Durham York Energy Centre
2012 Groundwater Monitoring Report
April 2013

Prepared for:
Regional Municipality of Durham
Works Department
605 Rossland Road East
P.O. Box 623
Whitby, Ontario
L1N 6A3

Prepared by:
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1 c Regional Municipality of Durham
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GENIVAR

Project No. 111-26648-00.100.0414013

April 30, 2013

Mr. Gioseph Anello, M.Eng., P.Eng., PMP
Manager of Waste Planning and Technical Services
Regional Municipality of Durham
Works Department
605 Rossland Road East
P.O. Box 623
Whitby, Ontario
L1N 6A3

Re: Durham York Energy Centre
2012 Groundwater Monitoring Report

Dear Mr. Anello:

We are pleased to forward the 2012 Groundwater Monitoring Report for the Durham York Energy Centre. This hydrogeological report presents an assessment of the natural (baseline) groundwater characteristics of the site prior to, and during, the current construction phase of the facility. Comments provided by the Region have been incorporated into the report.

The groundwater monitoring program was completed in accordance with the program described in the *Durham York Energy Centre Groundwater and Surface Water Monitoring Plan*, prepared by Stantec Consulting Ltd, dated September 14, 2011. Our report includes groundwater elevation and chemical data collected during the monitoring events between December 2011 and March 2013. Findings are summarized in the conclusions and recommendations section, and technical information is appended.

In general, the existing groundwater characteristics are reflective of natural groundwater conditions site, and the construction activity has not adversely affected the on-site groundwater quality. Groundwater levels within the area of the East Stormwater Management Pond decreased slightly through 2012, which is a reflection of the pond installation. The monitoring program outlined in the Groundwater and Surface Water Monitoring Plan should be continued into 2013.

Thank you for the opportunity to work on this study. If there are any questions, please contact us.

Yours truly,
GENIVAR Inc.

Jason T. Balsdon, M.A.Sc., P.Eng.
Consulting Engineer
SJT:nah

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1. Introduction

1.1 Background

The Durham York Energy Centre is an energy from municipal solid waste facility currently being constructed in the Municipality of Clarington, Ontario. The site property is located on the west side of Osborne Road, southeast of the Courtice Road and Highway 401 interchange, and north of the Courtice Water Pollution Control Plant and the CN Railway, as shown in Figure 1-1.

The water monitoring programs for the site were outlined in the *Durham York Energy Centre Groundwater and Surface Water Monitoring Plan*, prepared by Stantec Consulting Ltd, dated September 14, 2011, in accordance with Condition 20 of the Environmental Assessment (EA) for the site. To date, the groundwater monitoring component has been carried out by Genivar Inc, and the surface water monitoring component has been carried out by Golder Associates. The Durham York Energy Centre is located upon approximately 12.1 hectares of rural land. The site layout is shown in the Site Plan, Figure 1-2.

1.2 Ownership and Key Personnel

The owners of the site are:

The Regional Municipality of Durham
Contact: Mirka Januszkiewicz, P. Eng
Director, Management

and

The Regional Municipality of York
Contact: Laura McDowell, P.Eng.
Director, Environmental Promotion and Protection

The Site Operator during the construction phase is:

Covanta Durham York Renewable Energy L.P.
Contact: James Delaney
Resident Construction Manager
72 Osborne Road
Clarington, Ontario
L1E 2R2
Main: (905) 433-4870
Direct: (905) 433-4872
Fax: (905) 433-4889
Email: jdelaney@CovantaEnergy.com

Assistant Site Coordinator: Dave Haldenby
Email: dhaldenby@CovantaEnergy.com

The key contact person for environmental issues at the site is James Delany, listed above.

The Certified Environmental Practitioners for the site include:

Groundwater –

GENIVAR Inc.
Contact: Stephen J. Taziar, P.Eng
Senior Project Engineer
1091 Gorham Street, Suite 301
Newmarket, Ontario
L3Y 8X7
Phone: (905) 853-3303 (ext 226)
Fax: (905) 853-1759
Email: stephen.taziar@genivar.com

and

Surface Water –

Golder Associates
Contact: Steve Auger, M.Sc., P.Eng, C.P.E.S.C.
Water Resources Engineer, Surface Water CEP
140 Renfrew Drive, Suite 110
Markham, Ontario
L3R 6B3
Phone: (905) 475-5591 (ext 6030)
Fax: (905) 475-5257
Email: Steve_Auger@golder.com

1.3 MOE Liaison

As part of the ongoing activities on the subject site, the Owners (Regional Municipalities of Durham and York) and Covanta have been meeting with the Ministry of the Environment on-site, periodically, to review the status of construction, and assess potential affects to the surrounding environment.

1.4 Objective and Scope

The principal objectives of the 2012 annual water monitoring program are as follows.

- To assess the baseline on-site groundwater characteristics as part of the pre-construction and construction phases.
- To assess the effects of the construction activity on local groundwater resources.
- To assess the compliance of the groundwater quality with Ontario Drinking Water Quality Standards.
- To assess the need for remedial measures.
- To determine if changes are required for the 2013 monitoring program.

The 2012 water monitoring program involves a data collection component and an analysis and interpretation component.

1.5 Methodology

1.5.1 Groundwater Monitor Installations

Six groundwater monitors at four Borehole Locations were installed on the subject site between December 19 and 21, 2011, in accordance with the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan. Drilling of the boreholes was undertaken by a soils drilling rig, and installation of the groundwater monitors was supervised in the field by GENIVAR Inc. personnel. Single monitors were installed at Borehole Locations MW1 and MW4, and nests of two groundwater monitors were installed at Borehole Locations MW2 and MW3. During the soils drilling, split spoon samples were obtained and standard penetration tests were completed. This information was recorded in a project dedicated field book by the supervising field technician. Each groundwater monitor consists of 50 mm, Schedule 40, PVC and a 100mm x 100mm steel, lockable, protective casing.

Once the groundwater monitors were completed, dedicated high density polyethylene (HDPE) tubing, connected to inertial-lift sampling systems, were installed within each monitor. The monitors were subsequently purged to remove any water that may have been added during the drilling process, remove any fine-grained material within the monitor, and to establish a hydraulic connection with the surrounding in-situ soils.

During 2012, the riser for Monitor MW4 was shortened in response to the construction of the East Stormwater Management Pond. The monitor shortening involved the removal of 2.6 metres of riser and re-installation of the steel protective casing, in accordance with O. Reg. 903. Approximately 1.5 metres of the total riser were removed in June and the additional 1.1 metres of riser were removed in July 2012. The height adjustment of the monitor will not have an influence on the monitoring objectives for this location.

1.5.2 Slug Tests Hydraulic Response Testing

Following the installation and development of the six groundwater monitors, hydraulic response testing was undertaken to provide estimates of the horizontal hydraulic conductivity of the formation material surrounding the screened interval. Rising head tests (removing water and monitoring the change in water level) were conducted at each monitoring location. An assessment of the test results provided the following hydraulic conductivities:

- MW1: 1.8 x 10^{-7} m/s
- MW2A: 9.0 x 10^{-7} m/s
- MW2B: 5.8 x 10^{-8} m/s
- MW3A: 1.6 x 10^{-8} m/s
- MW3B: 3.4 x 10^{-7} m/s
- MW4: 8.0 x 10^{-7} m/s

These hydraulic conductivities are consistent with silt and till soils, and will be used for future assessments associated with groundwater flow velocities.

1.5.3 Groundwater Monitoring

The established groundwater monitoring program for the site, as outlined in the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan requires the collection of groundwater samples from the on-site monitors three times per year, in the spring, summer, and fall. The measurement of groundwater levels at the monitoring locations was completed in conjunction with the groundwater sampling events on the following dates:

- December 28, 2011
- March 14, 2012
- June 21, 2012
- November 5, 2012
- March 22, 2013

Prior to sampling, monitors were purged of at least three volumes of standing water, or were purged dry, using the dedicated inertial lift pump in accordance with established sampling protocols for this site and with industry standards. Samples were collected directly in bottles provided by the laboratory and submitted to AGAT Laboratories in Mississauga for analysis of the inorganic and metal parameters listed below, in accordance with the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan.

- Carbonate
- Bicarbonate
- Chloride
- Sulphate
- Calcium
- Magnesium
- Potassium
- Sodium
- Boron
- Cadmium
- Cobalt
- Lead
- Mercury

Samples intended for metals analysis were filtered in the field using 0.45 micron in-line disposable filters. Groundwater samples were analysed in the field for pH, conductivity, temperature, and oxidation reduction potential.

AGAT Laboratories is accredited by the Canadian Association for Laboratory Accreditation (CALA) and the Standards Council of Canada (SCC).

1.5.4 Interpretation and Reporting

Following collation of the database, a detailed analysis and interpretation of the data was completed. This component included the following items.

- Preparation of time-concentration graphs
- Statistical assessment
- Interpretation of short-term surface water quality patterns and trends
- Groundwater quality compliance with Ontario Drinking Water Quality Standards
- Consideration of future monitoring

Results of the 2012 surface water and groundwater monitoring program with conclusions and recommendations are presented in this report.

2. Physical Setting

The geologic setting has previously been described in previous reports, including the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan, prepared by Stantec Consulting Ltd. The Durham York Energy Centre is situated in the physiographic region of the Iroquois Plain, as described by Chapman & Putnam (1984). In the vicinity of the subject site, this region is comprised of silty lacustrine deposits and tills. The Stantec report indicates that the Durham York Energy Centre is underlain by Newmarket Till, which is a dense till comprised of clayey silt and sand till. The layer is estimated to be between 25 and 30 m deep, according to various references in the Stantec report.

The surficial soils on-site, as described in the borehole logs, Item A-3, Appendix A, are comparable to the soils described above. As shown in the borehole logs, the shallow soils on-site, to a depth of approximately 10 metres, include layers of sandy silt till, silt till, clayey silt, and silty sand. The varying thicknesses of the units generally range between 0.2 m and 4.5 m within the boreholes drilled in December 2011.

An interpretation of shallow groundwater flow direction is presented in Figure 1-2, based on the November 2012 water level elevations. As shown in the figure, shallow groundwater flow is in a general southwest direction. It is noted that the groundwater elevations within the southeast portion of the site decreased during the November 2012 monitoring event, compared to the March 2012 event, in response to the construction of the East Stormwater Management Pond. This lowering of the water level elevation was exhibited at monitor MW4, which decreased approximately 1.8 metres between March and November 2012. Water level elevations within Monitor MW4 during the November 2012 and March 2013 events are similar to, but slightly higher than, the base elevation of the East Stormwater Management Pond.

The decrease in water levels adjacent to the stormwater management ponds is not unexpected, as this aspect was predicted in Section 2.2 of the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan. It is noted, however, that the localized influence of the stormwater management ponds on the shallow groundwater flow regime will not have an adverse influence on the shallow groundwater flow patterns for the areas around the site.

Groundwater levels within monitoring nests MW2 and MW3, as shown in Figures A-2 and A-3, indicate that vertical hydraulic gradients are generally downwards, on-site.

3. Monitoring Results

3.1 Quality Assurance/Quality Control

Duplicate groundwater samples were collected during the sampling events in 2012 and early 2013 as part of the QA/QC program. A summary of the results is provided in Table B-3, Appendix B, along with the relative percent differences (RPD). It is noted that the acceptable RPD guideline of 20% is only applicable to parameter concentrations that are greater than 5 times the limit of quantitation (LOQ). Results for the duplicate sample were generally within the 20% guideline for the duplicates.

Based on the results from the QA/QC program, the RPD for the duplicate sample parameters, as shown in Table B-3, were below the 20% guideline. These results indicate that the laboratory values can be interpreted with confidence.

3.2 Groundwater Quality

Based on the configuration of the groundwater flow system, Borehole Locations MW1 and MW2 are considered to be upgradient of the on-site buildings, and represent the background water quality for the site. Borehole Locations MW3 and MW4 are downgradient or cross-gradient from the facility buildings within the property boundary, and provide monitoring locations for assessment of potential future influences from on-site activities.

3.2.1 Field Chemical Results

A comparison of field and laboratory values indicates that the field pH and conductivity measurements were generally similar to the laboratory results. Any differences between field and laboratory values are attributed primarily to differences in the testing environment.

3.2.2 Concentration Trends

The groundwater laboratory analytical results are summarized in Table B-2, Appendix B. The time-concentration graphs for chloride, sodium, sulphate, calcium, magnesium, potassium, boron, and bicarbonate are provided in Figures B-1 to B-8, Appendix B. As shown in these figures, parameter concentrations for the groundwater monitors are generally constant over the short term, between December 2011 and March 2013, although the following patterns are noted.

- Within the nested monitors at Borehole Location MW2, concentrations for chloride, sodium, sulphate, calcium, magnesium, and bicarbonate are higher within the shallow monitor, MW2B, compared to the deeper monitor MW2A; whereas boron concentrations were slightly higher at the deeper monitor compared to the shallow monitor, at this location.

- Within the nested monitors at Borehole Location MW4, concentrations for chloride, sodium, and boron are higher within the deeper monitor, MW4A, compared to the shallow monitor MW4B; whereas calcium, magnesium, and bicarbonate concentrations were higher within the shallow monitor compared to the deeper monitor, at this location.

- Concentrations for chloride, magnesium, potassium, and bicarbonate vary over a larger range at Monitor MW4, compared to the other groundwater monitors installed on-site.

The variations in the groundwater chemistry between the groundwater monitoring locations, and at the two nested monitoring locations, is attributed to various factors including soil type that the monitors are screened in, off-site (upgradient) influences, and previous land uses at the site. Since groundwater movement through the various silty till soils will be relative slow, compared to a sandy soil, historical influences on the local groundwater quality from previous land uses on-site, and upgradient of the site, will be reflected in the groundwater quality that has been assessed, to date.

The chemical data collected between December 2011 and March 2013 will provide an initial baseline for future comparison of possible groundwater variances. The patterns listed above only provide an initial summary of early noticeable patterns at the specific sampling locations and do not indicate an adverse influence on the local shallow groundwater quality. It is noted that groundwater characteristics will vary between sampling events, and the short term trends listed above are not an indication or a prediction of the future trend for parameter concentrations at this site.

3.2.3 Water Quality Compliance/Regulatory Criteria

The groundwater quality data indicate that concentrations satisfy the Ontario Drinking Water Quality Standards, as part of Ontario Regulation 169/03. These Standards are associated with health related parameters and are not associated with aesthetic objectives or operational guidelines.

The groundwater quality data collected during the sampling events satisfy the drinking water Objectives and Guidelines for the tested parameters, with the exception of a slight exceedance for alkalinity during the June 2012 sampling event at monitor MW4. Although alkalinity is not specifically analysed for the routine monitoring program at this site, the concentration for bicarbonate, a constituent of alkalinity, was 506 mg/L, which slightly exceeds the operational guideline of 500 mg/L. Alkalinity is an operational guideline, as elevated concentrations may produce scale incrustations on utensils, service pipes, and water heaters. It is noted that the concentration for bicarbonate decreased to 346 mg/L during the subsequent November sampling event.

As shown in Figure B-2, sodium concentrations generally ranged between 8 mg/L and 36 mg/L at the groundwater monitoring locations, although sodium concentrations at monitor MW3A ranged between 43 mg/L and 50 mg/L. These sodium concentrations satisfy the aesthetic objective for drinking water of 200 mg/L. As indicated in the Technical Support Document for the Ontario Drinking Water Standards, Objectives, and Guidelines, although the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L, so that information can be communicated to local physicians for their use with patients on sodium restricted diets, the actual aesthetic object for sodium is 200 mg/L. Although the laboratory certificates of analysis include the sodium concentrations of 20 and 200 mg/L for comparison, as shown in Table B-4, Appendix B, these values are comparison guidelines and are not drinking water Standards. It is noted that there are no groundwater users downgradient of the Durham York Energy Centre.

The parameter concentrations exhibited at the on-site groundwater monitors are considered to be representative of natural water quality conditions, or are associated with upgradient land uses, in place prior to the construction activities, and are not attributed to the on-site activities.

3.2.4 Contingency Measures

In accordance with Condition 17 of the EA for the site, a Spills Action plan is being developed for the facility by Covanta, and will be completed prior to the receipt of waste. The Spills Action plan will outline the actions to be taken if on-site spills require groundwater sampling. The plan will also outline a program to ensure good coordinated communication between the Ministry, the Owners, and their consultants.

4. Conclusions and Recommendations

4.1 Conclusions

The following conclusions are based on the findings presented in this report.

- The local shallow groundwater flow is in a southwesterly direction, towards Lake Ontario.
- Shallow groundwater elevations within the southeast portion of the site have lowered due to the construction of the East Stormwater Management Pond, and the on-site shallow groundwater flow will continue to be influenced by the presence of the stormwater management pond, but the shallow groundwater flow remains in a southwesterly direction. This groundwater response was predicted in the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan, and the localized influence from the stormwater management ponds is not expected to have an adverse influence on the shallow groundwater flow patterns in areas surrounding the site.
- Groundwater quality at each monitoring location is influenced by various factors including the soil type that the monitor is screened in, and historical land uses at the site.
- Groundwater quality within the groundwater monitors satisfies the Ontario Drinking Water Quality Standards for the parameters analysed.
- The construction activities have not had an adverse influence on the shallow groundwater quality.

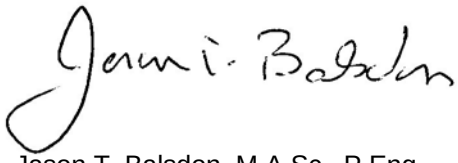
4.2 Recommendations

We respectfully submit the following recommendations based on the study findings for your consideration.

- Pursuant to the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan, the current groundwater monitoring program should be continued into 2013.
- Proposed Borehole Location MW5 should be installed within the central portion of the site once the construction activities have been completed, in accordance with the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan.

- No remedial measures, attributed to groundwater quality, are required at the present time.

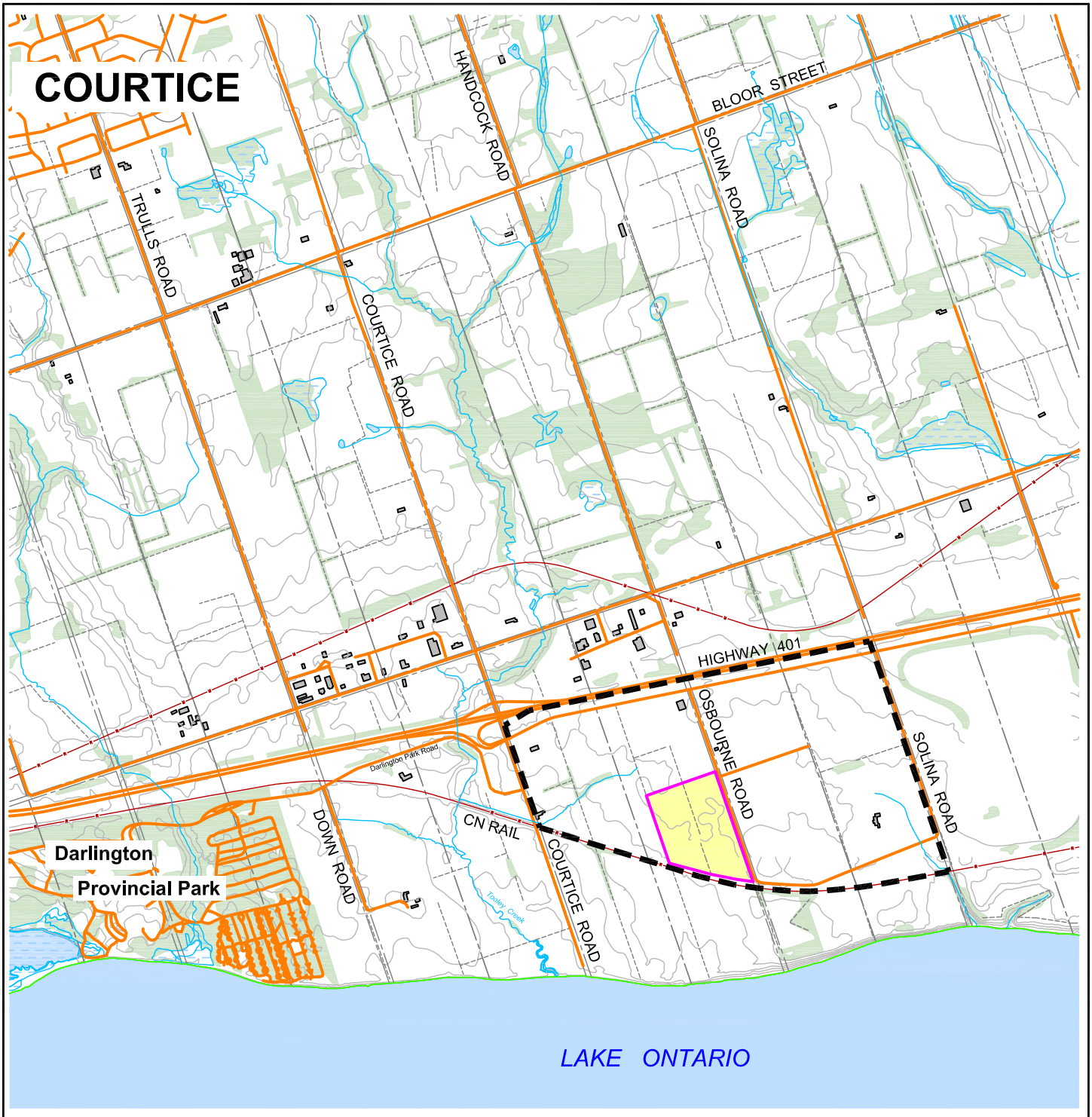
Report Respectfully Submitted
GENIVAR Inc.



Stephen J. Taziar, P.Eng.
Senior Project Engineer

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

Figures



LEGEND

DURHAM YORK ENERGY CENTRE

CLARINGTON ENERGY PARK

250 0 250 metres

MAP SOURCE:
OBM 1:10000 BASE MAPPING, NAD 84, ZONE 17 DATUM.

LOCATION MAP

2012 GROUNDWATER MONITORING PROGRAM
DURHAM YORK ENERGY CENTRE
For Regional Municipalities of Durham and York

DATE: APRIL 2013	SCALE: 1:25000
PROJECT: 111-26648-00 100	REF. NO.: 111-26648-00 100-3 F1_1-LM

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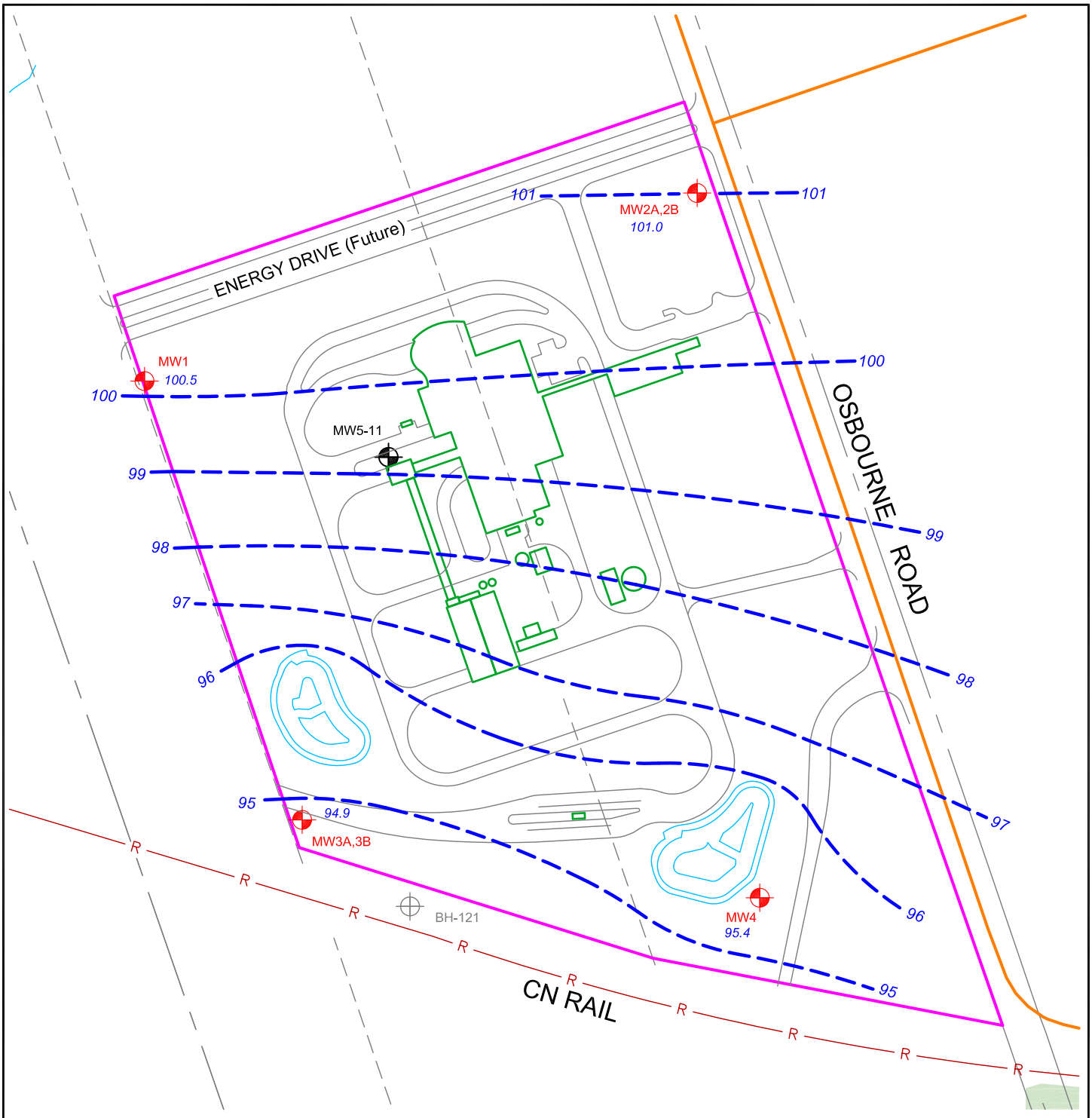
FIGURE 1-1



LEGEND

- DURHAM YORK ENERGY CENTRE
- MW4 (95.4) — GROUNDWATER MONITORING LOCATION, DESIGNATION AND SHALLOW WATER ELEVATION, NOV. 2012 (m assumed site datum)
- 95 — SHALLOW GROUND WATER CONTOURS (m assumed site datum)
- MW05-11 — PROPOSED GROUNDWATER MONITORING LOCATION AND DESIGNATION (UPON COMPLETION OF CONSTRUCTION)
- BH-121 — MONITOR ASSUMED DESTROYED

30 0 30 metres

MAP SOURCE: OBM 1:10000 BASE MAPPING, NAD 84, ZONE 17 DATUM.

SITE PLAN

2012 GROUNDWATER MONITORING PROGRAM
DURHAM YORK ENERGY CENTRE
For Regional Municipalities of Durham and York

DATE: APRIL 2013	SCALE: 1:3000
PROJECT: 111-26648-00 100	REF. NO.: 111-26648-00 100-3 F1_2-SP

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FIGURE 1-2

Appendices

Appendix A

Groundwater Regime

- Groundwater Monitor Details – Table A-1
- Groundwater Elevations – Table A-2
- Groundwater Hydrographs – Figures A-1 to A-4
- Borehole Logs – Item A-3
- Photos of Groundwater Monitor MW4 – Figures A5 and A6

TABLE A-1
GROUNDWATER MONITOR DETAILS
DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

MONITOR				T.O.P. ELEVATION (mSD)	GROUND ELEVATION (mSD)	SCREENED INTERVAL (mSD)	FILTER PACK (mSD)	BENTONITE SEAL (mSD)	SURFACE SEAL (mSD)
LOCATION	DESIGNATION	TYPE	DIAMETER (mm)						
MW1	1	S	51	102.32	101.29	95.19 - 93.67	95.50 - 93.67	101.29 - 95.50	
MW2	2B	S	51	103.08	102.01	97.46 - 95.94	97.77 - 95.94	102.01 - 97.77	
	2A	P	51	103.03	102.01	94.39 - 92.87	94.69 - 92.82	102.01 - 94.69	
MW3	3B	S	51	96.31	95.28	90.76 - 89.23	91.06 - 89.23	95.28 - 91.06	
	3A	P	51	96.22	95.17	87.63 - 86.10	87.93 - 86.10	93.95 - 87.93	95.17 - 93.95
MW4	4	S	51	98.27	97.17	95.25 - 93.72	95.55 - 93.72	97.17 - 95.55	

NOTES: 1) mSD - metres Site Datum
2) T.O.P. - Top Of Pipe - used as the measuring point for water levels.
3) P - Piezometer
S - Standpipe
3) Top of Pipe Elevation for Monitor 4A reflects elevation as of March 2013.

TABLE A-2
GROUNDWATER ELEVATIONS
DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

DATE	MW1	MW2A	MW2B	MW3A	MW3B	MW4
T.O.P. Elev. -->	102.32	103.03	103.08	96.22	96.31	98.27
28-Dec-11	100.62	100.18	99.98	* 89.20	94.50	97.17
14-Mar-12	100.58	100.53	100.75	94.34	94.51	97.18
21-Jun-12	99.76	100.06	100.22	94.26	94.11	96.51
05-Nov-12	100.47	100.24	101.00	94.56	94.91	95.39
22-Mar-13	100.50	100.22	100.79	94.50	94.59	95.44

NOTES: 1) All elevations are in mASD (metres above Site Datum).
2) T.O.P. - Top Of Pipe
3) * - Indicates water level elevation is not representative of groundwater characteristics and is excluded from interpretation.

FIGURE A-1
GROUND WATER HYDROGRAPH
UPGRADIENT MONITORS : Borehole 1

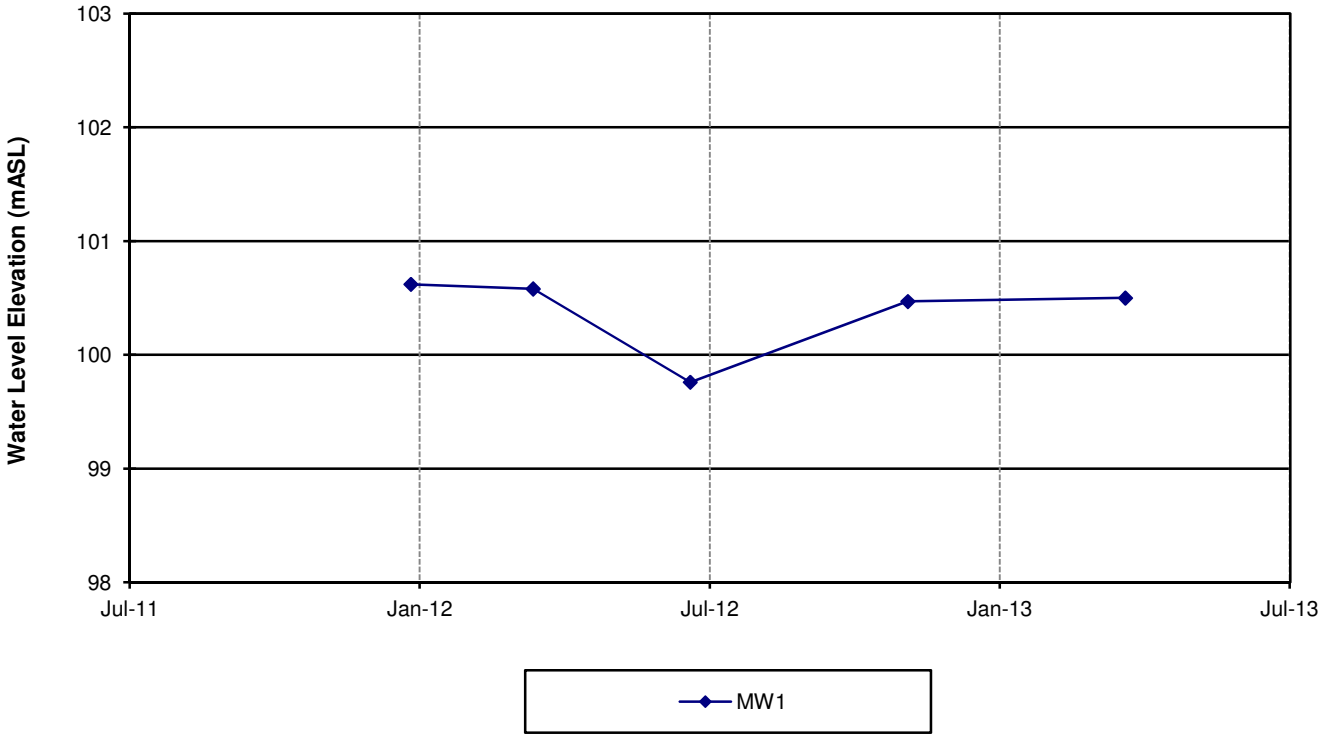


FIGURE A-2
GROUND WATER HYDROGRAPH
UPGRADIENT MONITORS : Borehole 2

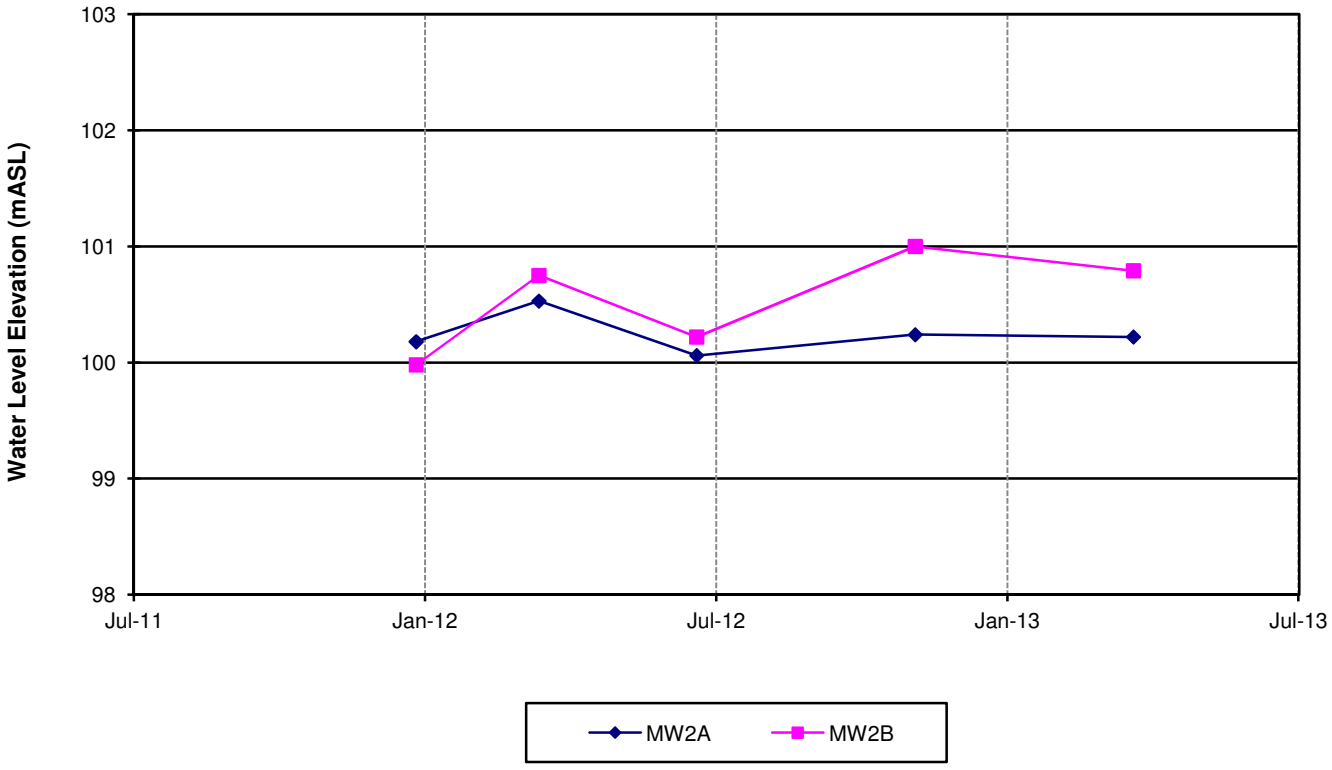


FIGURE A-3
GROUND WATER HYDROGRAPH
DOWNGRADIENT MONITORS : Borehole 3

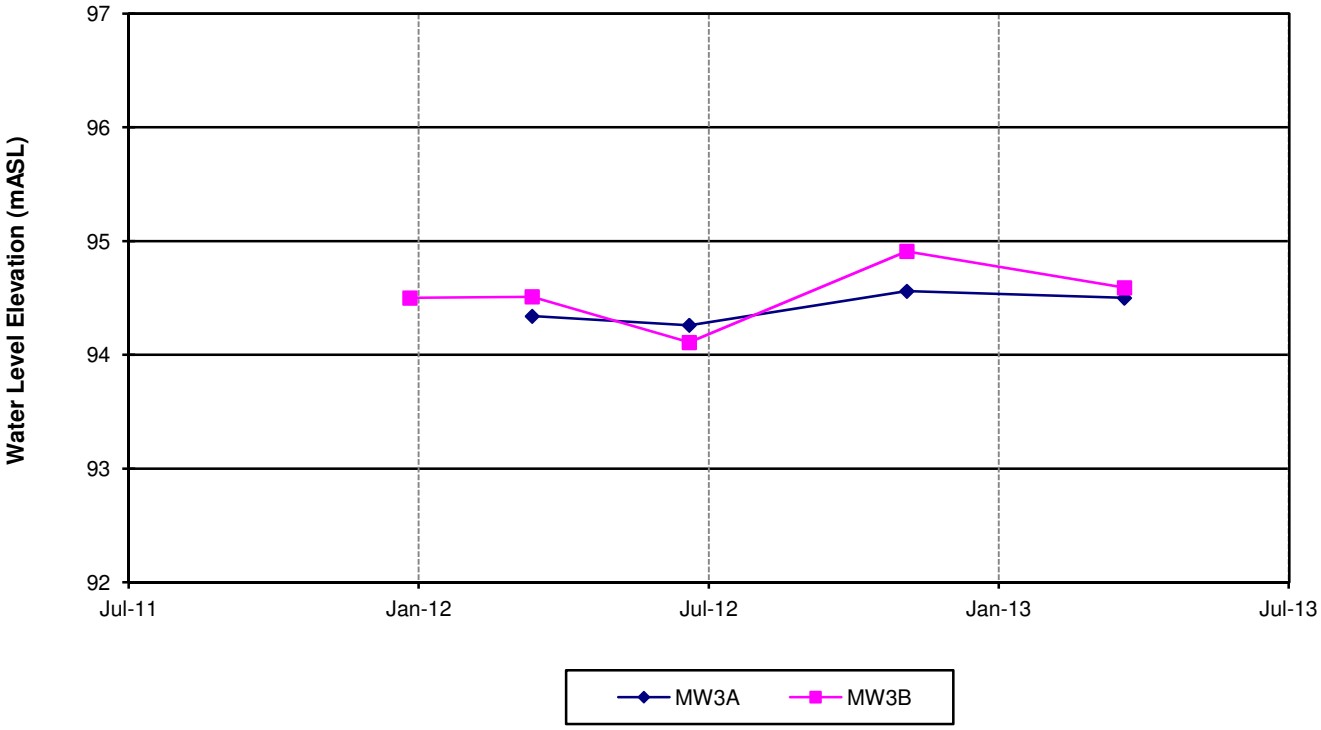
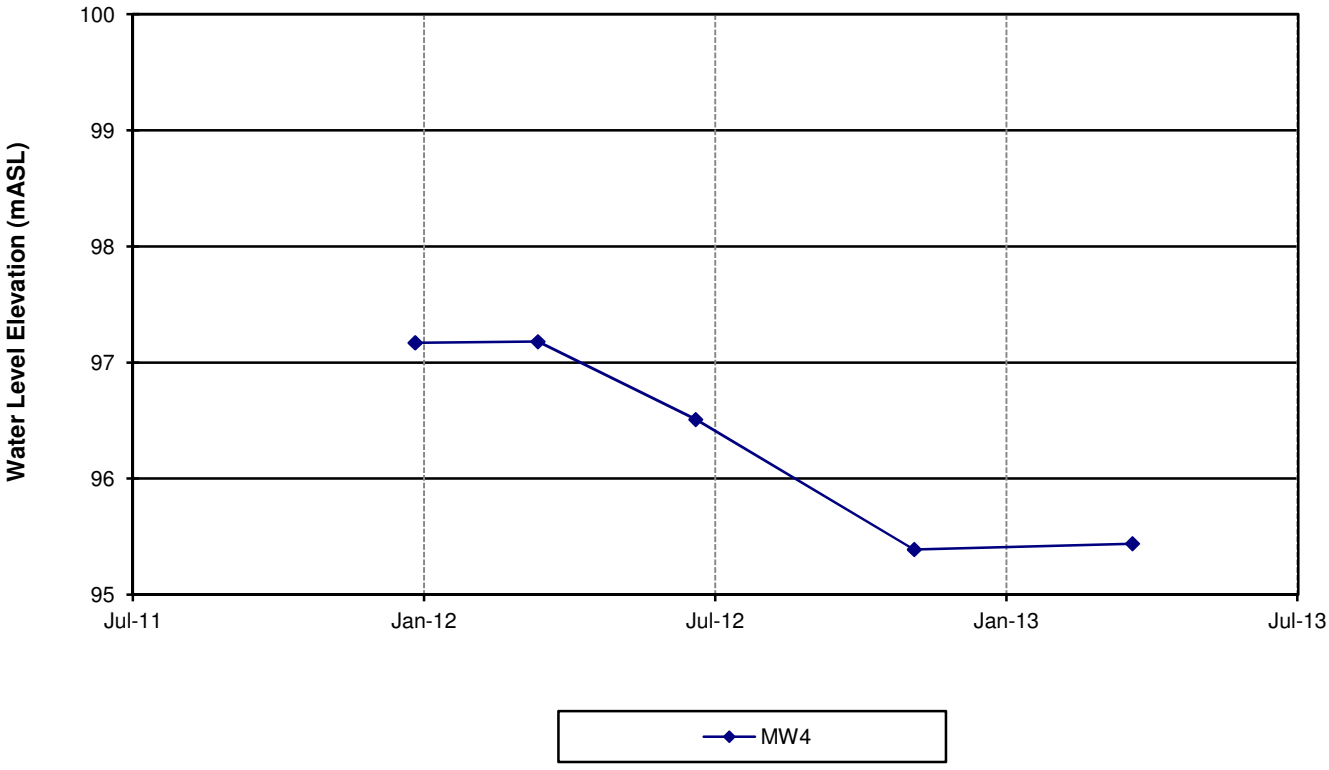


FIGURE A-4
GROUND WATER HYDROGRAPH
DOWNGRADIENT MONITORS : Borehole 4



Item A-3

Borehole Logs

BOREHOLE NO. MW1

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00

CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 20, 2011

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT

GROUND ELEVATION: 101.3 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680337
Northing: 4860451

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.3	TOPSOIL: BROWN TO DARK BROWN, SANDY SILT, LOOSE.			SS1	6		29				FROZEN TO 38 mm
	SANDY SILT TILL: LIGHT GREY BECOMING BROWNISH GREY AT 4.6 m, SANDY SILT, SOME MEDIUM TO COARSE GRAVEL, TRACE CLAY, TRACE FINE GRAVEL BETWEEN 4.6 m AND 4.9 m, MOIST, VERY DENSE.			SS2	24		100				
1.0				SS3	51		100		51		
2.0				SS4	84		100		84		
3.0				SS5	105		100		105		
4.0				SS6	99		100		99		
5.0				SS7	97		100		97		
5.3	SANDY SILT TILL: GREY, SANDY SILT, TRACE TO SOME CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS8	34		96				
6.0				SS9	25		92				
7.0				SS10	43		88		43		
8.0				SS11	21		83				
8.2	BOREHOLE TERMINATED AT 8.2 m IN SANDY SILT TILL.										
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

BOREHOLE NO. MW2A

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 20, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: 102.0 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680628
Northing: 4860550

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SILT, SOME CLAY, MOIST.										
	CLAYEY SILT: LIGHT GREY, TRACE FINE TO MEDIUM GRAVEL, DTPL TO APL, VERY STIFF.			SS1	6		50				
1.0				SS2	19		100				
2.0				SS3	22		100				
				SS4	17		100				
3.0											
3.0	SILT TILL: LIGHT GREY BECOMING GREY AT 3.8 m, CLAYEY SILT SOME FINE SAND TO SILT, SOME CLAY, SOME FINE SAND, SOME TO TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS5	17		100				
4.0				SS6	18		100				
				SS7	16		100				
5.0				SS8	13		100				
6.0				SS9	9		100				
6.9											
7.0	CLAYEY SILT: GREY, TRACE FINE TO MEDIUM GRAVEL, WTPL, STIFF.			SS10	12		100				
8.0				SS11	78		96		78		
8.4				SS12							REFUSAL OF SPOON AT 8.4 m
	SILT TILL: GREY, SOME FINE SAND, SOME CLAY, SOME MEDIUM TO COARSE GRAVEL, MOIST TO WET, DENSE.										
9.0				SS13	79		100		79		
9.2	BOREHOLE TERMINATED AT 9.2 m IN SILT TILL.										SS12 N VALUE: 29 FOR 150 mm, 50 FOR 50 mm
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

BOREHOLE NO. MW2B

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 21, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: 102.0 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680631
Northing: 4860550

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SILT, SOME CLAY, MOIST.										GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW2A.
	CLAYEY SILT: LIGHT GREY, TRACE FINE TO MEDIUM GRAVEL, DTPL TO APL, VERY STIFF.			SS1	6		50				
1.0				SS2	19		100				
2.0				SS3	22		100				
3.0				SS4	17		100				
3.0	SILT TILL: LIGHT GREY BECOMING GREY AT 3.8 m, CLAYEY SILT SOME FINE SAND TO SILT, SOME CLAY, SOME FINE SAND, SOME TO TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS5	17		100				
4.0				SS6	18		100				
5.0				SS7	16		100				
6.0				SS8	13		100				
6.1	BOREHOLE TERMINATED AT 6.1 m IN SILT TILL.										
7.0											
8.0											
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

BOREHOLE NO. MW3A

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 19, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: 95.2 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680420
Northing: 4860220

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	N VALUE	% WATER	% RECOVERY	RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SANDY SILT, TRACE CLAY, MOIST, LOOSE.			SS1	6		38				FROZEN TO 90 mm
	SANDY SILT TILL: LIGHT BROWN TO BROWN, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL, MOIST, COMPACT.			SS2	6		75				
1.0											
				SS3	33		92				
2.0											
2.1	SILTY SAND: LIGHT BROWN, TRACE CLAY, SATURATED, COMPACT.										
2.3	SANDY SILT TILL: BROWN BECOMING GREY AT 3.3 m, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, MOIST, LOOSE TO COMPACT.			SS4	43		88				
3.0											
3.3	CLAYEY SILT: GREY, SILTY CLAY TO CLAYEY SILT, TRACE TO SOME GRAVEL, WTPL, SOFT TO FIRM.			SS5	12		100				
4.0				SS6	13		100				
5.0				SS7	5		100				
5.3	SANDY SILT TILL: GREY, SILT AND SAND SOME CLAY, TO SANDY SILT, SOME GRAVEL, TRACE TO SOME CLAY, WET, LOOSE TO COMPACT.			SS8	10		96				
6.0				SS9	15		83				
7.0				SS10	8		54				
8.0				SS11	8		83				
				SS12	13		79				
9.0											
				SS13	13		75				
9.8	BOREHOLE TERMINATED AT 9.8 m IN SANDY SILT TILL.										
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

BOREHOLE NO. MW3B

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 19, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: 95.3 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680421
Northing: 4860220

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SANDY SILT, TRACE CLAY, MOIST, LOOSE.			SS1	6		38				GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW3A.
	SANDY SILT TILL: LIGHT BROWN TO BROWN, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL, MOIST, COMPACT.			SS2	6		75				
1.0											
				SS3	33		92				
2.0											
2.1	SILTY SAND: LIGHT BROWN, TRACE CLAY, SATURATED, COMPACT.										
2.3	SANDY SILT TILL: BROWN BECOMING GREY AT 3.3 m, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, MOIST, LOOSE TO COMPACT.			SS4	43		88		43		
3.0											
3.3	CLAYEY SILT: GREY, SILTY CLAY TO CLAYEY SILT, TRACE TO SOME GRAVEL, WTPL, SOFT TO FIRM.			SS5	12		100				
4.0				SS6	13		100				
5.0				SS7	5		100				
5.3	SANDY SILT TILL: GREY, SILT AND SAND SOME CLAY, TO SANDY SILT, SOME GRAVEL, TRACE TO SOME CLAY, WET, LOOSE TO COMPACT.			SS8	10		96				
6.0											
6.0	BOREHOLE TERMINATED AT 6.0 m IN SANDY SILT TILL.										
7.0											
8.0											
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

BOREHOLE NO. MW4

PROJECT NAME: DURHAM-YORK ENERGY CENTRE
PROJECT NO.: 111-26648-00
CLIENT: REGIONAL MUNICIPALITY OF DURHAM
DATE COMPLETED: Dec 21, 2011
BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER
SUPERVISOR: EWT
GROUND ELEVATION: 99.8 m (Assumed Datum)
REVIEWER: SJT

UTM CO-ORDINATES
UTM Zone: 17 NAD: 83
Easting: 680661
Northing: 4860179

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % RECOVERY	SAMPLE RQD (%)	CONE PENETRATION "N" VALUE / SHEAR STRENGTH	WATER CONTENT % (W_P – W_L)	REMARKS
0.0											
0.2	TOPSOIL: DARK BROWN, SANDY SILT, MOIST, LOOSE.										
	SILT AND SAND TILL: DARK BROWN, SANDY SILT TO SILT AND SAND, SOME GRAVEL, TRACE CLAY, MOIST, COMPACT.			SS1	26		38				
1.0				SS2	27		85				
1.5	SANDY SILT: DARK GREY TO LIGHT GREY, SOME TO TRACE CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS3	19		100				
2.0											
2.3	SANDY SILT TILL: GREY BECOMING DARK GREY AT 4.6 m, SOME GRAVEL, SOME TO TRACE CLAY, MOIST BECOMING MOIST TO WET AT 6.1 m, VERY DENSE.			SS4	69		100		69		
3.0				SS5	67		100		67		SS5 N VALUE: 67 FOR 150 mm
4.0				SS6	70		100		70		SS6 N VALUE: 70 FOR 150 mm
5.0				SS7	95		100		95		SS7 N VALUE: 45 FOR 150 mm, 50 FOR 25 mm
6.0				SS8	89		100		89		SS8 N VALUE: 39 FOR 150 mm, 50 FOR 125 mm
6.4	BOREHOLE TERMINATED AT 6.4 m IN SANDY SILT TILL.			SS9	105		100		105		SS9 N VALUE: 55 FOR 150 mm, 50 FOR 125 mm
7.0											
8.0											
9.0											
10.0											

GENIVAR GEOLOGIC B/W (M) WITH UTM 111-26648-00 100-3.GPJ JAGGER HIMS BASIC.GDT 4/30/13

GENIVAR

FIGURE A-5: Photo of Monitor MW4 and East Stormwater Management Pond during pond construction, and following height adjustment of Monitor MW4.

FIGURE A-6: Photo of Monitor MW4 following height adjustment.

Appendix B

Groundwater Chemistry

- Groundwater Field Chemical Results – Table B-1
- Groundwater Chemical Results – Table B-2
- Time Concentration Graphs – Figures B-1 to B-8
- Field Duplicate Samples RPD – Table B-3
- Laboratory Certificates of Analysis – Table B-4

TABLE B-1
GROUNDWATER FIELD CHEMICAL RESULTS
DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

MONITORING LOCATION	EVENT	Temperature (°C)	pH (as units)	Conductivity (µS/cm)	Turbidity (NTU)	ORP (mV)
MW1	Dec-11	8.2	7.0	800	>1000	-63
	Mar-12	9.8	8.2	705	>1000	-7
	Jun-12	17.7	7.9	692	>1000	-24
	Nov-12	10.0	7.1	667	>1000	35
	Mar-13	6.3	7.5	679	>1000	56
MW2A	Dec-11	7.7	8.0	506	>1000	-60
	Mar-12	10.1	8.2	462	>1000	1
	Jun-12	14.3	8.0	436	>1000	7
	Nov-12	9.8	7.7	414	>1000	22
	Mar-13	6.8	7.8	404	>1000	10
MW2B	Dec-11	6.7	8.0	628	>1000	-60
	Mar-12	9.6	8.2	648	>1000	-25
	Jun-12	13.5	7.7	643	819	-46
	Nov-12	10.1	7.5	590	>1000	29
	Mar-13	5.5	7.6	620	>1000	-39
MW3A	Dec-11	6.4	8.2	708	>1000	-37
	Mar-12	8.5	8.4	520	>1000	72
	Jun-12	11.3	7.9	455	>1000	-84
	Nov-12	9.8	7.4	407	>1000	-11
	Mar-13	7.9	7.6	465	465	39
MW3B	Dec-11	5.3	8.0	574	>1000	-40
	Mar-12	7.2	8.4	510	>1000	38
	Jun-12	10.9	7.7	473	926	-39
	Nov-12	10.1	7.3	464	>1000	26
	Mar-13	7.0	7.5	699	487	43
MW4	Dec-11	8.4	7.8	624	>1000	-39
	Mar-12	8.4	8.2	775	>1000	61
	Jun-12	14.1	7.8	889	851	-41
	Nov-12	11.8	7.4	721	684	-2
	Mar-13	3.1	7.6	670	463	-18

NOTE: ORP - Oxidation Reduction Potential

TABLE B-2
GROUNDWATER CHEMICAL RESULTS
DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

PARAMETER	UNIT	ODWQS [1]	MW1					MW2A					MW2B				
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Dec-11	Mar-12	Jun-12	Nov-12	Mar-13
Bicarbonate	mg/L		240	244	243	214	226	221	215	195	168	188	235	244	252	220	242
Carbonate	mg/L		<5	<5	<5	6	<5	<5	<5	<5	7	<5	<5	<5	<5	8	<5
Chloride	mg/L	250	14.9	15.0	13.5	15.3	14.8	4.7	3.2	1.8	4.0	1.9	13.5	11.7	11.8	12.6	14.2
Sulphate	mg/L	500	152	153	131	147	127	72.9	45.7	21.2	28.8	15.6	98.8	120	93.6	99.4	84.9
Calcium	mg/L		83.0	68.8	67.7	73.9	73.8	48.3	27.3	18.4	19.5	17.9	58.7	49.7	45.6	48.1	46.2
Magnesium	mg/L		46.2	44.4	45.5	50.1	53.2	32.0	31.3	32.2	35.5	37.5	34.8	42.3	44.2	49.5	54.5
Potassium	mg/L		2.99	2.99	3.10	3.55	3.28	2.31	2.20	1.62	1.80	1.75	1.09	1.67	1.81	2.20	2.23
Sodium	mg/L	200	10.3	8.3	8.1	8.5	10.2	23.5	16.8	14.6	17.3	17.6	29.1	24.0	20.7	20.4	21.9
Boron	mg/L	5 *	0.019	0.015	0.014	0.016	0.012	0.088	0.081	0.090	0.097	0.096	0.076	0.077	0.078	0.087	0.082
Cadmium	mg/L	0.005 *	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.002	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001
Lead	mg/L	0.01 *	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001 *	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

NOTES: 1) ODWQS - Ontario Drinking Water Quality Standards, Objectives, and Guidelines (2006).

2) * - Indicates health related drinking water standard.

TABLE B-2
GROUNDWATER CHEMICAL RESULTS
DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

PARAMETER	UNIT	ODWQS [1]	MW3A					MW3B					MW4				
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Dec-11	Mar-12	Jun-12	Nov-12	Mar-13
Bicarbonate	mg/L		181	153	147	130	124	247	212	211	186	213	300	430	506	346	330
Carbonate	mg/L		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	8	<5
Chloride	mg/L	250	22.7	24.6	24.4	26.3	25.1	10.8	10.2	10.7	12.5	15.6	12.3	14.5	7.1	12.0	8.2
Sulphate	mg/L	500	125	78.7	50.7	44.0	29.3	102	58.6	52.4	45.8	33.9	50.8	47.5	47.8	60.8	38.5
Calcium	mg/L		76.9	43.8	34.3	27.9	26.4	78.4	49.7	47.9	49.3	55.5	42.7	36.4	43.1	45.9	42.2
Magnesium	mg/L		11.5	9.92	9.13	8.95	8.76	22.4	19.9	20.2	21.7	26.4	51.5	72.8	88.2	68.2	68.8
Potassium	mg/L		1.79	1.79	1.33	1.86	1.25	2.00	1.42	1.55	1.99	1.59	4.39	2.45	2.70	6.08	2.81
Sodium	mg/L	200	47.5	45.3	43.0	46.0	49.6	35.5	25.5	25.7	26.2	26.4	22.0	25.5	28.0	23.1	23.7
Boron	mg/L	5 *	0.129	0.164	0.171	0.182	0.175	0.071	0.079	0.088	0.092	0.073	0.057	0.061	0.066	0.057	0.038
Cadmium	mg/L	0.005 *	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	0.001	<0.001
Lead	mg/L	0.01 *	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001 *	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

NOTES: 1) ODWQS - Ontario Drinking Water Quality Standards, Objectives, and Guidelines (2006).

2) * - Indicates health related drinking water standard.

TABLE B-3

FIELD DUPLICATE SAMPLES - Relative Percent Differences

DURHAM YORK ENERGY CENTRE - 2012 MONITORING PROGRAM

PARAMETER	UNITS	MW2A March 2012			MW1 June 2012			MW1 November 2012			MW2A March 2013		
		Original	Duplicate	RPD (%)	Original	Duplicate	RPD (%)	Original	Duplicate	RPD (%)	Original	Duplicate	RPD (%)
Bicarbonate (as CaCO3)	mg/L	215	204	**5**	243	246	**1**	214	209	**2**	188	190	**1**
Boron	mg/L	0.081	0.093	**14**	0.014	0.016	**13**	0.016	0.018	**12**	0.096	0.096	**0**
Cadmium	mg/L	<0.002	<0.002		<0.002	<0.002		<0.002	<0.002		<0.002	<0.002	
Calcium	mg/L	27.3	27.5	**1**	67.7	67	**1**	73.9	71.9	**3**	17.9	17.8	**1**
Carbonate (as CaCO3)	mg/L	<5	<5		<5	<5		6	5	**18**	<5	<5	
Chloride	mg/L	3.17	3.23	**2**	13.5	13.3	**1**	15.3	15.2	**1**	1.92	1.95	**2**
Cobalt	mg/L	<0.001	<0.001		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001	
Lead	mg/L	<0.002	<0.002		<0.002	<0.002		<0.002	<0.002		<0.002	<0.002	
Magnesium	mg/L	31.3	31.4	**0**	45.5	46	**1**	50.1	49.3	**2**	37.5	38.1	**2**
Mercury	mg/L	<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001	
Potassium	mg/L	2.2	2.23	**1**	3.1	3.03	**2**	3.55	3.38	**5**	1.75	1.64	**6**
Sodium	mg/L	16.8	17	**1**	8.09	7.94	**2**	8.46	8.33	**2**	17.6	18.1	**3**
Sulphate	mg/L	45.7	46	**1**	131	134	**2**	147	145	**1**	15.6	16.2	**4**

NOTES: 1) Blank indicates parameter not analysed.

2) RPD = Relative Percent Difference $\quad RPD = \frac{X1-X2}{Xavg} \times 100$

Table B-4

Laboratory Certificates of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 11T563079

PROJECT NO: 111-26648-00

CLIENT NAME: GENIVAR INC

ATTENTION TO: Eric Taylor

Durham - Groundwater - Group D Parameters

DATE SAMPLED: Dec 28, 2011 | **DATE RECEIVED: Dec 30, 2011** | **DATE REPORTED: Jan 06, 2012** | **SAMPLE TYPE: Water**

Parameter	Unit	G / S	RDL	MW1 3043392	MW2A 3043393	MW2B 3043399	MW3A 3043402	MW3B 3043405	MW4 3043411
Chloride	mg/L	(250)	0.10	14.9	4.72	13.5	22.7	10.8	12.3
Sulphate	mg/L	(500)	0.10	152	72.9	98.8	125	102	50.8
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5
Bicarbonate (as CaCO3)	mg/L		5	240	221	235	181	247	300
Calcium	mg/L		0.05	83.0	48.3	58.7	76.9	78.4	42.7
Magnesium	mg/L		0.05	46.2	32.0	34.8	11.5	22.4	51.5
Potassium	mg/L		0.05	2.99	2.31	1.09	1.79	2.00	4.39
Sodium	mg/L	20 (200)	0.05	10.3	23.5	29.1	47.5	35.5	22.0
Boron	mg/L	5	0.010	0.019	0.088	0.076	0.129	0.071	0.057
Cadmium	mg/L	0.005	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	0.002	0.001	0.001	0.001	<0.001	0.002
Lead	mg/L	0.01	0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002
Mercury	mg/L	0.001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O.Reg.169/03

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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Certificate of Analysis

AGAT WORK ORDER: 12T583046

PROJECT NO: 111-26648-00

CLIENT NAME: GENIVAR INC

ATTENTION TO: Eric Taylor

Groundwater 'D' Package

DATE SAMPLED: Mar 14, 2012 | **DATE RECEIVED: Mar 14, 2012** | **DATE REPORTED: Mar 23, 2012** | **SAMPLE TYPE: Water**

Parameter	Unit	G / S	RDL	MW1 3186542	MW2A 3186546	MW2B 3186549	MW3A 3186552	MW3B 3186557	MW4 3186563	Duplicate 3186776
Bicarbonate (as CaCO3)	mg/L		5	244	215	244	153	212	430	204
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	(250)	0.10	15.0	3.17	11.7	24.6	10.2	14.5	3.23
Sulphate	mg/L	(500)	0.10	153	45.7	120	78.7	58.6	47.5	46.0
Calcium	mg/L		0.05	68.8	27.3	49.7	43.8	49.7	36.4	27.5
Magnesium	mg/L		0.05	44.4	31.3	42.3	9.92	19.9	72.8	31.4
Sodium	mg/L	20 (200)	0.05	8.34	16.8	24.0	45.3	25.5	25.5	17.0
Potassium	mg/L		0.05	2.99	2.20	1.67	1.79	1.42	2.45	2.23
Boron	mg/L	5	0.010	0.015	0.081	0.077	0.164	0.079	0.061	0.093
Cadmium	mg/L	0.005	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.01	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O.Reg.169/03

Certified By: Elizabeth Rotakowska

AGAT Laboratories

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AGAT WORK ORDER: 12T612886

PROJECT NO: 111-26648-00

CLIENT NAME: GENIVAR INC

ATTENTION TO: Steve Taziar

Durham - Groundwater 'D' Parameters

DATE SAMPLED: Jun 21, 2012 | **DATE RECEIVED: Jun 22, 2012** | **DATE REPORTED: Jun 29, 2012** | **SAMPLE TYPE: Water**

Parameter	Unit	G / S	RDL	MW1 3449769	MW2A 3449812	MW2B 3449818	MW3A 3449824	MW3B 3449830	MW4 3449833	Duplicate 3449836
Bicarbonate (as CaCO3)	mg/L		5	243	195	252	147	211	506	246
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	(250)	0.10	13.5	1.81	11.8	24.4	10.7	7.11	13.3
Sulphate	mg/L	(500)	0.10	131	21.2	93.6	50.7	52.4	47.8	134
Calcium	mg/L		0.05	67.7	18.4	45.6	34.3	47.9	43.1	67.0
Magnesium	mg/L		0.05	45.5	32.2	44.2	9.13	20.2	88.2	46.0
Sodium	mg/L	20 (200)	0.05	8.09	14.6	20.7	43.0	25.7	28.0	7.94
Potassium	mg/L		0.05	3.10	1.62	1.81	1.33	1.55	2.70	3.03
Boron	mg/L	5	0.010	0.014	0.090	0.078	0.171	0.088	0.066	0.016
Cadmium	mg/L	0.005	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001
Lead	mg/L	0.01	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O.Reg.169/03

Certified By:

AGAT Laboratories

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AGAT WORK ORDER: 12T660268

PROJECT NO: 111-26648-00

CLIENT NAME: GENIVAR INC

ATTENTION TO: Steve Taziar

Durham - Groundwater - Group D Parameters

DATE RECEIVED: 2012-11-06

DATE REPORTED: 2012-11-14

		SAMPLE DESCRIPTION:		MW1	MW2A	MW2B	MW3A	MW3B	MW4	Duplicate
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		2012-11-05	2012-11-05	2012-11-05	2012-11-05	2012-11-05	2012-11-05	2012-11-05
Parameter	Unit	G / S	RDL	3895893	3895895	3895898	3895901	3895904	3895907	3895910
Chloride	mg/L	(250)	0.10	15.3	4.00	12.6	26.3	12.5	12.0	15.2
Sulphate	mg/L	(500)	0.10	147	28.8	99.4	44.0	45.8	60.8	145
Calcium	mg/L		0.05	73.9	19.5	48.1	27.9	49.3	45.9	71.9
Magnesium	mg/L		0.05	50.1	35.5	49.5	8.95	21.7	68.2	49.3
Sodium	mg/L	20 (200)	0.05	8.46	17.3	20.4	46.0	26.2	23.1	8.33
Potassium	mg/L		0.05	3.55	1.80	2.20	1.86	1.99	6.08	3.38
Boron	mg/L	5	0.010	0.016	0.097	0.087	0.182	0.092	0.057	0.018
Cadmium	mg/L	0.005	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
Lead	mg/L	0.01	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bicarbonate (as CaCO3)	mg/L		5	214	168	220	130	186	346	209
Carbonate (as CaCO3)	mg/L		5	6	7	8	<5	<5	8	5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O.Reg.169/03(mg/L)

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 13T699459

PROJECT NO: 111-26648-00

CLIENT NAME: GENIVAR INC

ATTENTION TO: Steve Taziar

GW-D Parameters

DATE RECEIVED: 2013-03-25

DATE REPORTED: 2013-04-02

		SAMPLE DESCRIPTION:		MW1	MW2A	MW2B	MW3A	MW3B	MW4	Duplicate
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:								
Parameter	Unit	G / S	RDL	4216197	4216198	4216201	4216204	4216208	4216211	4216214
Bicarbonate (as CaCO3)	mg/L		5	226	188	242	124	213	330	190
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	(250)	0.10	14.8	1.92	14.2	25.1	15.6	8.21	1.95
Sulphate	mg/L	(500)	0.10	127	15.6	84.9	29.3	33.9	38.5	16.2
Calcium	mg/L		0.05	73.8	17.9	46.2	26.4	55.5	42.2	17.8
Magnesium	mg/L		0.05	53.2	37.5	54.5	8.76	26.4	68.8	38.1
Sodium	mg/L	20 (200)	0.05	10.2	17.6	21.9	49.6	26.4	23.7	18.1
Potassium	mg/L		0.05	3.28	1.75	2.23	1.25	1.59	2.81	1.64
Boron	mg/L	5	0.010	0.012	0.096	0.082	0.175	0.073	0.038	0.096
Cadmium	mg/L	0.005	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.01	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mercury	mg/L	0.001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O.Reg.169/03(mg/L)

Date Sampled: March 22, 2013

Certified By:

Appendix C

MOE Checklist

Appendix D-Monitoring and Screening Checklist
General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.
Instructions: A complete checklist consists of:
(a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
(b) completed contact information for the Competent Environmental Practitioner (CEP)
(c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:
For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:
(a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
(b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..
Definition of Surface water CEP:
A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site Name	Durham York Energy Centre
Location (e.g. street address, lot, concession)	Osborne Road, south of South Service Road, southeast of Courtice Rd / Highway 401
GPS Location (taken within the property boundary at front gate/ front entry)	680660, 4860506, Zone 17, NAD 83
Municipality	Municipality of Clarington, in the Regional Municipality of Durham
Client and/or Site Owner	Regional Municipalities of Durham and York
Monitoring Period (Year)	2012
This Monitoring Report is being submitted under the following:	
Certificate of Approval No.:	7306-8FDKNX
Director's Order No.:	
Provincial Officer's Order No.:	
Other:	

Report Submission Frequency	◉ **Annual** ○ **Other**	
The site is:	◉ **Active** ○ **Inactive** ○ **Closed**	
If closed, specify C of A, control or authorizing document closure date:		N/A
Has the nature of the operations at the site changed during this monitoring period?	○ **Yes** ◉ **No**	
If yes, provide details:	Site is in the construction phase.	
Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i. e. exceeded the LEL for methane)	○ Yes ◉ No	

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:	◉ **Yes** ○ **No**	If no, list exceptions (Type Here):
2) All groundwater, leachate and WDS gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by Certificate(s) of Approval or other relevant authorizing/control document(s):	◉ **Yes** ○ **No** ○ **Not Applicable**	If no, list exceptions below or attach information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Some or all groundwater, leachate and WDS gas sampling and monitoring requirements have been established or defined outside of a ministry C of A, authorizing, or control document.	◯ **Yes** ◉ **No** ◯ **Not Applicable**	
b) If yes, the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:	◯ **Yes** ◯ **No** ◉ **Not Applicable**	If no, list exceptions below or attach additional information.

Groundwater Sampling Location	**Description/Explanation for change (change in name or location, additions, deletions)**	**Date**
		Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

4) All field work for groundwater investigations was done in accordance with standard operating procedures as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):	◉ **Yes** ◯ **No**	If no, specify (Type Here):

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.	◉ **Yes** ○ **No**		
6) The site meets compliance and assessment criteria.	◉ **Yes** ○ **No**		
7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.	◉ **Yes** ○ **No**	If no, list exceptions and explain reason for increase/change (Type Here):	
1) Is one or more of the following risk reduction practices in place at the site: ***(a)*** **There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/treatment; or** ***(b)*** **There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or** ***(c)*** **The site meets the following two conditions (typically achieved after 15 years or longer of site operation):** ***i.*** **The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and** ***ii.*** **Seasonal and annual water levels and water quality fluctuations are well understood.**	◉ **Yes** ○ **No**	**Note which practice(s):**	☐ **(a)** ☒ **(b)** ☐ **(c)**
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	○ **Yes** ◉ **No** ○ **Not Applicable**		

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.

I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories,* or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

30-Apr-2013

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

◉ **No changes to the monitoring program are recommended** ○ **The following change(s) to the monitoring program is/are recommended:**	
◉ **No Changes to site design and operation are recommended** ○ **The following change(s) to the site design and operation is/ are recommended:**	Type Here

Name:	Stephen J. Taziar, P.Eng		
Seal:	Add Image 		
Signature:		**Date:**	30-Apr-2013
CEP Contact Information:	Type Here		
Company:	GENIVAR Inc.		
Address:	1091 Gorham Street, Suite 301, Newmarket, ON L3Y 8X7		
Telephone No.:	(905) 853-3303 ext. 226	Fax No.:	(905) 853-1759
E-mail Address:	stephen.taziar@genivar.com		
Co-signers for additional expertise provided:			
Signature:		**Date:**	Select Date
Signature:		**Date:**	Select Date