m West of Driveway #2556	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 26, 09 Date Completed: Oct 26, 09	Revision No.:	0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 100 mm TOPSOIL	-0.1										
	brown **Gravel and Sand FILL** moist	0.1	SS	1	63	7			O	△ 5		
	brown **Silty Clay FILL** trace sand, trace gravel moist	-0.7 0.7	SS	2	67	8	1	-1	O	△ 15		
	brown **Sandy Silt FILL** trace clay moist	-1.4 1.4	SS	3	78	9			O	△ 15		
	brown **SILT AND SAND / SILTY SAND TILL** trace gravel very dense moist	-2.4 2.4	SS	4	100	50/15	2	-2	50 15	△ 25		
	trace cobbles / boulders		SS	5	100	50/15	3	-3	50 15	△ 5		
	reddish brown **WEATHERED SHALE**	-4.0 4.0					4	-4				
	End of Borehole	-4.6 4.6	SS	6	100	50/5			50 5	△ 5		

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 25

Project Number: TT93042
Project Client: AMEC Infrastructure Group
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: 170 m West of Driveway #2594
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 28, 09 Date Completed: Oct 28, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	Local Ground Surface Elevation: 0.0 m						
	brown **Sand and gravel FILL** trace silt moist	SS	1	67	30		
						1	-1
		SS	2	78	18		
	-1.4						
	reddish brown **Silty Clay FILL** trace sand, trace gravel moist	SS	3	67	13	2	-2
		SS	4	56	12		
						3	-3
		SS	5	67	6		
	-4.0						
	brown to reddish brown **CLAYEY SILT TILL** trace sand stiff to hard moist					4	-4
		SS	6	56	14		
						5	-5
						6	

FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BC 25

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

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	trace shale fragments -6.2	SS	7	100	50/15			50 15	△ 5					
	End of Borehole 6.2													

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'.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 26

Project Number: TT93042
Project Client: AMEC Infrastructure Group
Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study
Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.

Drilling Location: 50 m East of Driveway #2702
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: Oct 28, 09 Date Completed: Oct 28, 09

Logged by: JF
Compiled by: SN
Reviewed by: PB
Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT), MTO Vane* (Intact / Remould), Nilcon Vane* (Intact / Remould), * Undrained Shear Strength (kPa)	LAB TESTING: Rinse pH Values, Soil Vapour Reading (parts per million (ppm)), Lower Explosive Limit (LEL), Plastic / Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** moist	SS	1	75	30						
	trace clay	SS	2	100	20	1	-1				
	trace asphalt debris	SS	3	100	30						
	-2.1 grey **Clayey Silt FILL** trace sand, trace organics and yellow stains moist -2.9	SS	4	100	18	2	-2				
	brown **CLAYEY SILT TILL** trace sand hard damp	SS	5	100	32	3	-3				
	reddish brown					4	-4				
	-4.7 **End of Borehole** 4.7	SS	6	100	50/13			50/13			

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 27

amec

Project Number: TT93042 | Drilling Location: Driveway #2702 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 2/9/10

Local Ground Surface Elevation: 0.0 m

Lithology Plot	DESCRIPTION	Depth (m)	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value
	about 100 mm TOPSOIL	-0.1					
	brown **Sand and Gravel FILL** trace to some silt, trace rootlets moist	0.1		SS	1	75	8
	trace cobbles	-0.7 0.7					
	reddish brown **Silty Clay FILL** trace sand, trace gravel, trace oxidation moist			SS	2	0	12
	reddish brown **CLAYEY SILT TILL** trace shale fragments hard damp	-1.4 1.4		SS	3	100	38
				SS	4	100	50/15
				SS	5	100	50/13
		-4.6		SS	6	100	50/5
	End of Borehole	4.6					

FIELD TESTING: Penetration Testing — O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

AMEC Earth & Environmental
A division 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

No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 28

Project Number:	TT93042	Drilling Location:	Driveway #2719	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09	Date Completed: Oct 28, 09	Revision No.: 0, 2/9/10

Local Ground Surface Elevation: 0.0 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); *Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 75 mm ASPHALT	-0.1										
	brown **Sand and Gravel FILL** moist	0.1	SS	1	100	29			0	0		
			SS	2	100	16	1	-1	0	0		
	grey **Silty Clay FILL** trace sand moist	-1.4 1.4	SS	3	100	82			0	0		
	reddish brown **SILTY CLAY / CLAYEY SILT TILL** trace shale fragments hard damp	-1.8 1.8	SS	4	100	50/13	2	-2	50/13	0		
			SS	5	100	50/5	3	-3	50/5	0		
	End of Borehole	-4.6 4.6	SS	6	100	50/3	4	-4	50/3	5		

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 29

Project Number: TT93042 | Drilling Location: Driveway #2740 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 2/9/10

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 0.0 m)		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT); MTO Vane* (Intact / Remould); Nilcon Vane* (Intact / Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_l; Plastic / Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** moist		SS	1	79	32			32	0		
		-0.6										
	dark grey **Clayey Silt FILL** trace sand, trace organics moist	0.6	SS	2	78	14	1	-1	14	0		
		-1.4										
	reddish brown **CLAYEY SILT TILL** trace shale fragments hard damp	1.4	SS	3	100	50/15			50/15	0		
			SS	4	100	50/13	2	-2	50/13	0		
			SS	5	100	50/10	3	-3	50/10	0		
		-4.6	SS	6	100	50/5	4	-4	50/5	0		
	End of Borehole	4.6										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 30

Project Number:	TT93042	Drilling Location:	35 m East of Driveway #2774	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09	Date Completed: Oct 28, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	about 120 mm ASPHALT	-0.1													
	Sand and Gravel FILL	0.1													
		-0.3													
	reddish brown Silty Clay FILL moist	0.3	SS	1	56	10			○	0					
		-0.6													
	reddish brown SILTY CLAY / CLAYEY SILT TILL trace sand, trace shale fragments hard damp	0.6	SS	2	83	50/15	1	-1	50/15	0					
			SS	3	100	50/8			50/8	0					
		-2.1					2	-2							
	grey to reddish brown WEATHERED SHALE damp	2.1	SS	4	100	50/13			50/13	0					
			SS	5	100	50/8	3	-3	50/8	0					
		-4.6	SS	6	100	50/3	4	-4	50/3	0					
	End of Borehole	4.6													

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 31

amec

Project Number:	TT93042	Drilling Location:	Driveway #2774	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 28, 09	Date Completed: Oct 28, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane*: △ Intact, ▲ Remould; Nilcon Vane*: ◇ Intact, ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; △ Soil Vapour Reading parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); W_p W W_l; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	Local Ground Surface Elevation: 0.0 m											
	about 70 mm ASPHALT	-0.1										
	brown **Sand and Gravel FILL** trace to some silt moist	0.1	SS	1	56	12			O	▲ 0		
	reddish brown **CLAYEY SILT TILL** trace sand, trace shale fragments hard damp	-0.8 0.8 -1.4	SS	2	78	58	1	-1	O	▲ 0		
	grey **WEATHERED SHALE** limestone seams damp	1.4	SS	3	100	50/10			50/10	▲ 5		
			SS	4	100	50/8	2	-2	50/8	▲ 5		
			SS	5	100	50/5	3	-3	50/5	▲ 0		
	--- reddish brown						4	-4				
		-4.6	SS	6	100	50/5			50/5	▲ 10		
	End of Borehole	4.6										

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

RECORD OF BOREHOLE No. BC 32

amec

Project Number: TT93042 | Drilling Location: 40 m West of Driveway #2774 | Logged by: JF

Project Client: AMEC Infrastructure Group | Drilling Method: 150 mm Solid Stem Augering | Compiled by: SN

Project Name: Geotechnical Investigation for Bovaird Drive Class EA Study | Drilling Machine: Truck Mounted Drill | Reviewed by: PB

Project Location: Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON. | Date Started: Oct 28, 09 | Date Completed: Oct 28, 09 | Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_L; Plastic 20 40 60 80 Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown **Sand and Gravel FILL** moist	SS	1	79	25			O	0		
		SS	2	100	23	1	-1	O	0		
	-1.4 1.4 reddish brown **CLAYEY SILT TILL** trace shale fragments hard damp	SS	3	100	50/5			50/5	0		
		SS	4	100	50/5	2	-2	50/5	0		
		SS	5	100	50/5	3	-3	50/5	0		
	-4.6 4.6 **End of Borehole**	SS	6	100	50/5	4	-4	50/5	0		

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

RECORD OF BOREHOLE No. BC 33

amec

Project Number:	TT93042	Drilling Location:	Driveway #2838	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* Δ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	about 200 mm ASPHALT	-0.2 / 0.2													
	brown **Sand and Gravel FILL** trace to some silt moist		SS	1	83	18			O	0					
							1	-1							
			SS	2	78	17			O	0					
		-1.4 / 1.4													
	brown **Sandy Silt FILL** trace clay, trace gravel moist		SS	3	56	12			O	0					
							2	-2							
		-2.1 / 2.1													
	brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace gravel, trace oxidation stiff moist		SS	4	100	12			O	5					
							3	-3							
			SS	5	100	18			O	10					
		-4.0 / 4.0													
	brown to reddish brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace shale fragments hard wet						4	-4							
			SS	6	100	70			O	10					
		-5.0 / 5.0					5	-5							
	End of Borehole														

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/27/2009 at a depth of: 4.1 m.

RECORD OF BOREHOLE No. BC 34

amec

Project Number:	TT93042	Drilling Location:	Driveway #2809	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 200 mm ASPHALT	-0.2										
	brown **Sand and Gravel FILL** some silt moist	0.2	SS	1	83	13			O	△ 5 6		
	brown **Silty Sand FILL** trace gravel, trace organics moist	-0.8 0.8	SS	2	78	7	1	-1	O	△ 5 ○ 10		
	brown to dark grey **Silty Clay / Clayey Silt FILL** trace sand, trace gravel, trace organics moist	-1.7 1.7	SS	3	67	12			O	△ 20 ○ 14		
			SS	4	89	11	2	-2	O	△ 25 ○ 23		
	brown **SILTY CLAY / CLAYEY SILT TILL** trace sand, trace cobbles firm moist	-3.4 3.4	SS	5	56	6	3	-3	O	△ 25 ○ 17		
	brown **SILT AND SAND / SILTY SAND TILL** trace clay, trace gravel loose wet	-4.3 4.3					4	-4				
			SS	6	100	8	5	-5	O	△ 30 ○ 16		
	End of Borehole	-5.0 5.0										

AMEC Earth & Environmental
A division 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

▽ Groundwater depth on completion of drilling on 10/27/2009 at a depth of: 4.3 m.

RECORD OF BOREHOLE No. BC 35

Project Number:	TT93042	Drilling Location:	15 m West of Driveway #2838	Logged by:	JF
Project Client:	AMEC Infrastructure Group	Drilling Method:	150 mm Solid Stem Augering	Compiled by:	SN
Project Name:	Geotechnical Investigation for Bovaird Drive Class EA Study	Drilling Machine:	Truck Mounted Drill	Reviewed by:	PB
Project Location:	Bovaird Drive from Lake Louise Drive to Peel/Halton Boundary at Caseley Drive, Brampton, ON.	Date Started:	Oct 27, 09	Date Completed: Oct 27, 09	Revision No.: 0, 2/9/10

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 0.0 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT, □ PPT, ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l; Plastic Liquid; 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 150 mm TOPSOIL 0.0 0.6 brown **Sand and Gravel FILL** trace silt, trace clay moist	A	1			1	-1				
	--- trace organics, trace rootlets	A	2			2	-2				
	-4.0 4.0 brown to grey **Clayey Silt FILL** trace sand, trace gravel moist	A	3			3 4 5 6	-3 -4 -5				Bentonite: 0.3 - 11.3 m

AMEC Earth & Environmental
A division 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

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BC 35

Project Number: TT93042 Drilling Location: 15 m West of Driveway #2838 Logged by: JF

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey **Clayey Silt FILL** trace sand, trace gravel moist	A	4			7	-7				
		A	5			8	-8				
						9	-9				
						10	-10				
	-11.0	SS	6	56	32			O			
	11.0 reddish brown **WEATHERED SHALE** limestone seams damp					11	-11				
						12	-12				
		SS	7	100	50/5			50/5 O			Slotted pipe and sand: 11.3 m - 12.9 m

Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_p W W_L; Plastic Liquid 20 40 60 80

Scale: 1 : 32

Continued on Next Page

RECORD OF BOREHOLE No. BC 35

Project Number: TT93042 Drilling Location: 15 m West of Driveway #2838 Logged by: JF

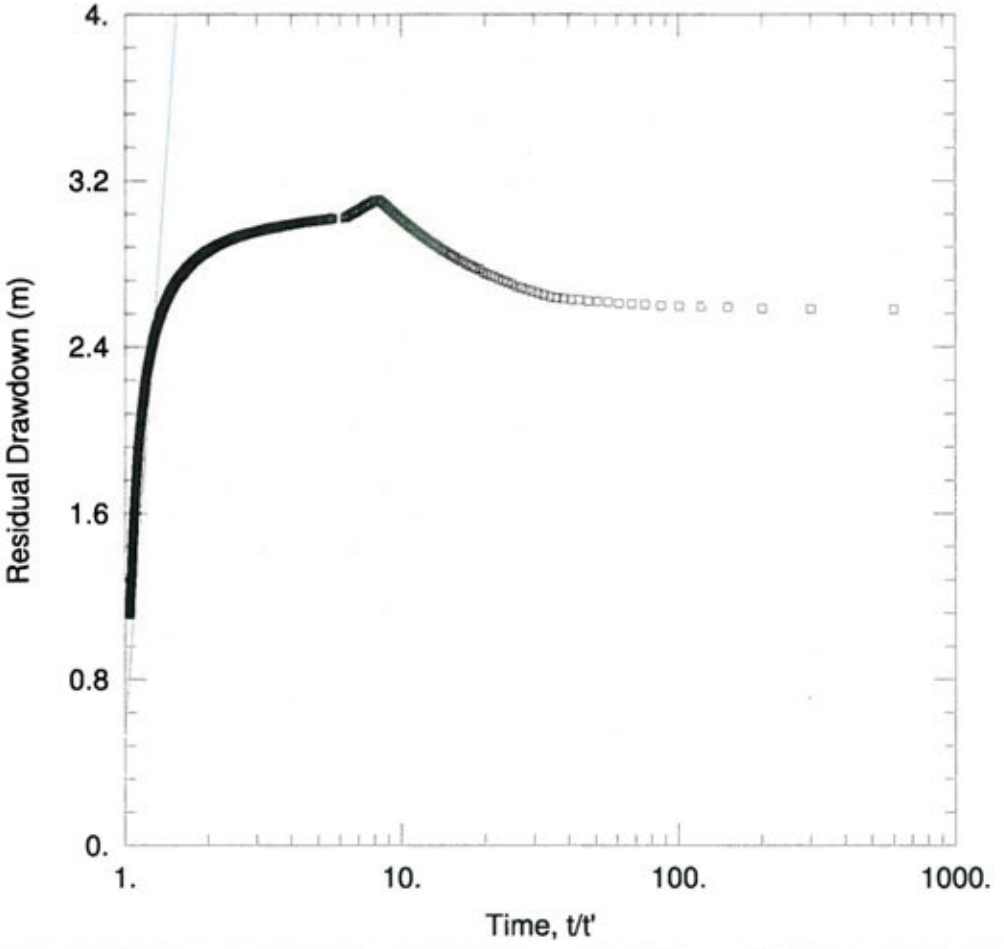
LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: O SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_p W W_l Plastic Liquid 20 40 60 80		GR SA SI CL
	12.9	SS	8	0	50/5						
	End of Borehole 12.9						-13				
	Auger refusal at 13.0 m depth.										

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'.

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

Pumping Wells

Well Name	X (m)	Y (m)
BC11	0	0

Observation Wells

Well Name	X (m)	Y (m)
BC11	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 7.7E-8 m^2/sec S/S' = 0.9386

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

Pumping Period Data

Time (sec)	Rate (L/min)	Time (sec)	Rate (L/min)
0.	0.47	600.	0.

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 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	1.467E+4	1.114
7328.	1.672	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
7332.	1.672	1.467E+4	1.114
7333.	1.671	1.467E+4	1.114
7334.	1.671	1.468E+4	1.114
7335.	1.671	1.468E+4	1.114
7336.	1.671	1.468E+4	1.114
7337.	1.671	1.468E+4	1.114
7338.	1.671	1.468E+4	1.114
7339.	1.671	1.468E+4	1.113
7340.	1.671	1.468E+4	1.114
7341.	1.67	1.468E+4	1.113
7342.	1.671	1.468E+4	1.113
7343.	1.67	1.468E+4	1.114
7344.	1.67	1.469E+4	1.114
7345.	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	1.469E+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

SOLUTION

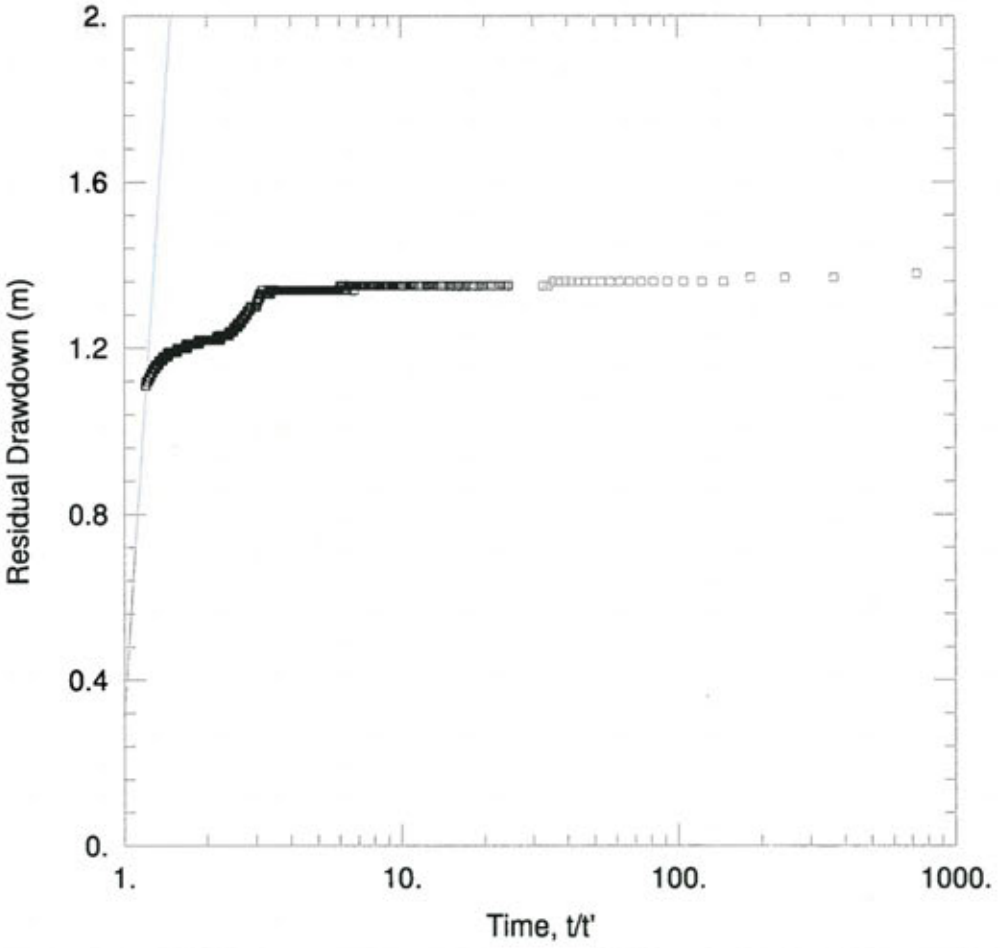
Pumping Test
Aquifer Model: Confined
Solution Method: Theis (Recovery)

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	7.7E-8	m^2/sec
S/S'	0.9386	

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

Pumping Wells

Well Name	X (m)	Y (m)
BC35	0	0

Observation Wells

Well Name	X (m)	Y (m)
BC35	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 1.313E-7 m^2/sec S/S' = 0.9347

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

Pumping Period Data

Time (sec)	Rate (L/min)	Time (sec)	Rate (L/min)
0.	0.43	1456.	0.

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 Data

Time (sec)	Displacement (m)	Time (sec)	Displacement (m)
2.	0.	4430.	1.19
4.	0.16	4432.	1.19
6.	0.15	4434.	1.19
8.	0.19	4436.	1.19
10.	0.2	4438.	1.19
12.	0.2	4440.	1.19
14.	0.2	4442.	1.19
16.	0.2	4444.	1.19
18.	0.22	4446.	1.19

Time (sec)	Displacement (m)	Time (sec)	Displacement (m)
4340.	1.19	8736.	1.11
4342.	1.19	8738.	1.11
4344.	1.19	8740.	1.11
4346.	1.19	8742.	1.11
4348.	1.19	8744.	1.11
4350.	1.19	8746.	1.11
4352.	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	8756.	1.11
4362.	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
4372.	1.19	8768.	1.11
4374.	1.19	8770.	1.11
4376.	1.19	8772.	1.11
4378.	1.19	8774.	1.11
4380.	1.19	8776.	1.11
4382.	1.19	8778.	1.11
4384.	1.19	8780.	1.11
4386.	1.19	8782.	1.11
4388.	1.19	8784.	1.11
4390.	1.19	8786.	1.11
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.	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		

SOLUTION

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

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.313E-7	m^2/sec
S/S'	0.9347	

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

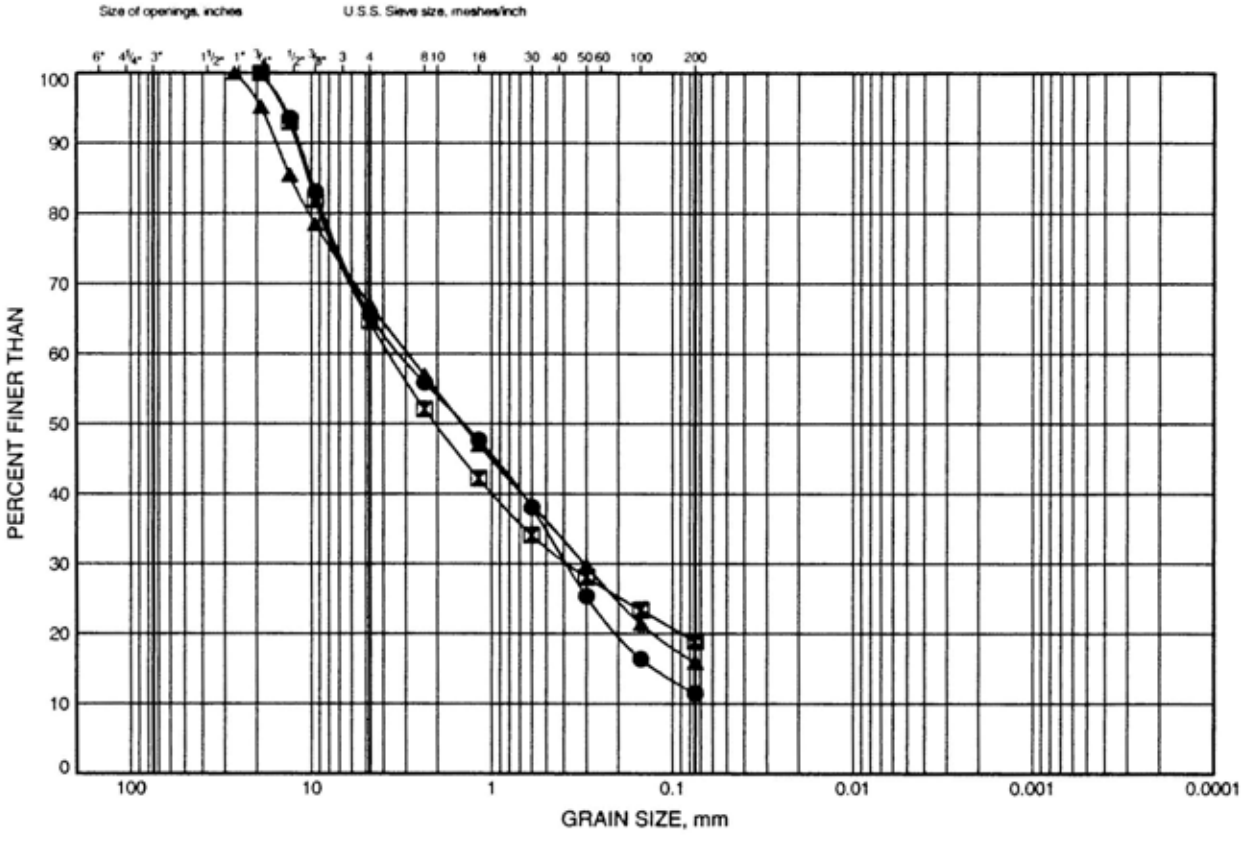
APPENDIX C

GRAINSIZE ANALYSES

Geotechnical Investigation for Bovaird Drive Class EA Study

GRAIN SIZE DISTRIBUTION
Gravelly Sand

FIGURE No. B1



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	B 01	SS1	0.00	0.00
⊠	B 09	SS1	0.00	0.00
▲	B 18	SS1	0.00	0.00

Date February 2010

Project TT93042

Prep'd .....

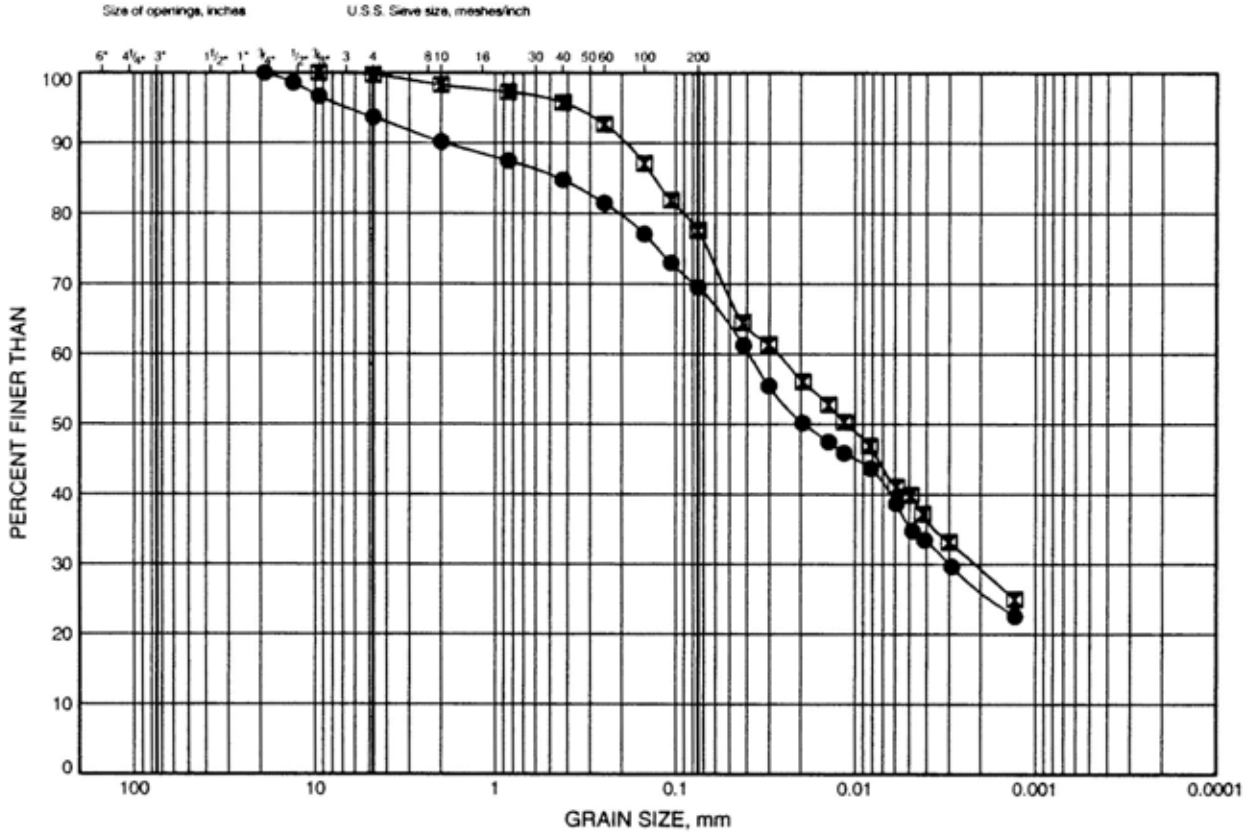
Chkd. .....

AMEC GRADATION CURVE TT93042.GPJ AMEC SCARBOROUGH LOG 2009.GDT 09/02/10

Geotechnical Investigation for Bovaird Drive Class EA Study

GRAIN SIZE DISTRIBUTION
Clayey Silt, Sandy

FIGURE No. B2



COBBLE SIZE	GRAVEL		SAND			SILT and CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	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 Prep'd .....

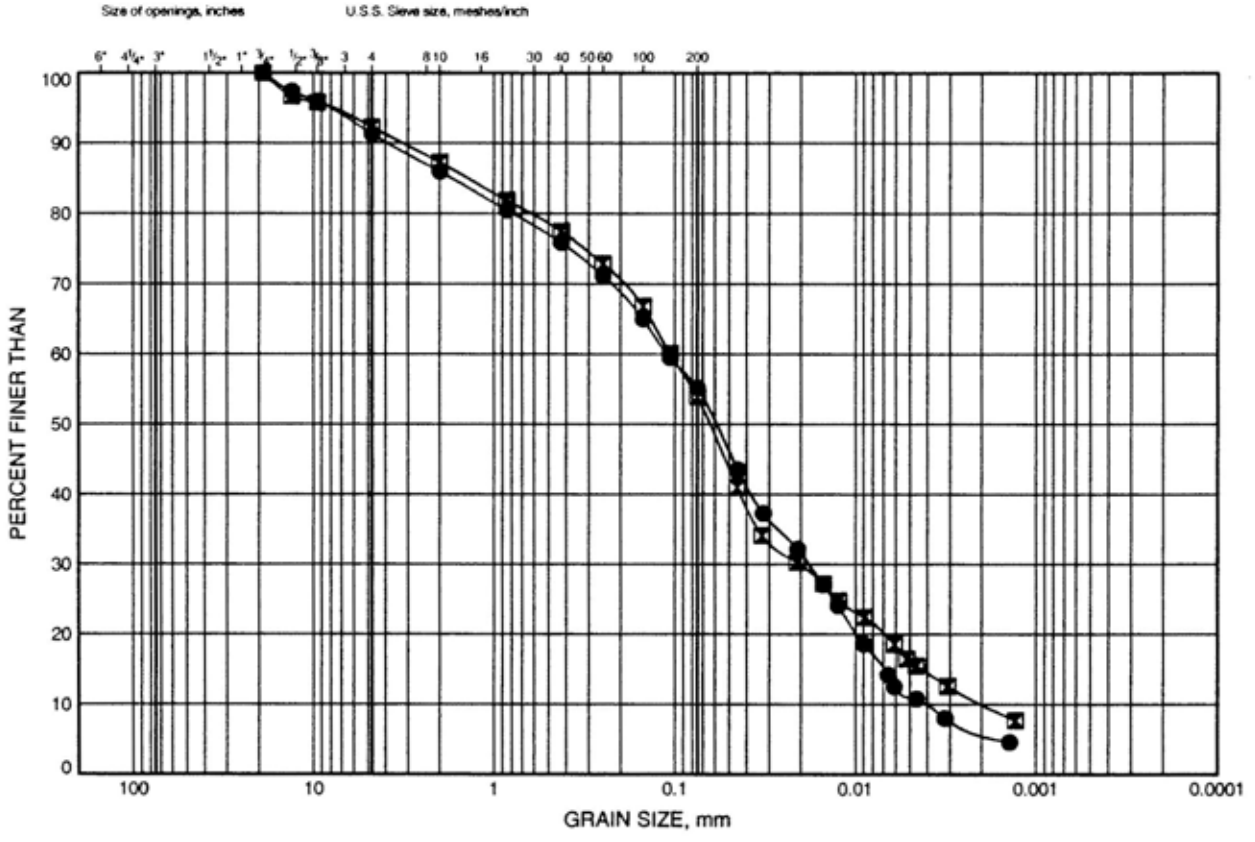
Project TT93042 Chkd. .....

AMEC GRADATION CURVE TT93042.GPJ AMEC SCARBOROUGH LOG 2009.GDT 09/02/10

Geotechnical Investigation for Bovaird Drive Class EA Study

GRAIN SIZE DISTRIBUTION
Silt and Sand

FIGURE No. B3



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	B 10	SS2	0.76	-0.76
⊠	BC 06	SS3	1.52	-1.52

Date February 2010 Prep'd .....

Project TT93042 Chkd. .....

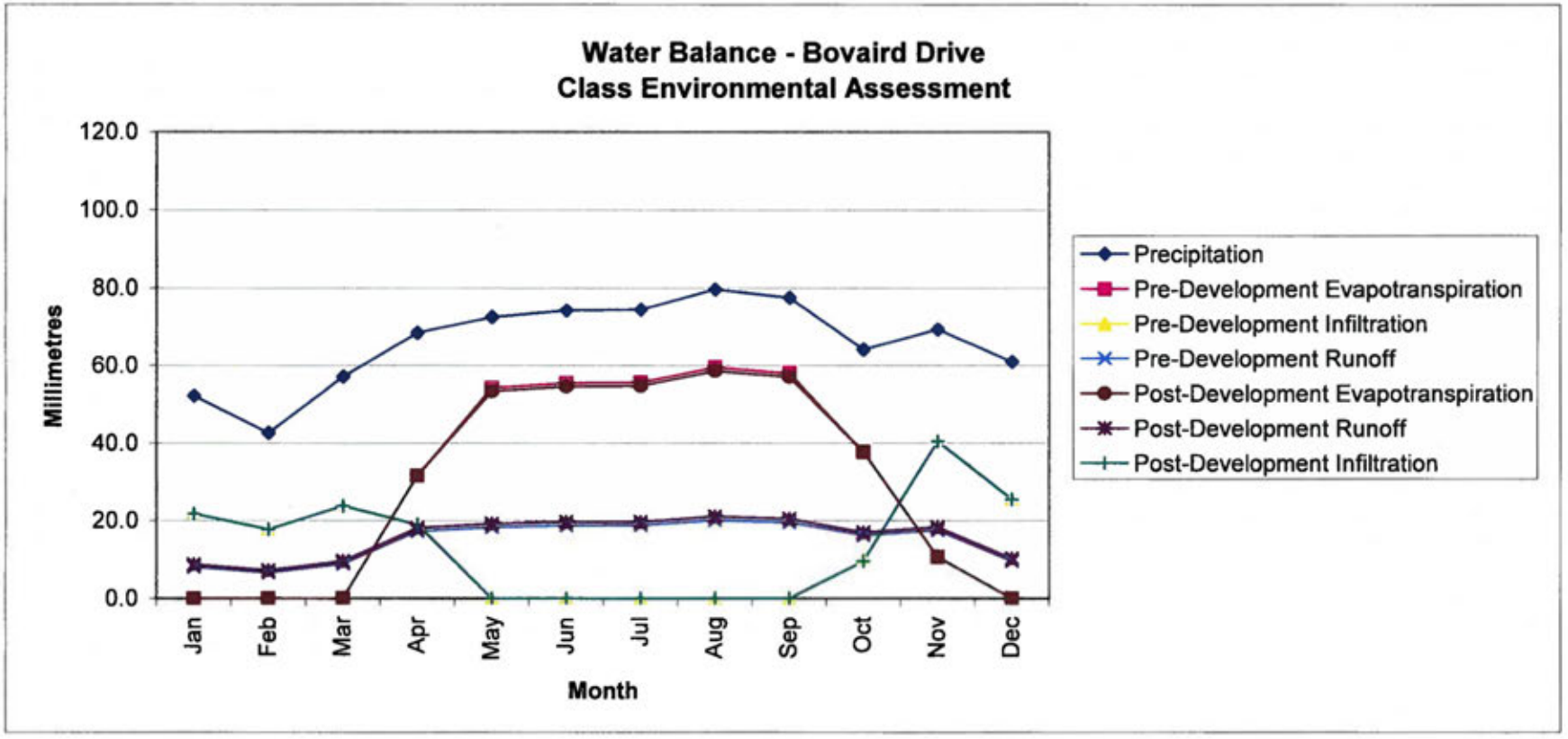
AMEC GRADATION CURVE TT93042.GPJ AMEC SCARBOROUGH LOG 2009.GDT 09/02/10

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**																		
Regional Municipa;ity of Peel - Hydrogeologic Investigation Bovaird Drive Class Environmental Assessment																			
Water Balance Calculation																			
Land Use				**Area (ha)**	**Topography/Soil**		**Runoff Coefficient**												
Total Area				**579**			**T>0°C**	**T<0°C**											
				Undeveloped															
Cultivated/Pasture				**372**	**Flat/Silt Clay Loam**		**0.15**	**0.08**											
Residential				**58**	**Flat/SiltClay Loam**		**0.35**	**0.25**											
Industrial/Commercial/Institutional				**30**	**Flat/Silt Clay Loam**		**0.60**	**0.50**											
Woodland				**74**	**Flat/Silt Clay Loam**		**0.35**	**0.15**											
Roadway				**30**	**Flat/Silt Clay Loam**		**0.85**	**0.70**											
Wetland				**15**	**Water**		**0.05**	**0.05**											
Composite Runoff Coefficient							**0.25**	**0.16**											
				Developed															
Cultivated/Pasture				**365**	**Flat/Partial Clay Loam**		**0.15**	**0.08**											
Residential				**58**			**0.35**	**0.25**											
Industrial/Commercial/Institutional				**30**			**0.6**	**0.5**											
Woodland				**72**			**0.35**	**0.15**											
Roadway				**39**			**0.85**	**0.7**											
Wetland				**15**	**Flat/Grass,shrubs-Clay Loam**		**0.1**	**0.05**											
Composite Runoff Coefficient							**0.26**	**0.17**											
Reference Location	Toronto International Airport - Normals 1971 to 2000																		
Latitude	43°41' N																		
Longitude	79°38' W																		
Elevation	173 m																		
Potential Evapotranspiration (PET) = 16d(10T/I)^{a} Thornthwaite Method (Palmer and Havens, 1958)																			
where:	PET = Potential evapotranspiration in mm																		
	T = Mean monthly air temperature in °C																		
	I = Annual thermal index = Sum of monthly indices i																		
	i = $(T/5)^{1.514}$ Note: i=0 when average T (°C) < 0																		
	d = Correction factor for monthly sunshine duration																		
	a = 0.49 + 0.0179 I - 0.0000771 I^2 + 0.000000675 I^3																		
URO = Pre-development runoff																			
AET=Actual evapotranspiration under pre-development conditions																			
UI = Infiltration for pre-development (U) conditions. When mean air temperature is < 0°C, infiltration (UI*) is assumed to = 0.5*(precipitation - runoff)																			
US = Water surplus due to unaccountable losses; such as sublimation of snow																			
UR = Pre-development (U) recharge = UI x available area																			
DRO = Post-development runoff																			
DAET=Actual evapotranspiration under post-development conditions																			
DS=Water surplus due to unaccountable losses; such as sublimation of snow																			
DI=Infiltration for post-development (U) conditions. When mean air temperature is < 0°C, infiltration (DI*) is assumed to = 0.5*(precipitation - runoff)																			
DR = Post development recharge = UI x available area																			

Month	Mean T °C	Prec mm	Rain mm	Snow mm	i	d	PET mm	AET mm	URO mm	URO m^3	UI mm	UI mm*	UR m^3	DAET mm	DRO mm	DRO m^3	DI mm	DI* mm	DRm^3
January	-6.3	52.2	24.9	31.1	0.000	0	0.0	0.0	8.1	4711.1	44.1	22.0	127564	0.0	8.8	50921	43.4	21.7	125658
February	-5.4	42.6	22.3	22.1	0.000	0	0.0	0.0	6.6	3844.7	36.0	18.0	104104	0.0	7.2	41556	35.4	17.7	102549
March	-0.4	57.1	36.7	19.2	0.000	0	0.0	0.0	8.9	5153.3	48.2	24.1	139538	0.0	9.6	55701	47.5	23.7	137454
April	6.3	68.4	62.4	5.7	1.419	1.12	31.5	31.5	17.3	10003.5	19.6	19.6	113689	31.5	18.1	104584	18.8	18.8	109140
May	12.9	72.5	72.4	0.1	4.199	1.24	76.1	54.2	18.3	10603.1	0.0	0.0	0	53.4	19.1	110853	0.0	0.0	0
June	17.8	74.2	74.2	0.0	6.837	1.3	113.3	55.5	18.7	10851.8	0.0	0.0	0	54.6	19.6	113452	0.0	0.0	0
July	20.8	74.4	74.4	0.0	8.656	1.28	132.2	55.6	18.8	10881.0	0.0	0.0	0	54.8	19.6	113758	0.0	0.0	0
August	19.9	79.6	79.6	0.0	8.095	1.18	116.1	59.5	20.1	11641.5	0.0	0.0	0	58.6	21.0	121708	0.0	0.0	0
September	15.3	77.5	77.5	0.0	5.437	1.05	77.6	57.9	19.6	11334.4	0.0	0.0	0	57.0	20.5	118498	0.0	0.0	0
October	8.9	64.1	63.4	0.5	2.394	0.92	37.7	37.7	16.2	9374.6	10.2	10.2	59216	37.7	16.9	98009	9.5	9.5	54954
November	3.2	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	233796
December	-2.9	60.9	34.7	29.2	0.000	0	0.0	0.0	9.5	5496.2	51.4	25.7	148824	0.0	10.3	59408	50.6	25.3	146602
Year	**7.5**	**792.8**	**684.5**	**115.5**	37.547		**595.0**	**362.5**	**179.7**	**104030**	250.7	**160.9**	**931340**	**358.1**	**189.0**	**1094406**	245.7	**157.2**	**910153**