PN 2630

Proposed Utica Pit
Hydrogeologic Assessment
Uxbridge, Regional Municipality of Durham, Ontario

July 2013

Prepared for:
Vicdom Sand and Gravel (Ontario) Limited
Box 1359
Uxbridge, Ontario
L9P 1N6

Prepared by:
GENIVAR Inc.
1091 Gorham Street, Suite 301
Newmarket, Ontario L3Y 8X7

Project No. 131-15683-00

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Project No. 131-15683-00

July 9, 2013

Mr. Bruno Giordano
Vicdom Sand and Gravel (Ontario) Limited
Box 1359
Uxbridge, Ontario
L9P 1N6

Re: Proposed Utica Pit
Hydrogeologic Assessment
Uxbridge, Regional Municipality of Durham, Ontario

Dear Sirs:

We are pleased to submit this final report for the above-noted project. The report provides the results of the groundwater and surface water assessment for the proposed Utica Pit application to be operated as a sand and gravel pit above the groundwater table. Findings are summarized in the executive summary provided at the front of the report. Details are provided in the report text and technical information is appended.

Thank you for the opportunity to complete the hydrogeologic assessment. Please contact us if there are any questions.

Yours truly,
GENIVAR Inc.

Jason T. Balsdon, M.A.Sc., P.Eng.
Consulting Engineer - Director, Environment

JTB:nah

126 Don Hillock Drive, Unit 2, Aurora, Ontario L4G 0G9
Telephone: 905.750.3080 • Fax: 905.727.0463 • www.genivar.com

Executive Summary

Vicdom Sand and Gravel (Ontario) Limited is applying for a Category 3, Class A licence for the proposed Utica Pit to operate an above water table pit in proximity to its existing licence east of Lake Ridge Road. The property is located at the northwest corner of the intersection of Lake Ridge Road and Goodwood Road within Lot 15 of Concessions 7 and 8, in the Township of Uxbridge. The village of Utica is located approximately 3.5 kilometres to the east as shown in Figure 1. This study was undertaken to meet the requirements of the Aggregate Resources Act (1990), Region of Durham Official Plan (2008), and the Oak Ridges Moraine Conservation Act (2001).

The proposed Utica Pit is located within an area of land that forms a recharge zone for groundwater and that is identified as a high aquifer vulnerability area. No well head protection areas are located below the proposed pit. The pit development above the water table will continue to function as a recharge zone and will not negatively affect the net recharge to the groundwater table. Therefore, no negative effects to groundwater quality or quantity are predicted and the water available for domestic water supply wells will not be negatively affected by the proposed pit.

Runoff from the existing property contributes to groundwater through infiltration from depressions and road ditches. Although development of the pit will reduce the amount of runoff leaving the property, runoff from the existing property does not contribute to local surface water features. The additional runoff that will be captured in the pit and that will flow off-site will continue to contribute to groundwater. Therefore, the change in runoff from the proposed pit will not affect regional surface water features.

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1. Introduction

1.1 Background

Vicdom Sand and Gravel (Ontario) Limited (VICDOM) is applying for a Category 3, Class A licence for the proposed Utica Pit to operate an above water table pit in proximity to its existing licence east of Lake Ridge Road. The property is located at the northwest corner of the intersection of Lake Ridge Road and Goodwood Road within Lot 15 of Concessions 7 and 8, in the Township of Uxbridge. The village of Utica is located approximately 3.5 kilometres (km) to the east as shown in Figure 1.

1.2 Objectives and Scope

The primary purpose of the study was to address the requirements of the Oak Ridges Moraine Conservation Plan by completing a hydrogeologic assessment of potential effects of the proposed Utica Pit on groundwater and surface water resources. This study was undertaken to meet the requirements of the Aggregate Resources Act (1990), Region of Durham Official Plan (2008), and the Oak Ridges Moraine Conservation Act (2001).

The main objectives of the hydrogeologic assessment are as follows.

- To determine the groundwater and surface water setting within the vicinity of the proposed pit.
- To assess the interconnections between the surface water system and groundwater.
- To predict the potential effects of the proposed pit on local groundwater and surface water resources.
- To recommend mitigation measures, if required, to protect local water resources.
- To document the study findings.

1.3 Methodology

To address the requirements of the Oak Ridges Moraine Conservation Plan and to obtain site-specific hydrogeologic information regarding the groundwater and surface water systems, possible groundwater and surface water interactions, and input to pit development, the following activities were undertaken.

- The available topographic and geological mapping for the property area was reviewed and analyzed to interpret the hydrogeologic conditions at the proposed pit.
- Ministry of the Environment (MOE) water well record summaries for the proposed pit and adjacent properties were collected and analyzed to investigate groundwater well depths, geologic profiles, and historic water levels. Water well information is provided in Appendix A.
- A reconnaissance visit was completed on April 24, 2013, to measure water levels within two existing wells on the property, to survey the elevation of the two wells to a benchmark, and to investigate for seeps, springs, and other components of groundwater and surface water systems.
- Data were collected with historic information and analyzed. A water balance assessment for the property was also completed. Findings are presented in the following report and technical data are appended.

2. Hydrogeologic Setting

2.1 Topography and Physiography

The property is located in a hilly area with a number of small knobs and low-lying areas. The maximum elevation on the property is about 351.5 m above sea level (m asl) in the western portion of the property, and the minimum elevation is below 338 m asl within a depression located in the central portion of the property just west of the existing house.

Drainage on the property is dominantly by infiltration into the sandy soil, with a component of runoff toward the low-lying areas. The largest low-lying area on the property is located within the central portion of the property where runoff may periodically accumulate and infiltrate into the subsurface. Localized low-lying areas along the southern and eastern limits of the property allow for some runoff to ditches along the road right-of-ways or through culverts that extend below the roads.

According to Chapman and Putnam (1984), the property is located within the Oak Ridges Moraine physiographic feature, a glacial landform that extends from Orangeville to near Trenton. Regionally, this moraine has a generally hummocky topography. Land within the region is primarily farmland and rural residential, with some patches of undeveloped sand/gravel highlands covered with bush.

2.2 Geology

2.2.1 Regional Geology

The available geological information for the Uxbridge area indicates that the surficial materials are lacustrine in origin. Exposures from sand and gravel pits in the Uxbridge area confirm the complexity of the deposition of the Oak Ridges Moraine. Two major geological units are recognized, and two less dominant surficial units are important.

Windblown sand occurs on the surface of the Oak Ridges Moraine wherever sand is exposed to wind. Sand veneers of several centimetres thickness are common throughout the Uxbridge area, and the thickness was observed to be approximately 8 metres (m) in some areas. Beneath the windblown sand, the Halton Till is a silty to sandy glacial till which was deposited along the south slope of the Oak Ridges Moraine. The till may range from a few centimetres in thickness to several metres in thickness, and there is a general thickening southward down the flank of the moraine.

Beneath and/or interbedded with the Halton Till is a glaciolacustrine sand and silt. Laminated sand to silt is present at surface overlying most of the sand and gravel materials that currently are being mined in the Uxbridge area. Thicknesses range from zero to more than 15 m, and are commonly in the 3 m to 6 m range. Beneath the laminated sand and silt, glaciofluvial sand and gravel deposits are present and exposed in the major pits in the Uxbridge area. This grouping of materials includes subaqueous fans and deltas as well as a closely associated series of ice-contact glaciofluvial materials. The subaqueous fans and deltas commonly contain sand and gravel and the ice-contact materials tend to contain irregular lenses and layers of gravelly material within a sand matrix that contains some gravel. This group of material commonly exceeds 10 m in thickness and locally may exceed 20 m to 30 m in some of the larger excavations.

2.2.2 Local Geology

Mapping in the vicinity of the proposed pit indicates that the material consists of ice-contact stratified drift, consisting dominantly of sand and gravel (Gwyn and DiLabio, 1973).

Existing water wells on and around the property provide an understanding of the local geology. In addition, an exploratory borehole was completed under the direction of VICDOM in August 2012 and completed as an observation well. Well information is provided in Appendix A.

Subsurface material is dominantly sand and gravel beneath the topsoil. In the vicinity of the proposed pit the sand and gravel generally ranges in thickness from about 28 m to over 38 m below ground surface (m bgs). Layers of fine-grained material, such as clay and silt, are also identified, but do not form a continuous unit in the area. Two well records of note include the following.

1) Well ID Number 1909715 indicates silt and clay from about 9.7 m bgs to 27.4 m bgs. However the well is located within an area that contains a sand and gravel pit.
2) Well ID Number 4603926 indicates medium sand to a depth of about 157 m bgs, although a static water level of about 51.8 m bgs is documented. It is likely that layers of fine-grained material occur within the sand, which required the completion of the deeper water well.

Based on the soil sampling of the exploratory borehole completed on the property (Well Tag No. A006365), sand and gravel was confirmed to occur to a depth of at least 40 m bgs.

Sand and gravel pits are present immediately to the north and to the east of the proposed pit. The presence of these two pits confirms the abundance of sand and gravel resources in the area.

2.3 Groundwater Setting

2.3.1 Regional Groundwater Setting

The property is underlain by the Oak Ridges Aquifer system, a complex of closely associated aquifers that are quite thick in the vicinity of the property. An unconfined aquifer within the uppermost sand unit is common, with deeper confined aquifers that are protected by overlying layers of fine-grained material. Considering the high topographic elevation of the area, the property is located within a groundwater recharge area.

Owing to the presence of near surface sand and gravel, the area in the vicinity of the proposed pit is identified as a High Aquifer Vulnerability Area in Map B2, Schedule B, of the Regional Municipality of Durham Official Plan. This mapping indicates that the groundwater is vulnerable to water quality impacts from land uses in the area. It is noted, however, that pits are not recognised as a direct threat to groundwater resources.

Water supplies for the rural development within the regional area are dominantly obtained from groundwater wells. The closest municipal groundwater use is for the Town of Uxbridge located about 5 km to the northwest of the proposed pit. No wellhead protection areas are located below the proposed pit.

2.3.2 Local Hydrogeology

The information contained in the MOE water well records, which is provided in Appendix A, indicates that most water wells in the vicinity of the proposed pit obtain groundwater from a deep unconfined aquifer. Based on the well records, the water table for this unconfined aquifer ranged from about 19.8 m bgs to 29.9 mbgs at the time of well installation. For the deep well completed at a depth of about 181.4 m bgs (Well ID Number 4603926) the static water level at the time of well construction was about 51.8 mbgs, which likely indicates the groundwater pressure within a deeper confined aquifer.

The groundwater depth and elevation for the two wells on the property are provided below. Well locations are shown in Figure 2. It is noted that the water level likely represents the high water table level as the level was measured during the spring on April 24, 2013, shortly after the spring snowmelt and a period of precipitation. No groundwater seeps or springs were identified during the reconnaissance visit of April 24, 2013.

WELL DESIGNATION	WELL ID NUMBER	TOP OF CASING (m asl)	DEPTH TO WATER TABLE (mbgs)	WATER TABLE ELEVATION (m asl)
DW-1	4605678	346.48	25.41	321.07
MW13-1	7187320	347.21	25.49	321.72

NOTES: 1) 'm asl' indicates metres above sea level
2) 'm bgs' indicates metres below ground surface

The depth to the water table will vary across the property owing to differences in the elevation of the water table and of ground surface. Based on a maximum water table elevation of 321.72 m asl and a 1.5 m separation between the high water table and the base on an above water table pit, the base of the pit could be located at an elevation of about 323.22 m asl.

The direction of horizontal groundwater movement could not be determined based on elevations from two wells, although an easterly to southeasterly flow direction is inferred based on topography and the available groundwater elevations.

2.4 Surface Water Setting

The proposed pit is located within the Uxbridge Brook subwatershed within the jurisdiction of the Lake Simcoe Region Conservation Authority. Uxbridge Brook is located to the north of the property with a tributary that originates in a low-lying area located about 200 m northeast of the property as shown in Figure 1.

No perennial watercourses occur on the property. Figure 3 presents the subcatchments on the property and Table 1 outlines the conditions of each subcatchment. In summary, during pre-development conditions a majority of the property drains toward a low-lying area within SC1 where the runoff infiltrates into the subsurface. Subcatchments SC2, SC4, and SC5 drain toward the north side of Goodwood Road where water can infiltrate into the subsurface and flow below the road through culverts at SC4 and SC5. Subcatchment SC3 also drains toward Goodwood Road, but excess runoff will move through a culvert below the road and flow to a depression on the property to the south where water can infiltrate into the subsurface. Subcatchments SC6 and SC7 drain towards the ditch on the west side of Lake Ridge Road where infiltration will also occur. Therefore, in summary, runoff from the property does not contribute

directly to surface water features. The runoff can move as overland flow to low-lying areas where the water will infiltrate into the subsurface and contribute to groundwater.

2.5 Water Balance

Climatic data from the Oshawa Water Pollution Control Plant (WPCP) climatological station are presented in Figure B-1, Appendix B, for annual precipitation and temperature. Based on the normalized data for 1971 to 2000, the annual precipitation averages about 877.8 millimetres/annum (mm/a). The wettest year on record occurred in 2006 with a total of 1,073.7 mm/a and the driest year occurred in 1994 with 677.0 mm/a of precipitation.

The water balance for the proposed pit was estimated using available climatic data from the on-line resources provided by Environmental Canada and the MOE infiltration guidelines. Water budget data from the Oshawa WPCP climatological station are summarized in Tables B-1 to B-3, Appendix B. The water budget data for the 30 Year Normal, the wettest year, and the driest year are summarized below. A soil moisture holding capacity of 75 mm was considered owing to the coarse-grained soil and medium to deep rooted crops.

YEAR	TOTAL PRECIPITATION (mm)	ACTUAL EVAOPTRANSPIRATION (mm)	UNADJUSTED MOISTURE SURPLUS (mm)
30 Year Normal	877.8	475.0	402.8
2006 (Wet Year)	1,073.7	569.9	503.8
1994 (Dry Year)	677.0	418.3	258.7

NOTE: 'mm' indicates millimetres for the year indicated.

As expected, a calculated water surplus typically occurs during the winter, spring, and fall months, with a water deficit during the summer months. It should be noted that the majority of water surplus in the winter accumulates as snow. Snowmelt during the spring results in the runoff and/or infiltration of precipitation that is effectively equivalent to the winter and spring water surplus.

Based on the hilly topography (0.1), sandy soil type (0.4), and cultivated land use (0.1), an infiltration rate of about 60% (0.6) is estimated. Therefore, an average runoff coefficient of about 0.4 is reasonable for the proposed pit for pre-development conditions. Thus, a 30 Year Normal annual runoff of about 161.1 mm/a and an annual infiltration of about 241.7 mm/a are reasonable.

Within low-lying areas with no outlets for runoff contribution to surface water features the runoff will infiltrate into the subsurface and contribute to groundwater. Within these areas an infiltration factor of 1 is reasonable. Some periodic seasonal accumulation of runoff may occur within the depressions as a result of excess runoff, but will be minor owing to the permeable nature of the sandy soil. No surface water accumulation was observed on the property on April 24, 2013.

3. Impact Assessment

The area proposed for excavation above the water table is presented in Figure 2.

3.1 Subcatchment Analysis

To assess the relationships between groundwater and surface water, and to obtain the data required for an environmental impact assessment of the proposed pit development, a subcatchment analysis was performed for the property and adjacent land.

The property was subdivided into seven contributing subcatchments based upon topography as well as pre-development and post-development conditions, with locations shown in Figure 3. A summary of land use for subcatchments under pre-development and post-development conditions is provided in Table 1. In summary, for post-development conditions the majority of the subcatchments drain into the proposed pit, with only the outside portion of the perimeter berms continuing to drain towards the adjacent roads. The total area of excavation is about 15.4 ha and the net drainage area transfer (i.e. area of off-site runoff transferred to on-site runoff) from pre-development to post-development conditions is approximately 1.9 ha.

3.2 Infiltration Analysis

The amount of infiltration and runoff that occurs within the local subcatchments during pre and post-development conditions was determined by estimating runoff and infiltration for component subcatchments. The results of the calculations for the 30 Year Normal, a wet year (2006), and a dry year (1994) are shown in Table 2 (pre-development) and Table 3 (post-development).

Table 4 presents the predicted net change in water balance for the proposed pit. In summary, the pit development will result in a net increase in infiltration within the property limits. Runoff to the road ditches and toward the property to the south, via the culvert below Goodwood Road, will decrease by between about 73% to 77% of pre-development conditions. However, as this runoff will continue to flow into the ditches and depressions for infiltration into the subsurface, there will be no impact to regional surface water features. This infiltration will continue to contribute to groundwater and will maintain the supply of water to local water wells.

3.3 Surface Water Assessment

No impacts are predicted for the regional surface water system as a result of the proposed pit. The regional groundwater system will continue to contribute to regional watercourses and low-lying areas.

3.4 Effect on Local Water Wells

Development of the pit as an above water table operation will not have a negative effect on local groundwater resources. The configuration of the regional groundwater system will not be impacted and its contribution to recharge of the deeper aquifers will be similar during pre and post-development conditions. The underlying low permeable units of clayey soil will continue to protect the quantity and quality of the water available to deeper local water wells.

3.5 Slope Stability Considerations

Based on the geotechnical characteristics of the sand and gravel, it is recommended that the final rehabilitated sideslopes of the extraction areas be no steeper than 3:1 (horizontal: vertical). These sideslopes will provide long-term stability and will allow for maximum resource removal. Localized sideslope maintenance may be required. The slopes for the extraction area sideslopes may be reduced as required for operations or rehabilitation.

3.6 Compliance With ORMCP

The property is located within the Oak Ridges Moraine Conservation Plan (ORMCP) area. The ORMCP requires that the quantity and quality of groundwater and surface water are maintained and where possible improved or restored.

According to common industry findings for above water table pit development and based on GENIVAR's 20 years of experience in groundwater monitoring at similar pits, above water table extraction is not known to negatively affect groundwater quality. However, to meet and exceed the Provincial requirements as established by the ARA Provincial Standards and the ORMCP, a detailed groundwater assessment was completed to evaluate the possible effects of the above water table extraction on groundwater resources.

No predicted change in overall infiltration of the water surplus to the groundwater table will maintain the groundwater recharge characteristics of the property. It is predicted that the cumulative effect of the proposed pit and the adjacent existing pits will continue to contribute water to the subsurface and maintain the existing water resources.

Water quality impacts are not anticipated and operation of the pit in accordance with prescribed conditions and Technical Standards and Safety Authority (TSSA) requirements will protect water quality. The sandy soil and attenuation capacity around the property will also prevent detectable changes in suspended solids or temperature within the groundwater.

In summary, it is predicted that the development of the proposed Utica Pit will not result in adverse effects to the local or regional groundwater and surface water quantity or quality. Thus, based on the hydrogeologic assessment results for the proposed Utica Pit and the presence of the adjacent pits with no documented impacts or water complaints, a groundwater and surface water monitoring program is not recommended.

4. Conclusions and Recommendations

The results of the hydrogeologic assessment for the proposed Utica Pit as an above the water table operation is summarized below.

- The proposed Pit is located within an area of land that forms a recharge zone for groundwater and that is identified as a high aquifer vulnerability area. No well head protection areas are located below the proposed pit.

- The pit development will not negatively affect the net recharge to the groundwater table. Therefore, no negative effects to groundwater quality or quantity are predicted and the water available for domestic water supply wells will not be negatively affected by the proposed pit.

- Runoff from the existing property contributes to groundwater through infiltration from depressions and road ditches. Although development of the pit will reduce the amount of runoff leaving the property, the additional runoff that is captured in the pit will continue to contribute to groundwater.

- Runoff from the existing property does not contribute to local surface water features. Therefore, the change in runoff from the proposed pit will not affect regional surface water features.

We recommend that the contents of this report should be considered as input for other work being completed for the proposed pit.

Prepared by:
GENIVAR Inc.

Jason T. Balsdon, M.A.Sc., P.Eng.
Consulting Engineer – Director, Environment

5. References

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Gwyn, Q.H.J. and DiLabio, R.N.W., 1973. Quaternary Geology of the Newmarket Area, Southern Ontario. Ontario Div. Mines, Prelim. Map P.386, Geol. Ser., scale 1:50,000. Geology 1972.

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Tables

TABLE 1
SUMMARY OF CONDITIONS AT SUBCATCHMENTS
PROPOSED UTICA PIT

Subcatchment Area	Pre-Development Condition	Post-Development Condition
SC1	Central portion of property. Runoff drains to an internal low-lying area where it recharges the soil.	Area is excavated with runoff collecting in the base of the pit where it will recharge the soil.
SC2	Western portion of property. Runoff drains to low-lying area and road ditch along the northern side of Goodwood Road.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.
SC3	South-central portion of property. Runoff drains to low-lying area where a culvert can direct runoff below Goodwood Road toward an off-site closed depression located south of the property.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.
SC4	South-central portion of property. Runoff drains to an on-site low-lying area just north of Goodwood Road.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.
SC5	Near southeastern portion of property. Runoff drains to a low-lying area and into an off-site ditch located on the north side of Goodwood Road.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.
SC6	Southeastern portion of property. Runoff drains in an easterly direction to a road ditch located on the west side of Lake Ridge Road.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.
SC7	Northeastern portion of property. Runoff drains in an easterly direction to a road ditch located on the west side of Lake Ridge Road.	Area outside of the 30 m buffer setback will be excavated. Runoff will collect in the base of the pit and will recharge the soil. For the berm area, about 50% will induce runoff toward the pit and about 50% will maintain runoff toward the road.

NOTES:

1)"SC" denotes subcatchment area.

TABLE 2A
WATER BALANCE CALCULATIONS, PRE-DEVELOPMENT CONDITIONS - 30 YEAR NORMAL
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	45,030	45,030	0	Runoff drains into low-lying area for recharge.
SC1 - Set-Back	1	2,597	1,046	1,046	0	Runoff drains into low-lying area for recharge.
SC1 - Total		114,389	46,076	46,076	0	
SC2 - Excludes Set-Back	0.6	1,889	761	457	304	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Set-Back	0.6	3,647	1,469	881	588	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Total		5,536	2,230	1,338	892	
SC3 - Excludes Set-Back	0.6	11,093	4,468	2,681	1,787	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Set-Back	0.6	9,525	3,837	2,302	1,535	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Total		20,618	8,305	4,983	3,322	
SC4 - Excludes Set-Back	1	1,372	553	553	0	Runoff drains toward low-lying area.
SC4 - Set-Back	1	3,002	1,209	1,209	0	Runoff drains toward low-lying area.
SC4 - Total		4,374	1,762	1,762	0	
SC5 - Excludes Set-Back	0.6	21,685	8,735	5,241	3,494	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Set-Back	0.6	8,441	3,400	2,040	1,360	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Total		30,126	12,135	7,281	4,854	
SC6 - Excludes Set-Back	0.6	1,015	409	245	164	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Set-Back	0.6	3,552	1,431	858	572	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Total		4,567	1,840	1,104	736	
SC7 - Excludes Set-Back	0.6	5,348	2,154	1,292	862	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Set-Back	0.6	6,801	2,739	1,644	1,096	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Total		12,149	4,893	2,936	1,957	
Totals		**191,759**	**77,241**	**65,479**	**11,761**	

NOTES:

1) "SC" denotes subcatchment area.

2) "m" denotes metres.

3) "a" denotes annum.

4) Moisture surplus is 402.8 mm/a based on 30-Year normal data per Table B-1, Appendix B.

TABLE 2B
WATER BALANCE CALCULATIONS, PRE-DEVELOPMENT CONDITIONS - WET YEAR (2006)
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	56,321	56,321	0	Runoff drains into low-lying area for recharge.
SC1 - Set-Back	1	2,597	1,308	1,308	0	Runoff drains into low-lying area for recharge.
SC1 - Total		114,389	57,629	57,629	0	
SC2 - Excludes Set-Back	0.6	1,889	952	571	381	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Set-Back	0.6	3,647	1,837	1,102	735	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Total		5,536	2,789	1,673	1,116	
SC3 - Excludes Set-Back	0.6	11,093	5,589	3,353	2,235	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Set-Back	0.6	9,525	4,799	2,879	1,920	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Total		20,618	10,387	6,232	4,155	
SC4 - Excludes Set-Back	1	1,372	691	691	0	Runoff drains toward low-lying area.
SC4 - Set-Back	1	3,002	1,512	1,512	0	Runoff drains toward low-lying area.
SC4 - Total		4,374	2,204	2,204	0	
SC5 - Excludes Set-Back	0.6	21,685	10,925	6,555	4,370	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Set-Back	0.6	8,441	4,253	2,552	1,701	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Total		30,126	15,178	9,107	6,071	
SC6 - Excludes Set-Back	0.6	1,015	511	307	204	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Set-Back	0.6	3,552	1,790	1,074	716	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Total		4,567	2,301	1,380	920	
SC7 - Excludes Set-Back	0.6	5,348	2,694	1,617	1,078	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Set-Back	0.6	6,801	3,426	2,056	1,370	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Total		12,149	6,120	3,672	2,448	
Totals		**191,759**	**96,608**	**81,898**	**14,710**	

NOTES:

1) "SC" denotes subcatchment area.
2) "m" denotes metres.
3) "a" denotes annum.
4) Moisture surplus is 503.5 mm/a based on a wet year (2006) per Table B-2, Appendix B.

TABLE 2C
WATER BALANCE CALCULATIONS, PRE-DEVELOPMENT CONDITIONS - DRY YEAR (1994)
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	28,921	28,921	0	Runoff drains into low-lying area for recharge.
SC1 - Set-Back	1	2,597	672	672	0	Runoff drains into low-lying area for recharge.
SC1 - Total		114,389	29,592	29,592	0	
SC2 - Excludes Set-Back	0.6	1,889	489	293	195	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Set-Back	0.6	3,647	943	566	377	Runoff drains toward road ditch north of Goodwood Road.
SC2 - Total		5,536	1,432	859	573	
SC3 - Excludes Set-Back	0.6	11,093	2,870	1,722	1,148	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Set-Back	0.6	9,525	2,464	1,479	986	Runoff drains to culvert that extends below Goodwood Road, which is connected to a watercourse that drains to a closed depression.
SC3 - Total		20,618	5,334	3,200	2,134	
SC4 - Excludes Set-Back	1	1,372	355	355	0	Runoff drains toward low-lying area.
SC4 - Set-Back	1	3,002	777	777	0	Runoff drains toward low-lying area.
SC4 - Total		4,374	1,132	1,132	0	
SC5 - Excludes Set-Back	0.6	21,685	5,610	3,366	2,244	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Set-Back	0.6	8,441	2,184	1,310	874	Runoff drains toward road ditch north of Goodwood Road.
SC5 - Total		30,126	7,794	4,676	3,117	
SC6 - Excludes Set-Back	0.6	1,015	263	158	105	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Set-Back	0.6	3,552	919	551	368	Runoff drains toward road ditch west of Lake Ridge Road.
SC6 - Total		4,567	1,181	709	473	
SC7 - Excludes Set-Back	0.6	5,348	1,383	830	553	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Set-Back	0.6	6,801	1,759	1,056	704	Runoff drains toward road ditch west of Lake Ridge Road.
SC7 - Total		12,149	3,143	1,886	1,257	
Totals		**191,759**	**49,608**	**42,054**	**7,554**	

NOTES:

1) "SC" denotes subcatchment area.
2) "m" denotes metres.
3) "a" denotes annum.
4) Moisture surplus is 258.7 mm/a based on a dry year (1994) per Table B-3, Appendix B.

TABLE 3A
WATER BALANCE CALCULATIONS, POST-DEVELOPMENT CONDITIONS - 30 YEAR NORMAL
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	45,030	45,030	0	Runoff collects in pit and recharges soil.
SC1 - Set-Back - Internal 50% of berm	1	1,298	523	523	0	Runoff drains from berm into pit, where it recharges soil.
SC1 - Set-Back - External 50% of berm	0.6	1,298	523	314	209	Runoff drains from berm to road ditch.
SC1 - Total		114,389	46,076	45,867	209	
SC2 - Excludes Set-Back	1	1,889	761	761	0	Runoff collects in pit and recharges soil.
SC2 - Set-Back - Internal 50% of berm	1	1,823	734	734	0	Runoff from berm into pit, where it recharges soil.
SC2 - Set-Back - External 50% of berm	0.6	1,823	734	441	294	Runoff from berm to road ditch.
SC2 - Total		5,536	2,230	1,936	294	
SC3 - Excludes Set-Back	1	11,093	4,468	4,468	0	Runoff collects in pit and recharges soil.
SC3 - Set-Back - Internal 50% of berm	1	4,763	1,918	1,918	0	Runoff from berm into pit, where it recharges soil.
SC3 - Set-Back - External 50% of berm	0.6	4,763	1,918	1,151	767	Runoff from berm to to culvert below road.
SC3 - Total		20,618	8,305	7,538	767	
SC4 - Excludes Set-Back	1	1,372	553	553	0	Runoff collects in pit and recharges soil.
SC4 - Set-Back - Internal 50% of berm	1	1,501	605	605	0	Runoff from berm into pit, where it recharges soil.
SC4 - Set-Back - External 50% of berm	0.6	1,501	605	363	242	Runoff from berm to road ditch.
SC4 - Total		4,374	1,762	1,520	242	
SC5 - Excludes Set-Back	1	21,685	8,735	8,735	0	Runoff collects in pit and recharges soil.
SC5 - Set-Back - Internal 50% of berm	1	4,221	1,700	1,700	0	Runoff from berm into pit, where it recharges soil.
SC5 - Set-Back - External 50% of berm	0.6	4,221	1,700	1,020	680	Runoff from berm to road ditch.
SC5 - Total		30,126	12,135	11,455	680	
SC6 - Excludes Set-Back	1	1,015	409	409	0	Runoff collects in pit and recharges soil.
SC6 - Set-Back - Internal 50% of berm	1	1,776	715	715	0	Runoff from berm into pit, where it recharges soil.
SC6 - Set-Back - External 50% of berm	0.6	1,776	715	429	286	Runoff from berm to road ditch.
SC6 - Total		4,567	1,840	1,553	286	
SC7 - Excludes Set-Back	1	5,348	2,154	2,154	0	Runoff collects in pit and recharges soil.
SC7 - Set-Back - Internal 50% of berm	1	3,400	1,370	1,370	0	Runoff from berm into pit, where it recharges soil.
SC7 - Set-Back - External 50% of berm	0.6	3,400	1,370	822	548	Runoff from berm to road ditch.
SC7 - Total		12,149	4,893	4,346	548	
Totals		**191,759**	**77,241**	**74,214**	**3,026**	

NOTES:

1) "SC" denotes subcatchment area.
2) "m" denotes metres.
3) "a" denotes annum.
4) Moisture surplus is 402.8 mm/a based on 30-Year normal data per Table B-1, Appendix B.

TABLE 3B
WATER BALANCE CALCULATIONS, POST-DEVELOPMENT CONDITIONS - WET YEAR (2006)
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	56,321	56,321	0	Runoff collects in pit and recharges soil.
SC1 - Set-Back - Internal 50% of berm	1	1,298	654	654	0	Runoff drains from berm into pit, where it recharges soil.
SC1 - Set-Back - External 50% of berm	0.6	1,298	654	392	262	Runoff drains from berm to road ditch.
SC1 - Total		114,389	57,629	57,367	262	
SC2 - Excludes Set-Back	1	1,889	952	952	0	Runoff collects in pit and recharges soil.
SC2 - Set-Back - Internal 50% of berm	1	1,823	919	919	0	Runoff from berm into pit, where it recharges soil.
SC2 - Set-Back - External 50% of berm	0.6	1,823	919	551	367	Runoff from berm to road ditch.
SC2 - Total		5,536	2,789	2,422	367	
SC3 - Excludes Set-Back	1	11,093	5,589	5,589	0	Runoff collects in pit and recharges soil.
SC3 - Set-Back - Internal 50% of berm	1	4,763	2,399	2,399	0	Runoff from berm into pit, where it recharges soil.
SC3 - Set-Back - External 50% of berm	0.6	4,763	2,399	1,440	960	Runoff from berm to to culvert below road.
SC3 - Total		20,618	10,387	9,428	960	
SC4 - Excludes Set-Back	1	1,372	691	691	0	Runoff collects in pit and recharges soil.
SC4 - Set-Back - Internal 50% of berm	1	1,501	756	756	0	Runoff from berm into pit, where it recharges soil.
SC4 - Set-Back - External 50% of berm	0.6	1,501	756	454	302	Runoff from berm to road ditch.
SC4 - Total		4,374	2,204	1,901	302	
SC5 - Excludes Set-Back	1	21,685	10,925	10,925	0	Runoff collects in pit and recharges soil.
SC5 - Set-Back - Internal 50% of berm	1	4,221	2,126	2,126	0	Runoff from berm into pit, where it recharges soil.
SC5 - Set-Back - External 50% of berm	0.6	4,221	2,126	1,276	851	Runoff from berm to road ditch.
SC5 - Total		30,126	15,178	14,327	851	
SC6 - Excludes Set-Back	1	1,015	511	511	0	Runoff collects in pit and recharges soil.
SC6 - Set-Back - Internal 50% of berm	1	1,776	895	895	0	Runoff from berm into pit, where it recharges soil.
SC6 - Set-Back - External 50% of berm	0.6	1,776	895	537	358	Runoff from berm to road ditch.
SC6 - Total		4,567	2,301	1,943	358	
SC7 - Excludes Set-Back	1	5,348	2,694	2,694	0	Runoff collects in pit and recharges soil.
SC7 - Set-Back - Internal 50% of berm	1	3,400	1,713	1,713	0	Runoff from berm into pit, where it recharges soil.
SC7 - Set-Back - External 50% of berm	0.6	3,400	1,713	1,028	685	Runoff from berm to road ditch.
SC7 - Total		12,149	6,120	5,435	685	
Totals		**191,759**	**96,608**	**92,823**	**3,785**	

NOTES:

1) "SC" denotes subcatchment area.
2) "m" denotes metres.
3) "a" denotes annum.
4) Moisture surplus is 503.8 for a wet year per Table B-2, Appendix B.

TABLE 3C
WATER BALANCE CALCULATIONS, POST-DEVELOPMENT CONDITIONS - DRY YEAR (1994)
PROPOSED UTICA PIT

Subcatchment Area ID	Infiltration Factor	Area (m^2)	Moisture Surplus (m^3/a)	Infiltration (m^3/a)	Runoff (m^3/a)	Flow Direction
SC1 - Excludes Set-Back	1	111,792	28,921	28,921	0	Runoff collects in pit and recharges soil.
SC1 - Set-Back - Internal 50% of berm	1	1,298	336	336	0	Runoff drains from berm into pit, where it recharges soil.
SC1 - Set-Back - External 50% of berm	0.6	1,298	336	202	134	Runoff drains from berm to road ditch.
SC1 - Total		114,389	29,592	29,458	134	
SC2 - Excludes Set-Back	1	1,889	489	489	0	Runoff collects in pit and recharges soil.
SC2 - Set-Back - Internal 50% of berm	1	1,823	472	472	0	Runoff from berm into pit, where it recharges soil.
SC2 - Set-Back - External 50% of berm	0.6	1,823	472	283	189	Runoff from berm to road ditch.
SC2 - Total		5,536	1,432	1,244	189	
SC3 - Excludes Set-Back	1	11,093	2,870	2,870	0	Runoff collects in pit and recharges soil.
SC3 - Set-Back - Internal 50% of berm	1	4,763	1,232	1,232	0	Runoff from berm into pit, where it recharges soil.
SC3 - Set-Back - External 50% of berm	0.6	4,763	1,232	739	493	Runoff from berm to to culvert below road.
SC3 - Total		20,618	5,334	4,841	493	
SC4 - Excludes Set-Back	1	1,372	355	355	0	Runoff collects in pit and recharges soil.
SC4 - Set-Back - Internal 50% of berm	1	1,501	388	388	0	Runoff from berm into pit, where it recharges soil.
SC4 - Set-Back - External 50% of berm	0.6	1,501	388	233	155	Runoff from berm to road ditch.
SC4 - Total		4,374	1,132	976	155	
SC5 - Excludes Set-Back	1	21,685	5,610	5,610	0	Runoff collects in pit and recharges soil.
SC5 - Set-Back - Internal 50% of berm	1	4,221	1,092	1,092	0	Runoff from berm into pit, where it recharges soil.
SC5 - Set-Back - External 50% of berm	0.6	4,221	1,092	655	437	Runoff from berm to road ditch.
SC5 - Total		30,126	7,794	7,357	437	
SC6 - Excludes Set-Back	1	1,015	263	263	0	Runoff collects in pit and recharges soil.
SC6 - Set-Back - Internal 50% of berm	1	1,776	459	459	0	Runoff from berm into pit, where it recharges soil.
SC6 - Set-Back - External 50% of berm	0.6	1,776	459	276	184	Runoff from berm to road ditch.
SC6 - Total		4,567	1,181	998	184	
SC7 - Excludes Set-Back	1	5,348	1,383	1,383	0	Runoff collects in pit and recharges soil.
SC7 - Set-Back - Internal 50% of berm	1	3,400	880	880	0	Runoff from berm into pit, where it recharges soil.
SC7 - Set-Back - External 50% of berm	0.6	3,400	880	528	352	Runoff from berm to road ditch.
SC7 - Total		12,149	3,143	2,791	352	
Totals		**191,759**	**49,608**	**47,664**	**1,944**	

NOTES:

1) "SC" denotes subcatchment area.
2) "m" denotes metres.
3) "a" denotes annum.
4) Moisture surplus is 258.7 mm/a based on a dry year per Table B-3, Appendix B.

TABLE 4
SUMMARY OF WATER BALANCE CALCULATIONS
PROPOSED UTICA PIT

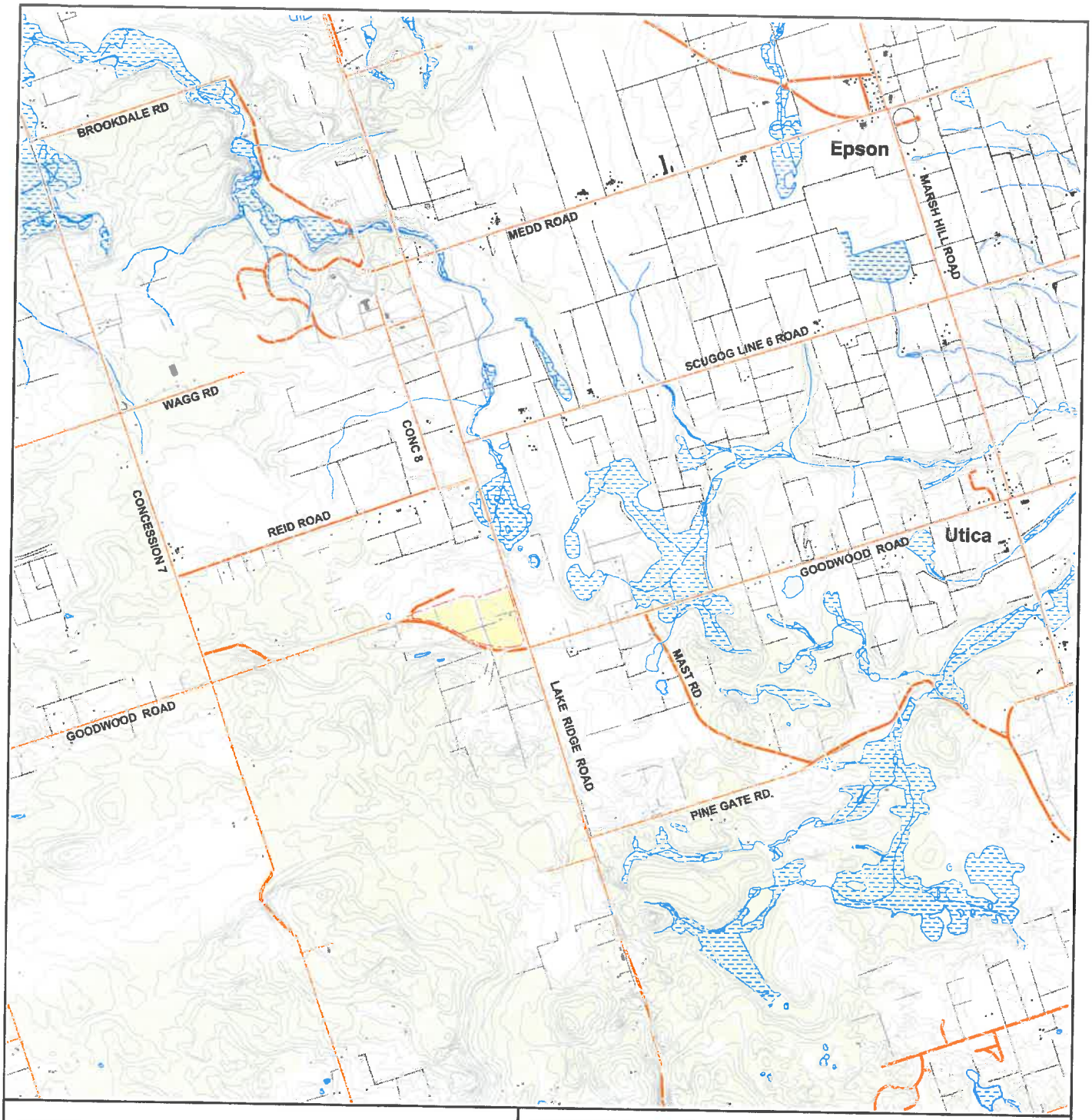
CLIMATIC CONDITION	PROPERTY INFILTRATION		RUNOFF TO ROAD DITCHES		RUNOFF TO PROPERTIES TO THE SOUTH	
	Pre-development	Post-development	Pre-development	Post-development	Pre-development	Post-development
30-Year Normal	65,479	74,214	8,439	2,259	3,322	767
Wet Year (2006)	81,898	92,823	10,555	2,825	4,155	960
Dry Year (1994)	42,054	47,664	5,420	1,451	2,134	493
Net Change	**13.3% Increase**		**73.2% Decrease**		**76.9% Decrease**	

NOTES:

1) Units in cubic metres per annum (m^3/a).

H:\Proj\13\15683-00\105 Hydrogeological Study\0414010\Tech\Water Balance\[Water Balance Summary.xls]Summary Table 4

Figures



LEGEND

PROPERTY LOCATION

40 20 0 40 metres

MAP SOURCE:
OBM 1:10000 MAPPING, NAD 83, ZONE 17 DATUM.

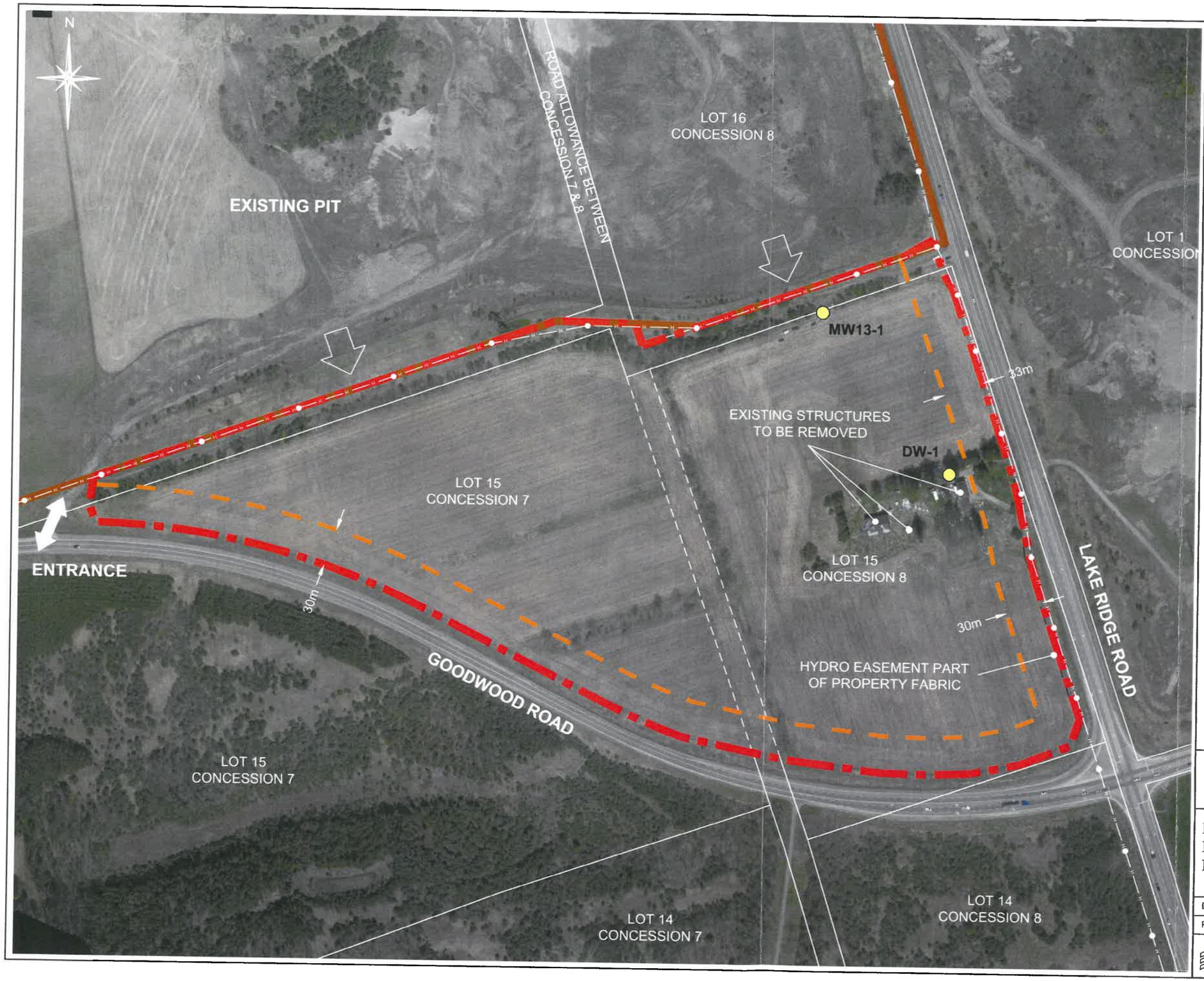
SITE LOCATION

HYDROGEOLOGIC ASSESSMENT
PROPOSED UTICA PIT
For Vicdom Sand & Gravel (Ontario) Ltd.

DATE: MAY 2013	SCALE: 1:40000
PROJECT: 131-15683-00 105	REF. NO.: 131-15683-00 105-0 F1-LM

GENIVAR

FIGURE 1



LEGEND

MW13-1

WELL LOCATION AND DESIGNATION

30 15 0 30 metres

MAP SOURCE:
SKELTON BRUMWELL, CONCEPT PLAN, PROJECT NUMBER 12-2630, FEBRUARY 2013.

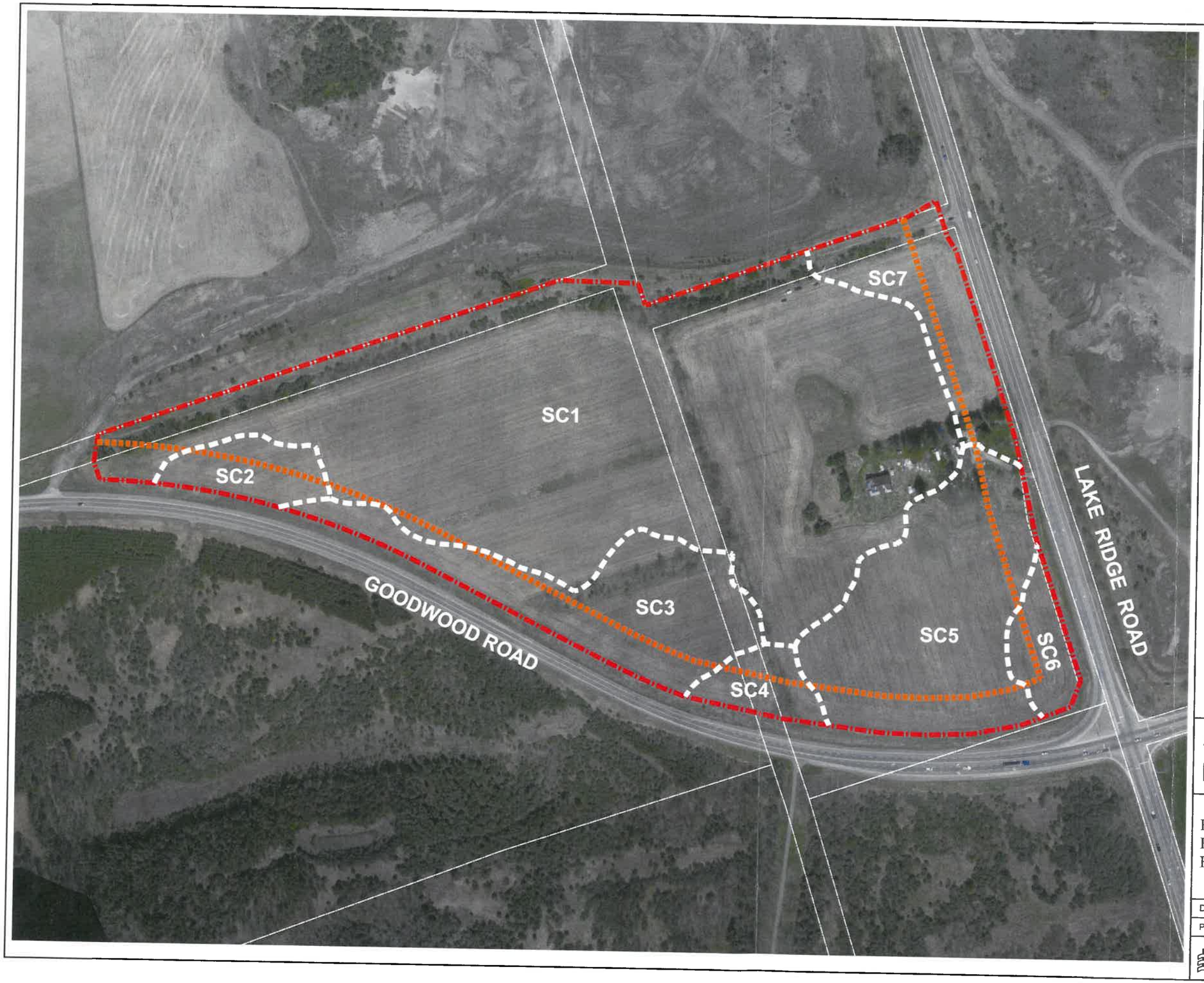
SITE PLAN

HYDROGEOLOGIC ASSESSMENT
PROPOSED UTICA PIT
For Vicdom Sand & Gravel (Ontario) Ltd.

DATE: MAY 2013	SCALE: 1:3000
PROJECT: 131-15683-00 105	FILE NO.: 131-15683-00 105-0 F2-SP

GENIVAR

FIGURE 2



LEGEND

PROPERTY LIMITS

SETBACK LIMITS

SUBCATCHMENT BOUNDARIES AND DESIGNATION

SC7

30 15 0 30 metres

MAP SOURCES:
OBM 1:10000 MAPPING, NAD 83, ZONE 17 DATUM AND SKELTON BRUMWEL DATA.

SUBCATCHMENT LOCATIONS

HYDROGEOLOGIC ASSESSMENT
PROPOSED UTICA PIT
For Vicdom Sand & Gravel (Ontario) Ltd.

DATE: MAY 2013	SCALE: 1:3000
PROJECT: 131-15683-00 105	FILE NO.: 131-15683-00 105 F3-SP

GENIVAR

FIGURE 3

Appendices

Appendix A

Water Well Information

Well Record Data

This interactive map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available on the MOE data download page *(http://www.ene.gov.on.ca/environment/en/resources/collection/data_downloads/index.htm)*.

Search interactive map

3900 lake ridge road, uxbridge Search ☐ Current Map Display

*1 result found for **3900 lake ridge road, uxbridge** in Ontario.*

Latitude:44.066404, Longitude:-79.057703 (UTM Zone:17, Easting:655549.17, Northing:4881082.02)

Filed with tags: water wells *(http://www.ene.gov.on.ca/environment/en/main/contents/details?term=water_wells)*

Well ID Number: 4603045

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Uxbridge Township (Uxbridge)	015	CON 08
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a
UTM Coordinates	**Municipal Plan and Sublot Number**	**Other**	

NAD83 — Zone 17
Easting: 654513.9
Northing: 4880382

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	GRVL			0 ft	53 ft
	MSND			53 ft	90 ft
	FSND			90 ft	123 ft
	FSND		GRVL	123 ft	125 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction
Rotary (Convent.)

Well Use
Livestock
Domestic

Status of Well
Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
4 inch	STEEL		122 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
	X	122 ft	125 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 3414

Results of Well Yield Testing

	Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
After test of well yield, water was	CLEAR			
		SWL 91 ft		
If pumping discontinued, give reason		1		
		2		
Pump intake set at		3		
Pumping Rate	3 GPM	4		
Duration of Pumping	36 h:0 m	5		
Final water level	117 ft	10		
If flowing give rate		15		
		20		
Recommended pump depth		25		
		30		
Recommended pump rate		40		
		45		
Well Production	PUMP	50		
Disinfected?		60		

Water Details

Water Found at Depth	Kind
125 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: September 23, 1956
Date Well Record Received by MOE: November 30, 1956

Well ID Number: 1906265

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Scugog Township (Reach)	001	CON 04
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a

UTM Coordinates *Municipal Plan and Sublot Number* *Other*

NAD83 — Zone 17
Easting: 654814.9
Northing: 4880223

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND			0 ft	21 ft
BRWN	MSND			21 ft	30 ft
BRWN	CLAY	SAND		30 ft	59 ft
BRWN	FSND			59 ft	75 ft
BRWN	FSND	MGRD		75 ft	99 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction Cable Tool

Well Use Commerical

Status of Well Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
6 inch	STEEL		85 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6 inch	X	82 ft	96 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 3136

Results of Well Yield Testing

After test of well yield, water was: CLEAR

If pumping discontinued, give reason:

Pump intake set at:

Pumping Rate: 30 GPM

Duration of Pumping: 12 h:0 m

Final water level: 85 ft

If flowing give rate:

Recommended pump depth: 95 ft

Recommended pump rate: 30 GPM

Well Production: PUMP

Disinfected?:

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	65 ft		
1			
2			
3			
4			
5			
10			
15	70 ft	15	
20			
25			
30	78 ft	30	
40			
45	85 ft	45	
50			
60	85 ft	60	

Water Details

Water Found at Depth	Kind
75 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: October 30, 1981
Date Well Record Received by MOE: January 08, 1982

Well ID Number: 4602190

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Scugog Township (Reach)	001	CON 04
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a

UTM Coordinates — *Municipal Plan and Subiot Number Other*

NAD83 -- Zone 17
Easting: 654909.9
Northing: 4880275

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	GRVL			0 ft	30 ft
	MSND			30 ft	95 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction

Cable Tool

Well Use

Livestock
Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
2 inch	STEEL		95 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To

Well Contractor and Well Technician Information

Well Contractor's Licence Number 2419

Results of Well Yield Testing

After test of well yield, water was: CLEAR
If pumping discontinued, give reason:
Pump intake set at:
Pumping Rate: 4 GPM
Duration of Pumping: 4 h:0 m
Final water level: 90 ft
If flowing give rate:
Recommended pump depth:
Recommended pump rate:
Well Production: PUMP
Disinfected?:

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	90 ft		
1			
2			
3			
4			
5			
10			
15			
20			
25			
30			
40			
45			
50			
60			

Water Details

Water Found at Depth	Kind
90 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: October 01, 1954
Date Well Record Received by MOE: November 26, 1954

Well ID Number: 1909715

Well Audit Number: *32652*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Uxbridge Township (Uxbridge)	016	CON 08
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a
UTM Coordinates	**Municipal Plan and Sublot Number**	**Other**	

NAD83 — Zone 17
Easting: 654351.9
Northing: 4880864

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	LOOS	0 ft	32 ft
BRWN	SILT	CLAY	SOFT	32 ft	45 ft
GREY	SILT	CLAY	SOFT	45 ft	90 ft
GREY	FSND	SILT	PCKD	90 ft	95 ft
GREY	CSND	SILT	PCKD	95 ft	101 ft
GREY	MSND	SILT	GRVL	101 ft	142 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction

Rotary (Convent.)

Well Use

Industrial

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
6 Inch	STEEL		111 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6 Inch	X	111 ft	121 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 1930

Results of Well Yield Testing

	Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
After test of well yield, water was		SWL		
If pumping discontinued, give reason		1		
Pump intake set at		2		
Pumping Rate		3		
Duration of Pumping		4		
Final water level		5		
If flowing give rate		10		
Recommended pump depth		15		
Recommended pump rate		20		
Well Production		25		
Disinfected?		30		
		40		
		45		
		50		
		60		

Water Details

Water Found at Depth	Kind
110 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: 32652
Date Well Completed: February 01, 1989
Date Well Record Received by MOE: April 18, 1989

Well ID Number: 1906375

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Scugog Township (Reach)	001	CON 05
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a

UTM Coordinates *Municipal Plan and Sublot Number* *Other*

NAD83 — Zone 17
Easting: 654814.9
Northing: 4880373

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	PRDG			0 ft	3 ft
BRWN	SAND	STNS	LOOS	3 ft	26 ft
BRWN	GRVL	DRY	LOOS	26 ft	34 ft
BRWN	SAND	GRVL	LOOS	34 ft	87 ft
BRWN	MSND	LOOS		87 ft	113 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction
Cable Tool

Well Use
Domestic

Status of Well
Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
6 inch	STEEL		110 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6 inch	X	110 ft	113 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 4738

Results of Well Yield Testing

After test of well yield, water was
CLEAR

If pumping discontinued, give reason

Pump intake set at

Pumping Rate
10 GPM

Duration of Pumping
1 h:0 m

Final water level
93 ft

If flowing give rate

Recommended pump depth
90 ft

Recommended pump rate
8 GPM

Well Production
BAILER

Disinfected?

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	84 ft		
1			
2			
3			
4			
5			
10			
15	93 ft	15	
20			
25			
30			
40			
45			
50			
60	93 ft	60	

Water Details

Water Found at Depth	Kind
87 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: March 30, 1982
Date Well Record Received by MOE: August 13, 1982

Well ID Number: 4605851

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Scugog Township (Reach)	001	CON 04
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a

UTM Coordinates *Municipal Plan and Sublot Number* *Other*

NAD83 — Zone 17
Easting: 654942.9
Northing: 4880309

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BLCK	LOAM			0 ft	1 ft
BRWN	SAND			1 ft	3 ft
BRWN	STNS			3 ft	33 ft
BRWN	SAND			33 ft	84 ft
RED	SAND			84 ft	92 ft
GREY	CLAY	STNS		92 ft	131 ft
RED	SAND			131 ft	133 ft
GREY	CLAY	STNS		133 ft	220 ft
RED	SAND			220 ft	231 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	218 ft		

Method of Construction
Rotary (Convent.)

Well Use
Livestock
Domestic

Status of Well
Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
4 inch	STEEL		223 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
4 inch	X	223 ft	231 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 1413

Results of Well Yield Testing

After test of well yield, water was
CLEAR

If pumping discontinued, give reason

Pump intake set at

Pumping Rate
8 GPM

Duration of Pumping
4 h:0 m

Final water level
120 ft

If flowing give rate

Recommended pump depth
140 ft

Recommended pump rate
7 GPM

Well Production
BAILER

Disinfected?

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	82 ft		
1			
2			
3			
4			
5			
10			
15	120 ft	15	
20			
25			
30			
40			
45			
50			
60	120 ft	60	

Water Details

Water Found at Depth	Kind
231 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: May 08, 1974
Date Well Record Received by MOE: June 05, 1974

Well ID Number: 7158627

Well Audit Number: *Z122962*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	*Township*	*Lot*	*Concession*
30 REGIONAL RD. 21	Scugog Township (Reach)	001	CON 04
County/District/Municipality	*City/Town/Village*	*Province*	*Postal Code*
DURHAM	SCUGOG	ON	n/a
UTM Coordinates	*Municipal Plan and Sublot Number*	*Other*	

NAD83 — Zone 17
Easting: 654984
Northing: 4880268

Overburden and Bedrock Materials Interval

General Colour	*Most Common Material*	*Other Materials*	*General Description*	*Depth From*	*Depth To*
				0 ft	

Annular Space/Abandonment Sealing Record

Depth From	*Depth To*	*Type of Sealant Used (Material and Type)*	*Volume Placed*
		BENTONOTE GROUT	

Method of Construction

Other Method
DECOM.

Well Use

Not Used

Status of Well

Abandoned-Other

Construction Record - Casing

Inside Diameter	*Open Hole OR material*	*Depth From*	*Depth To*
5 inch	STEEL	5 ft	221 ft

Construction Record - Screen

Outside Diameter	*Material*	*Depth From*	*Depth To*
	X		

Well Contractor and Well Technician Information

Well Contractor's Licence Number 1663

Results of Well Yield Testing

	Draw Down Time (min)	*Draw Down Water level*	*Recovery Time (min)*	*Recovery Water level*
After test of well yield, water was		SWL		79.6 ft
If pumping discontinued, give reason		1		
Pump intake set at		2		
		3		
Pumping Rate		4		
Duration of Pumping		5		
		10		
Final water level		15		
If flowing give rate		20		
Recommended pump depth		25		
		30		
Recommended pump rate		40		
Well Production		45		
		50		
Disinfected?		60		
Y				

Water Details

Water Found at Depth	*Kind*
	Untested

Hole Diameter

Depth From	*Depth To*	*Diameter*
5 ft	221 ft	5 Inch

Audit Number: Z122962
Date Well Completed: November 29, 2010
Date Well Record Received by MOE: February 01, 2011

Well ID Number: 1911647

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Uxbridge Township (Uxbridge)	014	CON 07
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a
UTM Coordinates	**Municipal Plan and Sublot Number**	**Other**	

NAD83 — Zone 17
Easting: 654374.9
Northing: 4879975

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BLCK	LOAM			0 ft	2 ft
BRWN	CLAY	SNDY	LOAM	2 ft	19 ft
BRWN	SAND	LOOS		19 ft	42 ft
YLLW	CLAY	SOFT		42 ft	67 ft
BRWN	SAND	LOOS		67 ft	98 ft
BRWN	SAND	PCKD		98 ft	125 ft
BRWN	SAND	CLAY	LYRD	125 ft	130 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	20 ft		

Method of Construction
Cable Tool

Well Use
Domestic

Status of Well
Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
6 inch	STEEL		116 ft
5 inch	STEEL		130 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6 inch	X	113 ft	120 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 4743

Results of Well Yield Testing

After test of well yield, water was
CLEAR

If pumping discontinued, give reason

Pump intake set at

Pumping Rate
10 GPM

Duration of Pumping
2 h:0 m

Final water level
108 ft

If flowing give rate

Recommended pump depth
115 ft

Recommended pump rate
8 GPM

Well Production
BAILER

Disinfected?

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	98 ft		
1			
2			
3			
4			
5			
10			
15			
20			
25			
30			
40			
45			
50			
60			

Water Details

Water Found at Depth	Kind
98 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: October 21, 1992
Date Well Record Received by MOE: December 03, 1992

Well ID Number: 4603926

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location
not available

Township
Uxbridge Township (Uxbridge)

Lot
015

Concession
CON 07

County/District/Municipality
DURHAM

City/Town/Village

Province
ON

Postal Code
n/a

UTM Coordinates
NAD83 — Zone 17
Easting: 653644.9
Northing: 4880343

Municipal Plan and Sublot Number

Other

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	LOAM			0 ft	2 ft
	MSND			2 ft	515 ft
	CLAY			515 ft	580 ft
	GRVL			580 ft	595 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction

Cable Tool

Well Use

Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
6 inch	STEEL		595 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
	X		

Well Contractor and Well Technician Information

Well Contractor's Licence Number 2518

Results of Well Yield Testing

After test of well yield, water was
CLEAR

If pumping discontinued, give reason

Pump intake set at

Pumping Rate
40 GPM

Duration of Pumping
4 h:0 m

Final water level
280 ft

If flowing give rate

Recommended pump depth
350 ft

Recommended pump rate
20 GPM

Well Production
PUMP

Disinfected?

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	170 ft		
1			
2			
3			
4			
5			
10			
15			
20			
25			
30			
40			
45			
50			
60			

Water Details

Water Found at Depth	Kind
595 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: July 04, 1968
Date Well Record Received by MOE: July 04, 1968

Well ID Number: 1905315

Well Audit Number: *none*
Well Tag Number: *none*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	Township	Lot	Concession
not available	Uxbridge Township (Uxbridge)	015	CON 07
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
DURHAM		ON	n/a
UTM Coordinates	**Municipal Plan and Sublot Number**	**Other**	

NAD83 — Zone 17
Easting: 653664.9
Northing: 4880423

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	DRY		0 ft	18 ft
BRWN	CLAY	PCKD		18 ft	43 ft
BRWN	SAND	DRY		43 ft	95 ft
BRWN	FSND	LOOS		95 ft	124 ft
GREY	CLAY	HARD		124 ft	125 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed

Method of Construction

Rotary (Convent.)

Well Use

Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole OR material	Depth From	Depth To
5 inch	STEEL		116 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
5 inch	X	116 ft	124 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number 1413

Results of Well Yield Testing

After test of well yield, water was CLEAR

If pumping discontinued, give reason

Pump intake set at

Pumping Rate 8 GPM

Duration of Pumping 2 h:0 m

Final water level 102 ft

If flowing give rate

Recommended pump depth 115 ft

Recommended pump rate 7 GPM

Well Production BAILER

Disinfected?

Draw Down Time (min)	Draw Down Water level	Recovery Time (min)	Recovery Water level
SWL	95 ft		
1			
2			
3			
4			
5			
10			
15	102 ft	15	
20			
25			
30			
40			
45			
50			
60	102 ft	60	

Water Details

Water Found at Depth	Kind
124 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter

Audit Number: *none*
Date Well Completed: April 16, 1979
Date Well Record Received by MOE: May 10, 1979

Ontario Ministry of the Environment

Measurements recorded in: ☑ Metric ☑ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A086365

RECEIVED

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
978970	[illegible] gravel		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
Box 1359	Uxbridge	ON	L9P 1M6	905 [illegible]

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
[illegible] Lake Ridge Rd		[illegible]	[illegible]

County/District/Municipality	City/Town/Village	Province	Postal Code
	[illegible]	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	[illegible]	[illegible]		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
[illegible]	Sand	gravel	[illegible]	[illegible]	[illegible]
[illegible]	sand	gravel	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	gravel	[illegible]	[illegible]	[illegible]

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
[illegible]	[illegible]	Bentonite	[illegible]
[illegible]	[illegible]	Sand	2.0

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, specify NA

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping ___ hrs + ___ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☐ Other, specify [illegible]

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☑ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
[illegible]	Plastic	[illegible]	0	37

Status of Well

☐ Water Supply ☐ Replacement Well ☑ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
[illegible]	Plastic	10	37	[illegible]

Map of Well Location

Please provide a map below following instructions on the back.

Water Details

Water found at Depth ___ Kind of Water: ☐ Fresh ☐ Untested (m/ft) ☐ Gas ☐ Other, specify NA

Water found at Depth ___ Kind of Water: ☐ Fresh ☐ Untested (m/ft) ☐ Gas ☐ Other, specify NA

Water found at Depth ___ Kind of Water: ☐ Fresh ☐ Untested (m/ft) ☐ Gas ☐ Other, specify NA

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	[illegible]	6

Well Contractor and Well Technician Information

Business Name of Well Contractor: [illegible]

Well Contractor's Licence No: 1 5 [illegible] 8

Business Address (Street Number/Name): [illegible]

Municipality: [illegible]

Province: [illegible] Postal Code: [illegible] Business E-mail Address: [illegible]

Bus. Telephone No. (inc. area code): [illegible] Name of Well Technician (Last Name, First Name): [illegible]

Well Technician's Licence No: [illegible] Signature of Technician and/or Contractor Date Submitted: [illegible]

Comments: [illegible]

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☐ Yes ☑ No	[illegible]	Audit No. Z107919
	Date Work Completed [illegible]	Received

Well Owner's Copy

Appendix B

Climatic Data

FIGURE B-1
Annual Climatic Summary - Oshawa WPCP

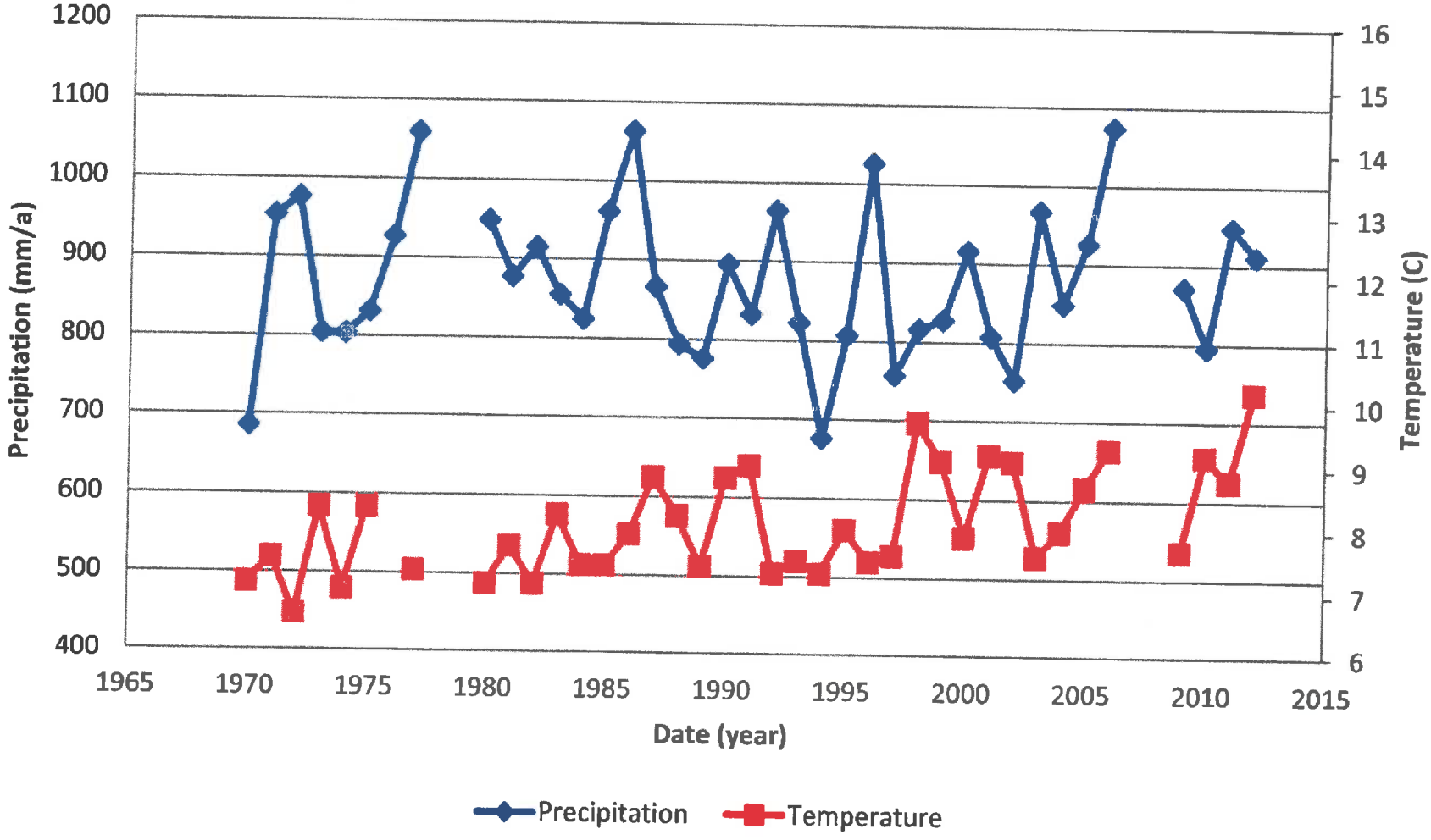


TABLE B-1
CLIMATIC WATER BUDGET: 1971 - 2000 (Normal Year)
PROPOSED UTICA PIT

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature (°C)	Heat Index	Potential Evapo-transpiration (mm)	Daylight Correction Value	Adjusted Potential Evapo-transpiration (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	PPT - PET (mm)	Accumulated Potential Water Loss (mm)	Storage (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus (mm)
January	-5.7	0.0	0.0	0.765	0.0	71	71.0	0.0	71.0	0.0	224.7	0.0	0.0	0.0	71.0
February	-4.8	0.0	0.0	0.871	0.0	52.7	52.7	0.0	52.7	0.0	277.4	0.0	0.0	0.0	52.7
March	-0.1	0.0	0.0	0.986	0.0	62.3	62.3	0.0	62.3	0.0	75.0	0.0	0.0	0.0	62.3
April	6.3	1.4	25.7	1.116	28.7	73.1	44.4	0.0	44.4	0.0	75.0	0.0	28.7	0.0	44.4
May	12.2	3.8	49.7	1.231	61.2	74.7	13.5	0.0	13.5	0.0	75.0	0.0	61.2	0.0	13.5
June	16.9	6.3	68.9	1.293	89.1	80.6	0.0	8.5	-8.5	-8.5	66.5	-8.5	89.1	0.0	0.0
July	20.3	8.3	82.8	1.269	105.0	67.3	0.0	37.7	-37.7	-46.2	39.0	-27.5	94.8	10.2	0.0
August	19.6	7.9	79.9	1.173	93.8	83.3	0.0	10.5	-10.5	-56.6	34.4	-4.6	87.9	5.9	0.0
September	15.4	5.5	62.8	1.048	65.8	87.9	22.1	0.0	22.1	0.0	56.5	22.1	65.8	0.0	0.0
October	9.1	2.5	37.1	0.918	34.1	66.3	32.2	0.0	32.2	0.0	75.0	18.5	34.1	0.0	13.7
November	4.1	0.7	16.7	0.803	13.4	79.9	66.5	0.0	66.5	0.0	75.0	0.0	13.4	0.0	66.5
December	-2.5	0.0	0.0	0.741	0.0	78.7	78.7	0.0	78.7	0.0	153.7	0.0	0.0	0.0	78.7
TOTALS (mm)		36.4			491.0	877.8	443.4	56.6	386.8	-111.3	1,227.2	0.0	475.0	16.0	402.8

Total Water Surplus 386.8 mm

TOTAL MOISTURE SURPLUS 402.8 mm

NOTES:

1) Evapotrans. = Evapotranspiration.
2) Water budget based on Thornthwaite Method. Adjusted for latitude and daylight.
3) (°C) - Represents calculated mean of daily temperatures for the month.
4) Data from the Oshawa WPCP Climatological Station, Environment Canada on-line
5) Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration.
6) Unadjusted Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual potential evapotranspiration and change in soil moisture
7) Storage represents soil water holding capacity. Considered 75 mm based on sand and gravel and medium rooted crops (corn) for pre-development to deep rooted crops (pasture) for rehabilitation

H:\Proj\13\15583-00\105 Hydrogeological Study\0414010\Tech\Climatic Data\[Copy of Climatic Water Budget.xls]Water Budget - Normal

TABLE B-2
CLIMATIC WATER BUDGET: 2006 (Wet Year)
PROPOSED UTICA PIT

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature (°C)	Heat Index	Potential Evapo-transpiration (mm)	Daylight Correction Value	Adjusted Potential Evapo-transpiration	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	PPT - PET (mm)	Accumulated Potential Water Loss (mm)	Storage (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus (mm)
January	0	0.0	0.0	0.765	0.0	99.9	99.9	0.0	99.9	0.0	75.0	0.0	0.0	0.0	99.9
February	-3.7	0.0	0.0	0.871	0.0	85.9	85.9	0.0	85.9	0.0	160.9	0.0	0.0	0.0	85.9
March	0.8	0.1	2.6	0.986	2.6	53.2	50.6	0.0	50.6	0.0	75.0	0.0	2.6	0.0	50.6
April	7.2	1.7	31.1	1.116	34.7	79.2	44.5	0.0	44.5	0.0	75.0	0.0	34.7	0.0	44.5
May	12.8	4.1	59.5	1.231	73.2	80.7	7.5	0.0	7.5	0.0	75.0	0.0	73.2	0.0	7.5
June	18.5	7.2	90.0	1.293	116.4	51.1	0.0	65.3	-65.3	-65.3	30.7	-44.3	95.4	21.0	0.0
July	21.4	9.0	106.1	1.269	134.6	167.4	32.8	0.0	32.8	0.0	63.5	32.8	134.6	0.0	0.0
August	20.5	8.4	101.1	1.173	118.6	52.2	0.0	66.4	-66.4	-66.4	30.0	-33.5	85.7	32.9	0.0
September	15.8	5.7	75.4	1.048	79.0	106.9	27.9	0.0	27.9	0.0	57.9	27.9	79.0	0.0	0.0
October	9.1	2.5	40.5	0.918	37.2	152	114.8	0.0	114.8	0.0	75.0	17.1	37.2	0.0	97.7
November	5.8	1.3	24.4	0.803	19.6	73.4	53.8	0.0	53.8	0.0	75.0	0.0	19.6	0.0	53.8
December	2.8	0.4	10.7	0.741	8.0	71.8	63.8	0.0	63.8	0.0	75.0	0.0	8.0	0.0	63.8
TOTALS (mm)		40.4			623.8	1073.7	581.6	131.7	449.9	-131.7	868.0	0.0	569.9	53.9	503.8

Total Water Surplus 449.9 mm

TOTAL MOISTURE SURPLUS 503.8 mm

NOTES:

1) Evapotrans. = Evapotranspiration
2) Water budget based on Thornthwaite Method. Adjusted for latitude and daylight
3) (°C) - Represents calculated mean of daily temperatures for the month
4) Data from the Oshawa WPCP Climatological Station, Environment Canada on-line
5) Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration
6) Unadjusted Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual potential evapotranspiration and change in soil moisture.
7) Storage represents soil water holding capacity. Considered 75 mm based on sand and gravel and medium rooted crops (corn) for pre-development to deep rooted crops (pasture) for rehabilitation.

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TABLE B-3
CLIMATIC WATER BUDGET: 1994 (Dry Year)
PROPOSED UTICA PIT

	Thornthwaite (1948)									Thornthwaite and Mather (1957)					
Month	Mean Temperature	Heat Index	Potential Evapo-transpiration	Daylight Correction Value	Adjusted Potential Evapo-	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)	PPT - PET (mm)	Accumulated Potential Water Loss	Storage (mm)	Change in Soil Moisture (mm) (delta S)	Actual Evapo-transpiration (mm)	Moisture Deficit (mm)	Unadjusted Moisture Surplus
January	-11.1	0.0	0.0	0.765	0.0	67.1	67.1	0.0	67.1	0.0	142.1	0.0	0.0	0.0	67.1
February	-7.2	0.0	0.0	0.871	0.0	37.2	37.2	0.0	37.2	0.0	179.3	0.0	0.0	0.0	37.2
March	-0.01	0.0	0.0	0.986	0.0	41.6	41.6	0.0	41.6	0.0	75.0	0.0	0.0	0.0	41.6
April	6.5	1.5	29.8	1.116	33.2	78.3	45.1	0.0	45.1	0.0	75.0	0.0	33.2	0.0	45.1
May	10.8	3.2	51.4	1.231	63.3	88.6	25.3	0.0	25.3	0.0	75.0	0.0	63.3	0.0	25.3
June	17.8	6.8	88.0	1.293	113.7	44.6	0.0	69.1	-69.1	-69.1	28.9	-46.1	90.7	23.0	0.0
July	20.6	8.5	103.0	1.269	130.6	33.7	0.0	96.9	-96.9	-166.1	8.0	-20.9	54.6	76.0	0.0
August	18.3	7.1	90.6	1.173	106.3	47.2	0.0	59.1	-59.1	-225.2	3.0	-5.0	52.2	54.1	0.0
September	16.1	5.8	79.0	1.048	82.7	80.2	0.0	2.5	-2.5	-227.8	3.0	0.0	80.2	2.5	0.0
October	9.8	2.8	46.3	0.918	42.5	22.2	0.0	20.3	-20.3	-248.1	3.0	0.0	22.2	20.3	0.0
November	5.8	1.3	26.3	0.803	21.1	81.7	60.6	0.0	60.6	0.0	63.6	60.6	21.1	0.0	0.0
December	0.3	0.0	1.1	0.741	0.8	54.6	53.8	0.0	53.5	0.0	75.0	11.4	0.8	0.0	42.4
TOTALS (mm)		36.9			594.4	677.0	330.7	225.2	82.4	-936.2	730.9	0.0	418.3	176.1	258.7

Total Water Surplus 82.6 mm

TOTAL MOISTURE SURPLUS 258.7 mm

NOTES:

1) Evapotrans. = Evapotranspiration.

2) Water budget based on Thornthwaite Method. Adjusted for latitude and daylight

3) (°C) - Represents calculated mean of daily temperatures for the month

4) Data from the Oshawa WPCP Climatological Station, Environment Canada on-line

5) Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapotranspiration

6) Unadjusted Moisture Surplus (Thornthwaite and Mather, 1957) is calculated as total precipitation minus actual potential evapotranspiration and change in soil moisture

7) Storage represents soil water holding capacity. Considered 75 mm based on sand and gravel and medium rooted crops (corn) for pre-development to deep rooted crops (pasture) for rehabilitation