

# DURHAM YORK ENERGY CENTRE

## 2014 GROUNDWATER MONITORING REPORT

**Regional Municipality of Durham**

Project No. 111-26648-00

April 2015

Distribution:

1 c Regional Municipality of Durham

1 c Regional Municipality of York

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April 27, 2015

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Regional Municipality of Durham  
Works Department  
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Whitby, Ontario  
L1N 6A3

**Subject:           Durham York Energy Centre  
                      2014 Groundwater Monitoring Report  
                      Project No. 111-26648-00-100-0414015**

Dear Mr. Anello:

We are pleased to forward the 2014 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 October 2014. 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. The monitoring program outlined in the Groundwater and Surface Water Monitoring Plan should be continued into 2015.

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

Yours truly,  
**WSP Canada Inc.**

A handwritten signature in blue ink, appearing to read "SJT", written over a faint blue grid.

Stephen J. Taziar, P.Eng.  
Senior Project 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 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. (now WSP Canada 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, Waste 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.  
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Assistant Site Coordinator: Dave Haldenby  
Email: [dhaldenby@CovantaEnergy.com](mailto:dhaldenby@CovantaEnergy.com)

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

The Certified Environmental Practitioners for the site include:

Groundwater –

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Golder Associates  
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### 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.

Annual meetings have been held with the Regional Director to review the monitoring program, as required by Condition 20.3 in the ECA Notice of Approval.

## 1.4 OBJECTIVE AND SCOPE

The principal objectives of the 2014 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 2015 monitoring program.

The 2014 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 WSP 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 2013, 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 2013. The height adjustment of the monitor will not have an influence on the monitoring objectives for this location.

Monitors MW3A and MW3B were decommissioned in September 2013 due to infrastructure construction activities in the local area. These monitors were replaced in March 2014 by monitors designated as MW3A-R and MW3B-R, which were screened at the same approximate depths as the original monitors at MW3. Two additional groundwater monitors, designated MW5A and MW5B, were also installed within the central portion of the property in March 2014. Monitors MW5A/5B were installed in accordance with the Durham York Energy Centre Groundwater and Surface Water Monitoring Plan, and will be included in future

groundwater sampling events. Monitors MW5A and MW5B were drilled to a depth of approximately 9 m and 6 m below grade, in accordance with the Monitoring Plan.

### 1.5.2 SLUG TESTS HYDRAULIC RESPONSE TESTING

Following the installation and development of the original 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:  $1.8 \times 10^{-7}$  m/s
- MW2A:  $9.0 \times 10^{-7}$  m/s
- MW2B:  $5.8 \times 10^{-8}$  m/s
- MW3A:  $1.6 \times 10^{-8}$  m/s
- MW3B:  $3.4 \times 10^{-7}$  m/s
- MW4:  $8.0 \times 10^{-7}$  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:

- April 9, 2014 (MW1, MW2A, MW2B, and MW4, only)
- June 18, 2014 (MW3A-R, MW3B-R, MW5A, and MW5B, only)
- Aug 11, 2014 (the six on-site groundwater monitors)
- October 29, 2014 ( the six on-site groundwater monitors)

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 2014 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 October 2014 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 2014. Water level elevations within Monitor MW4 since the November 2012 event are similar to, but slightly higher than, the base elevation of the East Stormwater Management Pond. Future reports will include a reference to water level elevations within the pond, once water levels have stabilized.

Currently, the permanent outfall pipes for the SWM ponds discharge directly to the new receiving swale, south of the site and north of the CNR tracks, and have been online since late April 2014. Prior to this, the SWM ponds were discharged primarily by controlled pumping after a run-off event, or gravity discharged during significant rainfall run-off events.

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.

As shown in Figure A-1, Appendix A, the groundwater elevations noticeably decreased at monitor MW1 during the November 2013 and April 2014 sampling events. The decrease in water level elevations is attributed to excavation activities to the west of the subject property for the installation of trunk sewer infrastructure. The approximate location and configuration of the trunk sewer is shown in Figure 1-2. Continued monitoring will further assess the influence of the underground services, at this location, over the long term.

Groundwater levels within monitoring nests MW2 and MW3, as shown in Figures A-2 and A-3, indicate that the slight 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 2014 as part of the QA/QC program. A summary of the results for the duplicate samples obtained during the April and October events is provided in Table B-3, Appendix B, along with the relative percent differences (RPD). It is considered that the results of samples for which the relative percent differences (RPD) are less than 20%, applied to parameter concentrations that are at least 5 times the Limit of Quantitation (LOQ), can generally be interpreted with confidence. As shown in the table, the RPD values were less than the 20% guideline for the duplicate samples. 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. Although water levels at Monitor MW1 have decreased during the past year, as outlined in Section 2,

this monitor remains suitable as a reference location since this monitor is not downgradient of the facility buildings. Continued monitoring will permit an assessment of the suitability for this monitor as a reference location in the future. Borehole Locations MW3, MW4 and MW5 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 and analytical equipment.

### 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 October 2014, although the following patterns are noted.

- Within the nested monitors at Borehole Location MW2, concentrations for chloride, sodium, sulphate, calcium, magnesium, potassium and bicarbonate are generally 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.
- Concentrations for chloride at monitor MW2B were relatively stable until the 2014 sampling events, which show an increasing trend. Given the close proximity to Osborne Road and the increased development in the area, the increased chloride concentrations are likely attributed to road salt effects. Continued monitoring will permit an assessment of the recent increases over the long term.
- Within the nested monitors at Borehole Location MW3, concentrations for chloride, sodium, and boron are higher within the deeper monitor, MW3A, compared to the shallow monitor MW3B; whereas calcium, magnesium, and bicarbonate concentrations were higher within the shallow monitor compared to the deeper monitor, at this location. Concentrations for the analysed parameters at the replacement monitors, MW3A-R and MW3B-R are generally similar to the values within the original locations, although chloride and sodium concentrations within monitor MW3A-R are slightly lower compared to the original monitor.
- 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 November 2014 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.

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 30 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 objective 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 Environmental Assessment Notice of Approval, a Spill Contingency and Emergency Response Plan has been developed for the site. The plan outlines the actions to be taken if on-site spills require groundwater sampling and established communications protocol 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.

- Shallow groundwater elevations within the northwest portion of the site have lowered due to the construction of the Courtice Trunk Sanitary Sewer, but the shallow groundwater flow remains in a southwesterly direction. The local influence from the sewer construction is not expected to have an adverse influence on the shallow groundwater flow patterns in the 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 2015.
- No remedial measures, attributed to groundwater quality, are required at the present time.

Report Respectfully Submitted  
**WSP Canada Inc.**

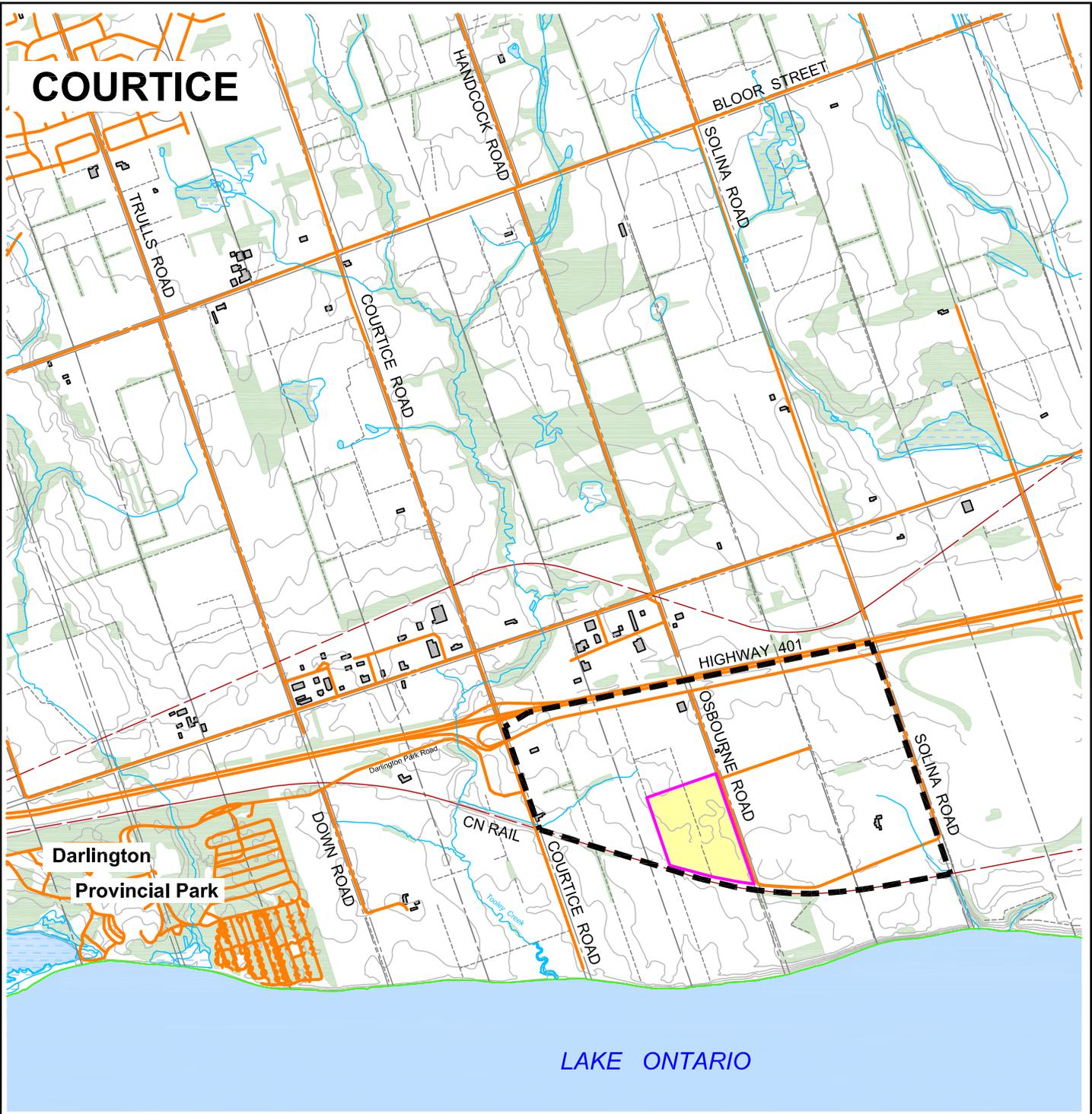


Jordan J. Healey, C.Tech.  
Environmental Technician



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

# Figures



LEGEND

-  DURHAM YORK ENERGY CENTRE
-  CLARINGTON ENERGY PARK



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

# LOCATION MAP

2014 GROUNDWATER MONITORING PROGRAM  
DURHAM YORK ENERGY CENTRE  
For Regional Municipalities of Durham and York

DATE: APRIL 2015

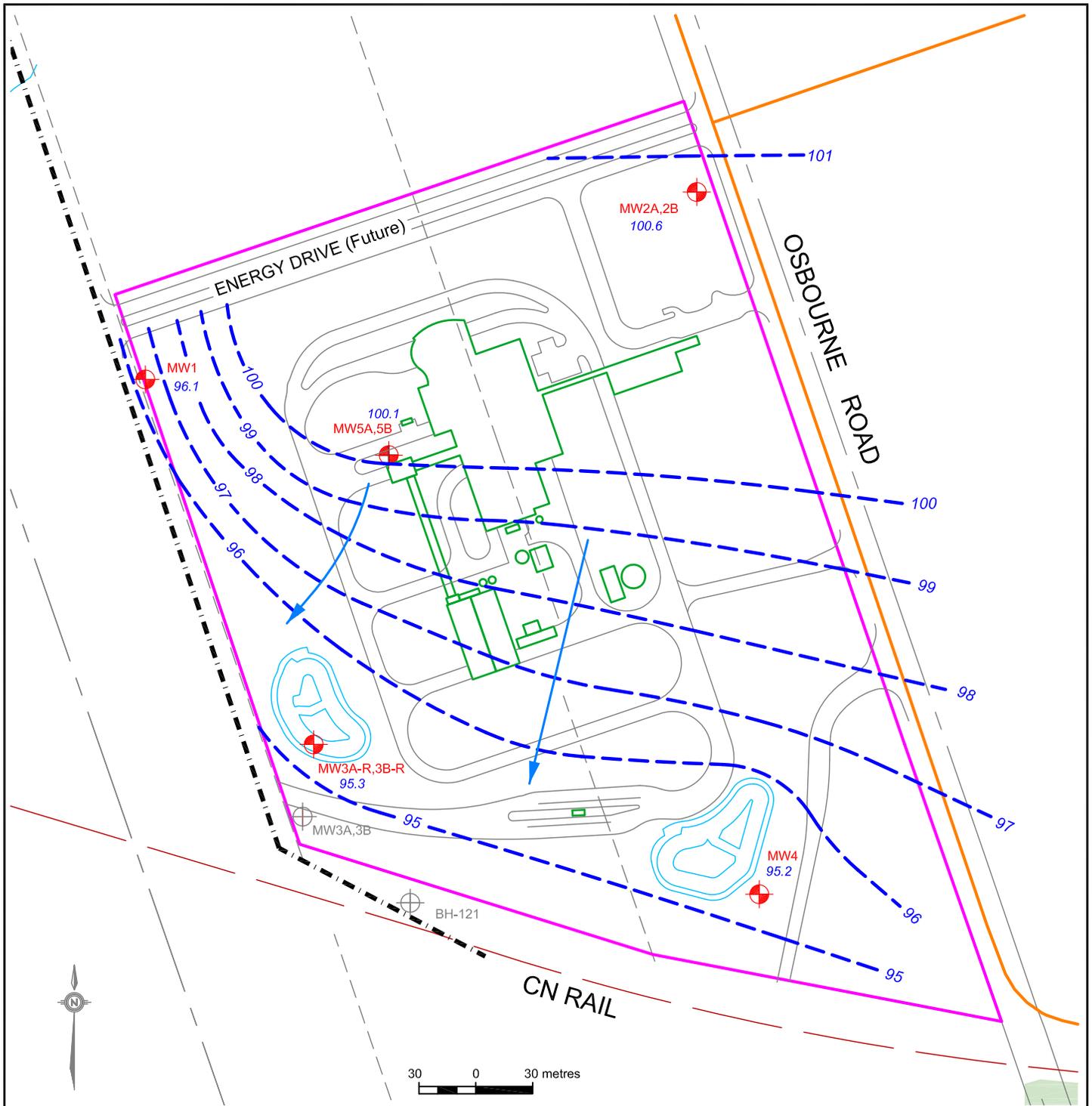
SCALE: 1:25000

PROJECT: 111-26648-00 100

REF. NO.: 111-26648-00 100-5 F1\_1-LM



FIGURE **1-1**



**LEGEND**

- DURHAM YORK ENERGY CENTRE
- MW4  
(96.1) GROUNDWATER MONITORING LOCATION, DESIGNATION AND SHALLOW WATER ELEVATION, OCTOBER 2014 (m assumed site datum)
- SHALLOW GROUND WATER CONTOURS (m assumed site datum)
- INTERPRETED GROUNDWATER FLOW DIRECTION
- BH-121 PREVIOUS GROUNDWATER MONITORING LOCATION AND DESIGNATION
- APPROXIMATE TRUNK SEWER LOCATION (PHASE 1, STAGE 2)

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

## SITE PLAN

2014 GROUNDWATER MONITORING PROGRAM  
 DURHAM YORK ENERGY CENTRE  
 For Regional Municipalities of Durham and York

DATE: APRIL 2015

SCALE: 1:3000

PROJECT: 111-26648-00 100

REF. NO.: 111-26648-00 100-5 F1\_2-SP



FIGURE **1-2**

# Appendices

# Appendix A

**GROUNDWATER REGIME**

**TABLE A-1  
GROUNDWATER MONITOR DETAILS  
DURHAM YORK ENERGY CENTRE - 2014 MONITORING PROGRAM**

MONITOR				T.O.P.	GROUND	SCREENED	FILTER	BENTONITE SEAL	SURFACE
LOCATION	DESIGNATION	TYPE	DIAMETER (mm)	ELEVATION (mSD)	ELEVATION (mSD)	INTERVAL (mSD)	PACK (mSD)	(mSD)	SEAL (mSD)
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
	3B-r	S	51	99.16	98.31	93.81 - 91.86	94.06 - 91.86	98.31 - 94.06	
	3A-r	P	51	99.11	98.36	90.74 - 89.22	91.35 - 89.22	98.36 - 91.35	
MW4	4	S	51	98.27	97.17	95.25 - 93.72	95.55 - 93.72	97.17 - 95.55	
MW5	5B	S	51	102.75	101.97	97.47 - 95.97	97.77 - 95.87	101.97 - 97.77	
	5A	P	51	102.79	101.96	94.81 - 93.36	95.16 - 93.36	101.96 - 95.16	

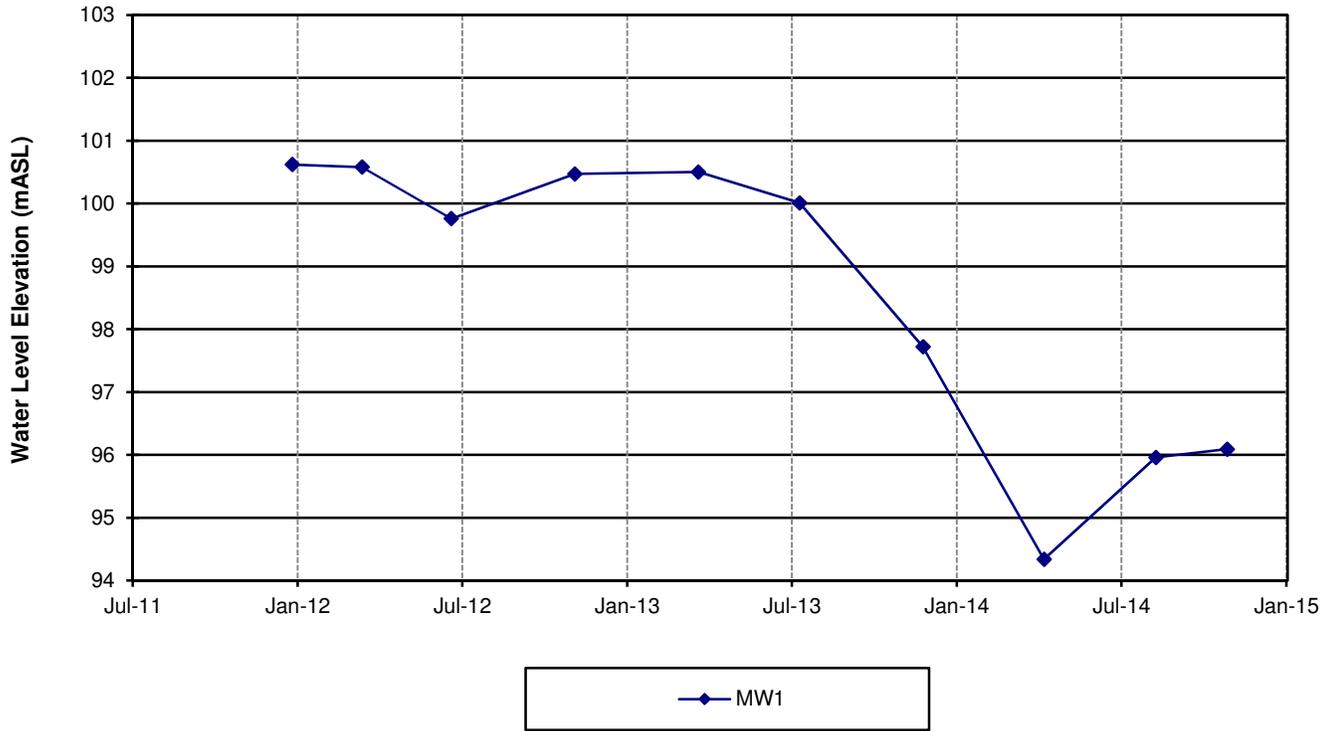
- NOTES: 1) mSD - metres Site Datum  
2) T.O.P. - Top Of Pipe - used as the measuring point for water levels.  
3) P - Piezometer  
S - Standpipe  
3) Top of Pipe Elevation for Monitor MW4 reflects elevation as of March 2013.

**TABLE A-2  
GROUNDWATER ELEVATIONS  
DURHAM YORK ENERGY CENTRE - 2014 MONITORING PROGRAM**

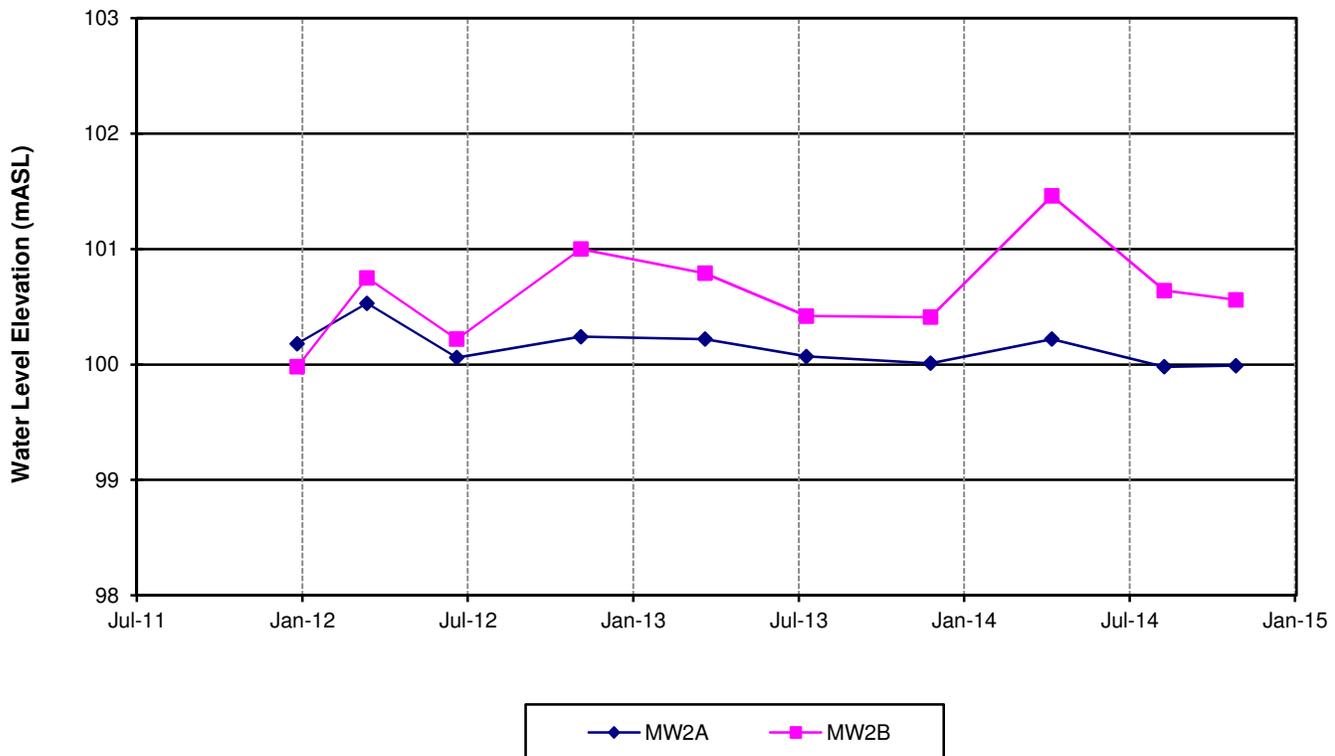
DATE	MW1	MW2A	MW2B	MW3A	MW3B	MW3A-R	MW3B-R	MW4	MW5A	MW5B
T.O.P. Elev. -->	102.32	103.03	103.08	96.22	96.31	99.16	99.11	98.27	102.75	102.79
28-Dec-11	100.62	100.18	99.98	* 89.20	94.50			97.17		
14-Mar-12	100.58	100.53	100.75	94.34	94.51			97.18		
21-Jun-12	99.76	100.06	100.22	94.26	94.11			96.51		
05-Nov-12	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		
12-Jul-13	100.01	100.07	100.42	94.94	94.14			95.32		
09-Sep-13				94.33	94.22					
26-Nov-13	97.72	100.01	100.41					95.30		
09-Apr-14	94.34	100.22	101.46			93.52	92.40	95.26	100.18	100.58
18-Jun-14						95.07	95.34		100.27	100.26
11-Aug-14	95.96	99.98	100.64			94.98	95.04	94.83	100.13	100.12
29-Oct-14	96.09	99.99	100.56			95.12	95.31	95.19	100.10	100.08

- 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.

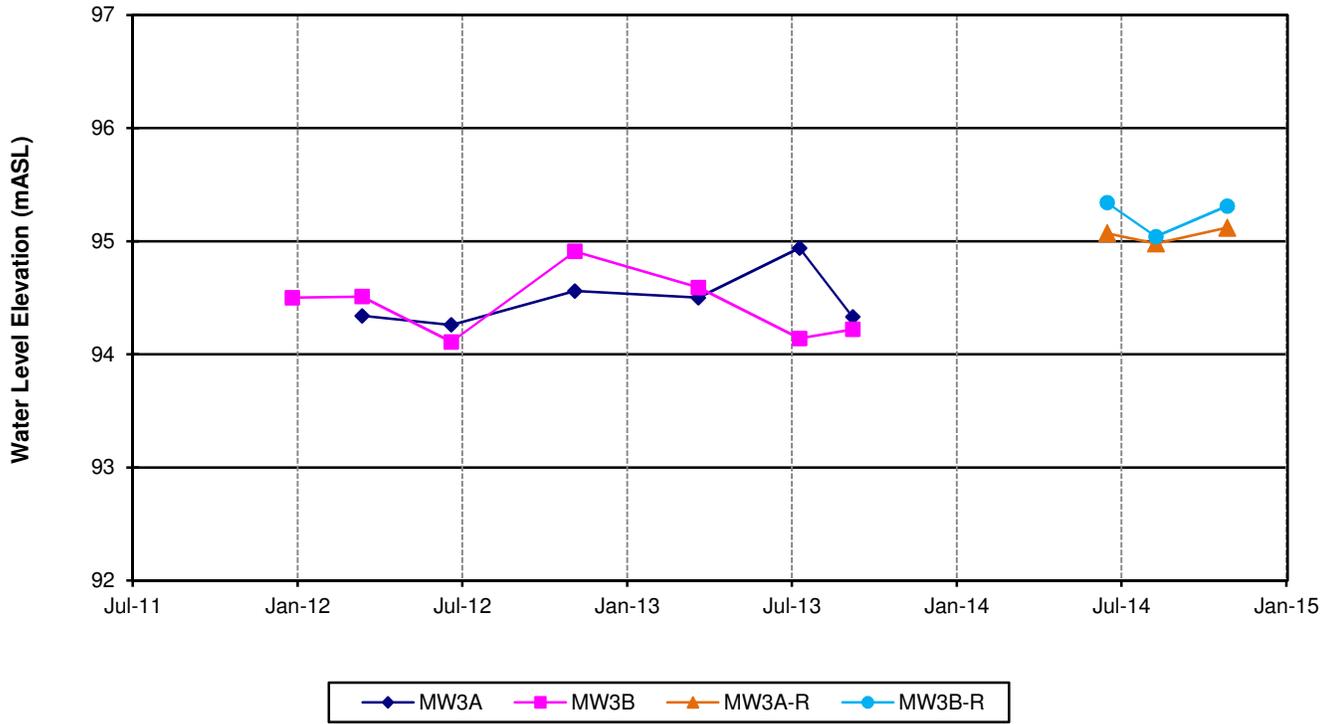
**FIGURE A-1**  
**GROUND WATER HYDROGRAPH**  
**UPGRADIENT MONITORS : Borehole 1**



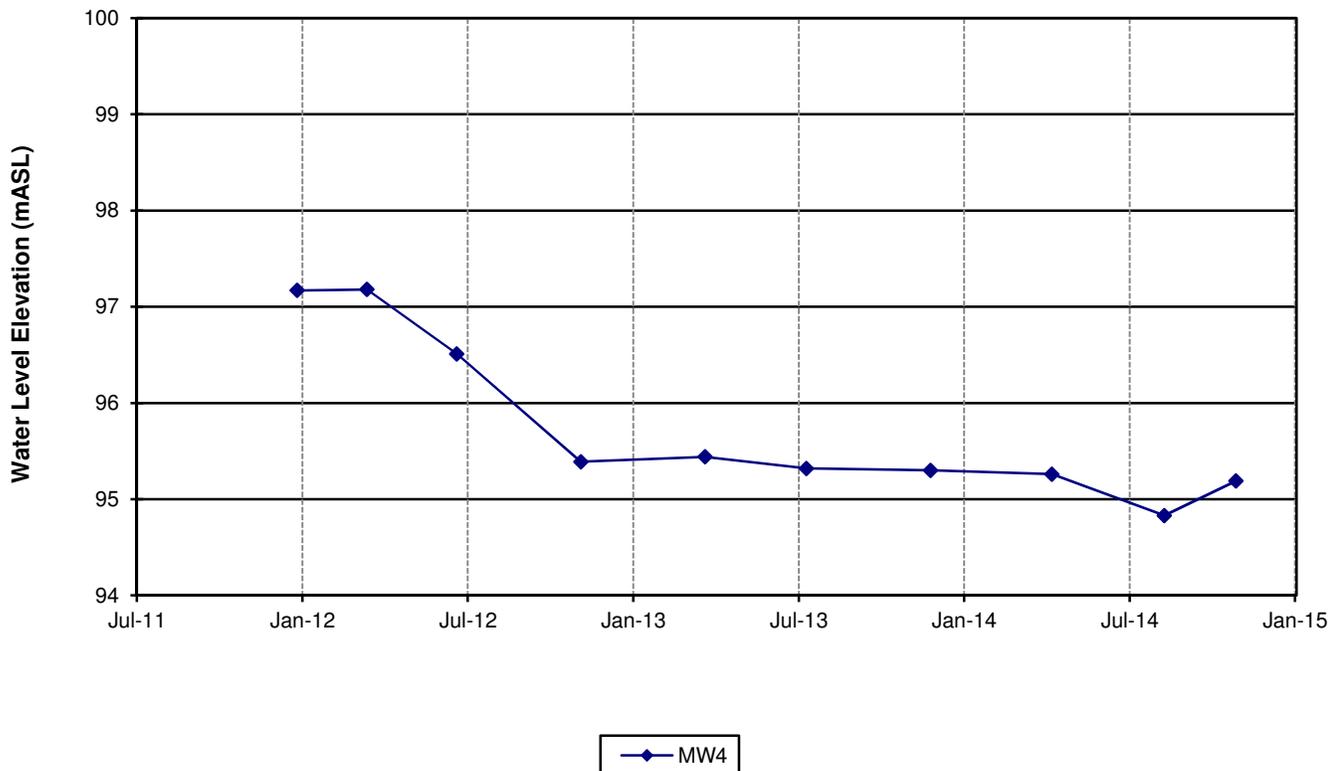
**FIGURE A-2**  
**GROUND WATER HYDROGRAPH**  
**UPGRADIENT MONITORS : Borehole 2**



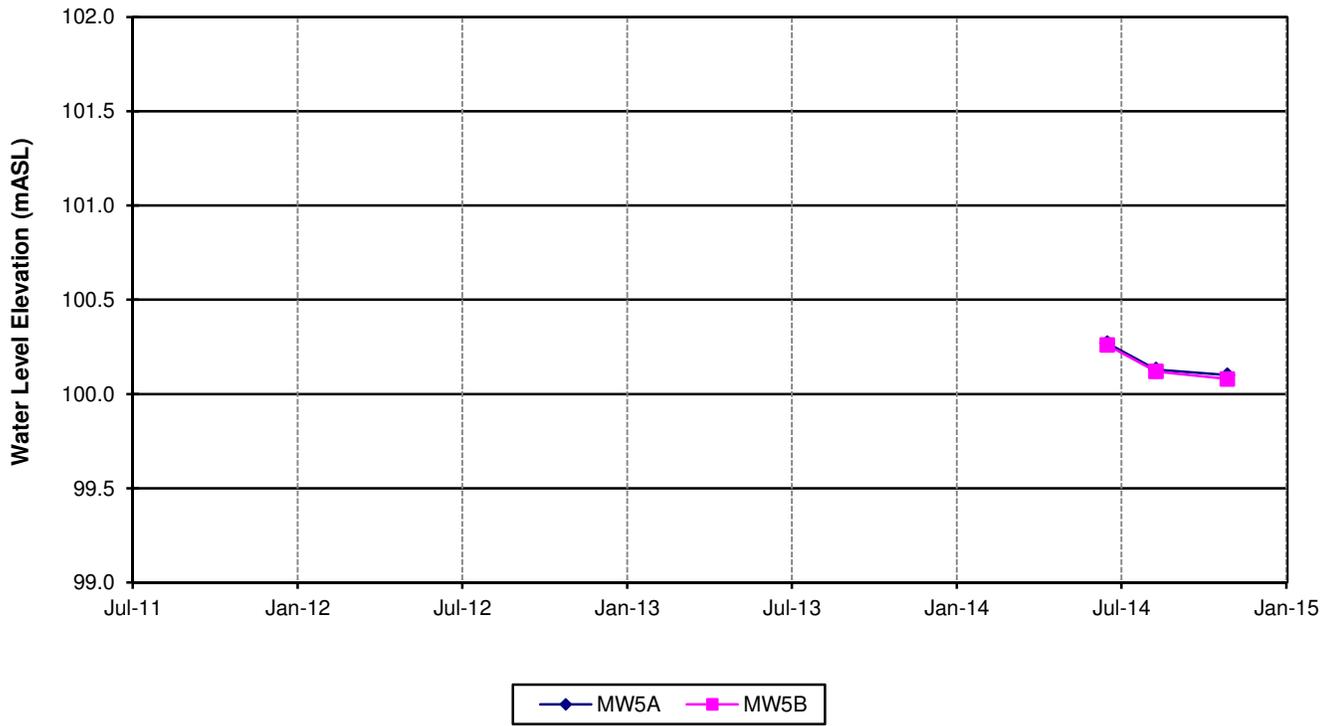
**FIGURE A-3**  
**GROUND WATER HYDROGRAPH**  
**DOWNGRADIENT MONITORS : Borehole 3**



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



**FIGURE A-5**  
**GROUND WATER HYDROGRAPH**  
**DOWNGRADIENT MONITORS : Borehole 5**



# BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

## DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

## STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

<u>Soil Classification*</u>	<u>Terminology</u>	<u>Proportion</u>
Clay <0.002 mm		
Silt 0.002 to 0.06 mm	"trace" (e.g. trace sand)	<10%
Sand 0.06 to 2 mm	"some" (e.g. some sand)	10% - 20%
Gravel 2 to 60 mm	adjective (e.g. sandy)	20% - 35%
Cobbles 60 to 200 mm	"and" (e.g. and sand)	35% - 50%
Boulders >200 mm	noun (e.g. sand)	>50%

\* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

<u>COHESIONLESS SOIL</u>		<u>COHESIVE SOIL</u>	
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m
Very Loose	0 to 4	Very Soft	0 to 2
Loose	4 to 10	Soft	2 to 4
Compact	10 to 30	Firm	4 to 8
Dense	30 to 50	Stiff	8 to 15
Very Dense	Over 50	Very Stiff	15 to 30
		Hard	Over 30

The moisture conditions of cohesionless and cohesive soils are defined as follows.

<u>COHESIONLESS SOILS</u>		<u>COHESIVE SOILS</u>	
Dry		DTPL	- Drier Than Plastic Limit
Moist		APL	- About Plastic Limit
Wet		WTPL	- Wetter Than Plastic Limit
Saturated		MWTPL	- Much Wetter Than Plastic Limit

## STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

## MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.

	Standpipe		Geotextile Material / Liner		Granular Backfill
	Piezometer		Borehole Seal (Bentonite Grout)		Granular (Filter) Pack
	Screened Interval		Cement Seal		Native Soil Backfill / Cave / Slough
	Borehole Seal (Peltonite, Bentonite or Hole Plug)				

Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

## SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS = Split Spoon	GS = Grab Sample
ST = Thin Walled Shelby Tube	CS = Channel Sample
AS = Auger Flight Sample	WS = Wash Sample
CC = Continuous Core	RC = Rock Core

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

<u>RQD Classification</u>	<u>RQD (%)</u>
Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

## **TEST DATA**

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60° steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as  $\frac{xBlows}{mm}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W<sub>p</sub> - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W<sub>L</sub> - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

## **REMARKS**

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

# 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

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
0.0	TOPSOIL: BROWN TO DARK BROWN, SANDY SILT, LOOSE.													
0.3	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.			SS1	6		29							FROZEN TO 38 mm
1.0				SS2	24		100							
2.0				SS3	51		100			51				
3.0				SS4	84		100			84				
4.0				SS5	105		100			105				
5.0				SS6	99		100			99				
5.3	SANDY SILT TILL: GREY, SANDY SILT, TRACE TO SOME CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.			SS7	97		100			97				
6.0				SS8	34		96							
7.0				SS9	25		92							
8.0				SS10	43		88			43				
8.2	BOREHOLE TERMINATED AT 8.2 m IN SANDY SILT TILL.			SS11	21		83							

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



# 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: EWI

GROUND ELEVATION: 102.0 m (Assumed Datum)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
								SHEAR STRENGTH		W <sub>p</sub> W <sub>L</sub>				
0.0														
0.2	<p><b>TOPSOIL:</b> DARK BROWN, SILT, SOME CLAY, MOIST.</p> <p><b>CLAYEY SILT:</b> LIGHT GREY, TRACE FINE TO MEDIUM GRAVEL, DTPL TO APL, VERY STIFF.</p>	[Hatched Pattern]	[Hatched Pattern]	SS1	6		50						<p><b>UTM CO-ORDINATES</b> UTM Zone: 17 NAD: 83 Easting: 680631 Northing: 4860550</p> <p>GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW2A.</p>	
1.0				SS2	19		100							
2.0				SS3	22		100							
3.0				SS4	17		100							
3.0	<p><b>SILT TILL:</b> 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.</p>	[Dotted Pattern]	[Dotted Pattern]	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



# 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: EWI

GROUND ELEVATION: 95.3 m (Assumed Datum)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
0.0														
0.2	<p><b>TOPSOIL:</b> DARK BROWN, SANDY SILT, TRACE CLAY, MOIST, LOOSE.</p> <p><b>SANDY SILT TILL:</b> LIGHT BROWN TO BROWN, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, TRACE TO SOME GRAVEL, MOIST, COMPACT.</p>			SS1	6		38							<p>UTM CO-ORDINATES UTM Zone: 17 NAD: 83 Easting: 680421 Northing: 4860220</p> <p>GEOLOGIC DETAILS AND N VALUES ARE FROM BOREHOLE MW3A.</p>
1.0			SS2	6		75								
2.0			SS3	33		92								
2.1	<p><b>SILTY SAND:</b> LIGHT BROWN, TRACE CLAY, SATURATED, COMPACT.</p>													
2.3	<p><b>SANDY SILT TILL:</b> BROWN BECOMING GREY AT 3.3 m, FINE SAND AND SILT, SOME CLAY, TO SANDY SILT, SOME CLAY, MOIST, LOOSE TO COMPACT.</p>			SS4	43		88							
3.0														
3.3	<p><b>CLAYEY SILT:</b> GREY, SILTY CLAY TO CLAYEY SILT, TRACE TO SOME GRAVEL, WTPL, SOFT TO FIRM.</p>			SS5	12		100							
4.0														
5.0														
5.3	<p><b>SANDY SILT TILL:</b> GREY, SILT AND SAND SOME CLAY, TO SANDY SILT, SOME GRAVEL, TRACE TO SOME CLAY, WET, LOOSE TO COMPACT.</p>			SS6	13		100							
6.0	BOREHOLE TERMINATED AT 6.0 m IN SANDY SILT TILL.			SS7	5		100							
7.0														
8.0														
9.0														
10.0														

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

# 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: EWI

GROUND ELEVATION: 99.8 m (Assumed Datum)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
					SHEAR STRENGTH		W <sub>p</sub>		W <sub>L</sub>					
0.0														
0.2	<p><b>TOPSOIL:</b> DARK BROWN, SANDY SILT, MOIST, LOOSE.</p> <p><b>SILT AND SAND TILL:</b> DARK BROWN, SANDY SILT TO SILT AND SAND, SOME GRAVEL, TRACE CLAY, MOIST, COMPACT.</p>			SS1	26		38							
1.0				SS2	27		85							
1.5	<p><b>SANDY SILT:</b> DARK GREY TO LIGHT GREY, SOME TO TRACE CLAY, TRACE FINE TO MEDIUM GRAVEL, MOIST, COMPACT.</p>			SS3	19		100							
2.3	<p><b>SANDY SILT TILL:</b> 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.</p>			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



# BOREHOLE NO. MW3A-r

PROJECT NAME: DURHAM-YORK ENERGY CENTRE

PROJECT NO.: 111-26648-00 100

CLIENT: REGIONAL MUNICIPALITY OF DURHAM

DATE COMPLETED: Mar 21, 2014

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER

SUPERVISOR: EWT

GROUND ELEVATION: 98.3 m (Relative to Local Benchmark)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
0.0	FILL: GREYISH BROWN, SANDY SILT, TRACE GRAVEL, ORGANICS, MOIST.			SS1	28		38							
0.6	CLAYEY SILT: GREYISH BROWN, BECOMING LIGHT GREY AT 2.9 m, TRACE GRAVEL, DTPL BECOMING APL AT 1.4 m, STIFF TO VERY STIFF, BECOMING HARD AT 2.9 m.			SS2	20		44							
1.0				SS3	12		92							
2.0				SS4	42		71							
3.0				SS5	50		63							
3.8	SANDY SILT: LIGHT GREY, TRACE FINE TO COARSE GRAVEL, MOIST, VERY DENSE.			SS6	82		60							
4.0				SS7	67		63							
4.4	CLAYEY SILT: LIGHT GREY, TRACE GRAVEL, TRACE COBBLES, DTPL, HARD BECOMING STIFF AT 7.2 m.			SS8	53		67							
5.0				SS9	35		50							
6.0				SS10	12		38							
7.0				SS11	13		40							
8.0				SS12	7		81							
8.8	BOREHOLE TERMINATED AT 8.8 m IN CLAYEY SILT.													
9.0														
10.0														

WSP GEOLOGIC (METRIC) WITH UTM 111-26648-00 100-5 LOGS.GPJ WSP\_ENV\_V1.GDT 4/27/15

**UTM CO-ORDINATES**  
 UTM Zone: 17 NAD: 83  
 Easting: 680418  
 Northing: 4860247



# BOREHOLE NO. MW3B-r

PROJECT NAME: DURHAM-YORK ENERGY CENTRE

PROJECT NO.: 111-26648-00 100

CLIENT: REGIONAL MUNICIPALITY OF DURHAM

DATE COMPLETED: Mar 21, 2014

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER

SUPERVISOR: EWT

GROUND ELEVATION: 98.4 m (Relative to Local Benchmark)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		UTM CO-ORDINATES UTM Zone: 17 NAD: 83 Easting: 680418 Northing: 4860248	REMARKS			
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %					
									10	20	30	10			20	30	
0.0	FILL: GREYISH BROWN, SANDY SILT, TRACE GRAVEL, ORGANICS, MOIST.			SS1	28		38										
0.6	CLAYEY SILT: GREYISH BROWN, BECOMING LIGHT GREY AT 2.9 m, TRACE GRAVEL, DTPL BECOMING APL AT 1.4 m, STIFF TO VERY STIFF, BECOMING HARD AT 2.9 m.			SS2	20		44										
1.0				SS3	12		92										
2.0				SS4	42		71										
3.0				SS5	50		63										
3.8				SS6	82		60										
4.0	SANDY SILT: LIGHT GREY, TRACE FINE TO COARSE GRAVEL, MOIST, VERY DENSE.			SS7	67		63										
4.4	CLAYEY SILT: LIGHT GREY, TRACE GRAVEL, TRACE COBBLES, DTPL, HARD.			SS8	53		67										
5.0				SS9	35		50										
6.0																	
6.7	BOREHOLE TERMINATED AT 6.7 m IN CLAYEY SILT.																
7.0																	
8.0																	
9.0																	
10.0																	

WSP GEOLOGIC (METRIC) WITH UTM 111-26648-00 100-5 LOGS.GPJ WSP\_ENV\_V1.GDT 4/27/15



# BOREHOLE NO. MW5A

PROJECT NAME: DURHAM-YORK ENERGY CENTRE

PROJECT NO.: 111-26648-00 100

CLIENT: REGIONAL MUNICIPALITY OF DURHAM

DATE COMPLETED: Mar 22, 2014

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER

SUPERVISOR: EWT

GROUND ELEVATION: 102.0 m (Relative to Local Benchmark)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
0.0	FILL: GREY, CLAYEY SILT, TRACE SAND, STIFF, MOIST.													
0.6	CLAYEY SILT: DARK GREY, TRACE GRAVEL, DTPL, VERY STIFF BECOMING HARD AT 1.4 m.			SS1	31		73							
1.0				SS2	25		96							
2.0				SS3	81		77			81				
				SS4	94		25			94				
2.9	SILTY SAND: BROWNISH GREY, TRACE MEDIUM TO COARSE GRAVEL, TRACE COBBLES, DENSE TO VERY DENSE.			SS5	30		17							
4.0				SS6	105		67			105				
4.4	CLAYEY SILT: GREY, SOME TO TRACE GRAVEL, TRACE COBBLES AT 5.9 m, WTPL TO APL.			SS7	88		46			88				
5.0				SS8	95		42			95				
6.0				SS9	127		50			127				
7.0				SS10	77		31			77				
8.0				SS11	58		27			67				
9.0	BOREHOLE TERMINATED AT 9.0 m IN CLAYEY SILT.			SS12			0							
10.0														

WSP GEOLOGIC (METRIC) WITH UTM 111-26648-00 100-5 LOGS.GPJ WSP\_ENV\_V1.GDT 4/27/15

**UTM CO-ORDINATES**  
 UTM Zone: 17 NAD: 83  
 Easting: 680474  
 Northing: 4860412



# BOREHOLE NO. MW5B

PROJECT NAME: DURHAM-YORK ENERGY CENTRE

PROJECT NO.: 111-26648-00 100

CLIENT: REGIONAL MUNICIPALITY OF DURHAM

DATE COMPLETED: Mar 22, 2014

BOREHOLE TYPE: 168 mm HOLLOW STEM AUGER

SUPERVISOR: EWT

GROUND ELEVATION: 102.0 m (Relative to Local Benchmark)

REVIEWER: SJT

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE					CONE PENETRATION		WATER CONTENT %		REMARKS	
				TYPE	N VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			WATER CONTENT %		
									10	20	30	10		20
0.0	FILL: GREY, CLAYEY SILT, TRACE SAND, STIFF, MOIST.													
0.6	CLAYEY SILT: DARK GREY, TRACE GRAVEL, DTPL, VERY STIFF BECOMING HARD AT 1.4 m.			SS1	31		73							
1.0				SS2	25		96							
2.0				SS3	81		77			81				
				SS4	94		25			94				
2.9	SILTY SAND: BROWNISH GREY, TRACE MEDIUM TO COARSE GRAVEL, TRACE COBBLES, DENSE TO VERY DENSE.			SS5	30		17							
4.0				SS6	105		67			105				
4.4	CLAYEY SILT: GREY, SOME TO TRACE GRAVEL, TRACE COBBLES AT 5.9 m, WTPL TO APL.			SS7	88		46			88				
5.0				SS8	95		42			95				
6.0														
6.4	BOREHOLE TERMINATED AT 6.4 m IN CLAYEY SILT.													
7.0														
8.0														
9.0														
10.0														

WSP GEOLOGIC (METRIC) WITH UTM 111-26648-00 100-5 LOGS.GPJ WSP\_ENV\_V1.GDT 4/27/15

**UTM CO-ORDINATES**  
 UTM Zone: 17 NAD: 83  
 Easting: 680470  
 Northing: 4860403

# Appendix B

GROUNDWATER CHEMISTRY

**TABLE B-1  
GROUNDWATER FIELD CHEMICAL RESULTS  
DURHAM YORK ENERGY CENTRE - 2014 MONITORING PROGRAM**

<b>MONITORING LOCATION</b>	<b>EVENT</b>	<b>Temperature (°C)</b>	<b>pH (as units)</b>	<b>Conductivity (µS/cm)</b>	<b>Turbidity (NTU)</b>	<b>ORP (mV)</b>
<b>MW1</b>	Apr-14	8.3	6.7	782	>1000	
	Aug-14	12.2	7.8	704	>1000	131
	Oct-14	11.1	7.2	749	>1000	-118
<b>MW2A</b>	Apr-14	8.5	6.8	413	>1000	
	Aug-14	13.7	8.4	408	530	-90
	Oct-14	10.9	7.3	438	>1000	120
<b>MW2B</b>	Apr-14	7.5	6.5	626	540	
	Aug-14	12.4	8.0	658	293	-108
	Oct-14	11.6	7.1	755	764	122
<b>MW3A-R</b>	Jun-14	10.6	8.2	317	491	
	Aug-14	13.7	8.4	288	583	113
	Oct-14	11.7	7.7	323	687	84
<b>MW3B-R</b>	Jun-14	10.5	7.9	580	206	
	Aug-14	13.2	8.0	548	237	-113
	Oct-14	12.6	7.5	582	504	91
<b>MW4</b>	Apr-14	5.1	7.3	578	208	
	Aug-14	16.2	7.9	625	190	-15
	Oct-14	13.0	7.5	634	>1000	-70
<b>MW5A</b>	Jun-14	10.1	8.1	404	836	
	Aug-14	12.3	8.3	372	177	118
	Oct-14	10.7	7.4	52	>1000	100
<b>MW5B</b>	Jun-14	9.5	8.1	598	383	
	Aug-14	14.3	8.2	584	904	-115
	Oct-14	11.9	7.3	626	>1000	114

NOTES: 1) ORP - Oxidation Reduction Potential  
2) Blank indicates measurement not obtained

**TABLE B-2  
GROUNDWATER CHEMICAL RESULTS  
DURHAM YORK ENERGY CENTRE - 2014 MONITORING PROGRAM**

PARAMETER	UNIT	ODWQS <sup>1</sup>	MW1									
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Nov-13	Apr-14	Aug-14	Oct-14
Bicarbonate	mg/L		240	244	243	214	226	228	241	223	262	244
Carbonate	mg/L		<5	<5	<5	6	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	14.9	15.0	13.5	15.3	14.8	14.6	13.4	13.5	15.0	15.3
Sulphate	mg/L	500	152	153	131	147	127	129	132	227	151	150
Calcium	mg/L		83.0	68.8	67.7	73.9	73.8	65.3	65.5	90.7	70.4	69.1
Magnesium	mg/L		46.2	44.4	45.5	50.1	53.2	46.0	43.6	62.2	50.1	47.8
Potassium	mg/L		2.99	2.99	3.10	3.55	3.28	2.71	2.98	4.32	3.80	3.74
Sodium	mg/L	200	10.3	8.3	8.1	8.5	10.2	8.6	10.0	9.6	13.4	13.0
Boron	mg/L	5 *	0.019	0.015	0.014	0.016	0.012	0.023	0.015	0.014	0.012	0.015
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
Cobalt	mg/L		0.002	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
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

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 - 2014 MONITORING PROGRAM**

PARAMETER	UNIT	ODWQS <sup>1</sup>	MW2A									
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Nov-13	Apr-14	Aug-14	Oct-14
Bicarbonate	mg/L		221	215	195	168	188	190	206	185	180	188
Carbonate	mg/L		<5	<5	<5	7	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	4.7	3.2	1.8	4.0	1.9	2.7	2.5	3.3	4.5	4.5
Sulphate	mg/L	500	72.9	45.7	21.2	28.8	15.6	18.9	21.8	25.1	27.5	26.3
Calcium	mg/L		48.3	27.3	18.4	19.5	17.9	15.4	16.5	15.8	16.6	15.1
Magnesium	mg/L		32.0	31.3	32.2	35.5	37.5	32.3	30.6	33.6	30.0	30.6
Potassium	mg/L		2.31	2.20	1.62	1.80	1.75	1.34	1.51	1.52	1.42	1.30
Sodium	mg/L	200	23.5	16.8	14.6	17.3	17.6	15.2	18.7	24.7	25.9	25.2
Boron	mg/L	5 *	0.088	0.081	0.090	0.097	0.096	0.106	0.104	0.106	0.108	0.117
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
Cobalt	mg/L		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
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

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 - 2014 MONITORING PROGRAM**

PARAMETER	UNIT	ODWQS <sup>1</sup>	MW2B									
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Nov-13	Apr-14	Aug-14	Oct-14
Bicarbonate	mg/L		235	244	252	220	242	241	248	224	236	238
Carbonate	mg/L		<5	<5	<5	8	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	13.5	11.7	11.8	12.6	14.2	15.2	14.3	22.6	45.4	59.9
Sulphate	mg/L	500	98.8	120	93.6	99.4	84.9	82.2	77.3	84.0	78.1	80.2
Calcium	mg/L		58.7	49.7	45.6	48.1	46.2	40.8	39.4	43.6	44.7	45.8
Magnesium	mg/L		34.8	42.3	44.2	49.5	54.5	46.8	44.2	52.2	52.3	53.2
Potassium	mg/L		1.09	1.67	1.81	2.20	2.23	1.82	2.03	2.02	2.04	2.00
Sodium	mg/L	200	29.1	24.0	20.7	20.4	21.9	18.5	19.3	22.5	22.5	24.5
Boron	mg/L	5 *	0.076	0.077	0.078	0.087	0.082	0.086	0.083	0.076	0.077	0.080
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
Cobalt	mg/L		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
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

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 - 2014 MONITORING PROGRAM**

PARAMETER	UNIT	ODWQS <sup>1</sup>	MW3A							MW3A-R		
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Sep-13	Jun-14	Aug-14	Oct-14
Bicarbonate	mg/L		181	153	147	130	124	121	151	134	120	123
Carbonate	mg/L		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	22.7	24.6	24.4	26.3	25.1	23.8	26.2	7.5	6.5	6.2
Sulphate	mg/L	500	125	78.7	50.7	44.0	29.3	23.0	20.3	27.4	20.7	21.4
Calcium	mg/L		76.9	43.8	34.3	27.9	26.4	22.5	24.4	22.0	19.4	16.0
Magnesium	mg/L		11.5	9.92	9.13	8.95	8.76	6.68	6.91	9.27	8.73	8.74
Potassium	mg/L		1.79	1.79	1.33	1.86	1.25	1.09	2.94	2.34	2.09	1.41
Sodium	mg/L	200	47.5	45.3	43.0	46.0	49.6	40.8	44.7	35.1	35.7	34.5
Boron	mg/L	5 *	0.129	0.164	0.171	0.182	0.175	0.172	0.169	0.132	0.139	0.155
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
Cobalt	mg/L		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 *	0.003	<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

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 - 2014 MONITORING PROGRAM**

PARAMETER	UNIT	ODWQS <sup>1</sup>	MW3B							MW3B-R		
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Sep-13	Jun-14	Aug-14	Oct-14
Bicarbonate	mg/L		247	212	211	186	213	202	235	198	209	203
Carbonate	mg/L		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	10.8	10.2	10.7	12.5	15.6	13.9	18.8	15.4	12.3	10.7
Sulphate	mg/L	500	102	58.6	52.4	45.8	33.9	39.9	43.4	103.0	88.7	85.7
Calcium	mg/L		78.4	49.7	47.9	49.3	55.5	46.8	61.4	58.3	46.8	47.7
Magnesium	mg/L		22.4	19.9	20.2	21.7	26.4	21.2	25.1	31.4	29.2	29.3
Potassium	mg/L		2.00	1.42	1.55	1.99	1.59	1.38	2.39	5.92	4.62	4.04
Sodium	mg/L	200	35.5	25.5	25.7	26.2	26.4	24.1	27.1	25.1	23.8	23.9
Boron	mg/L	5 *	0.071	0.079	0.088	0.092	0.073	0.095	0.082	0.118	0.095	0.115
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
Cobalt	mg/L		<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
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

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 - 2014 MONITORING PROGRAM**

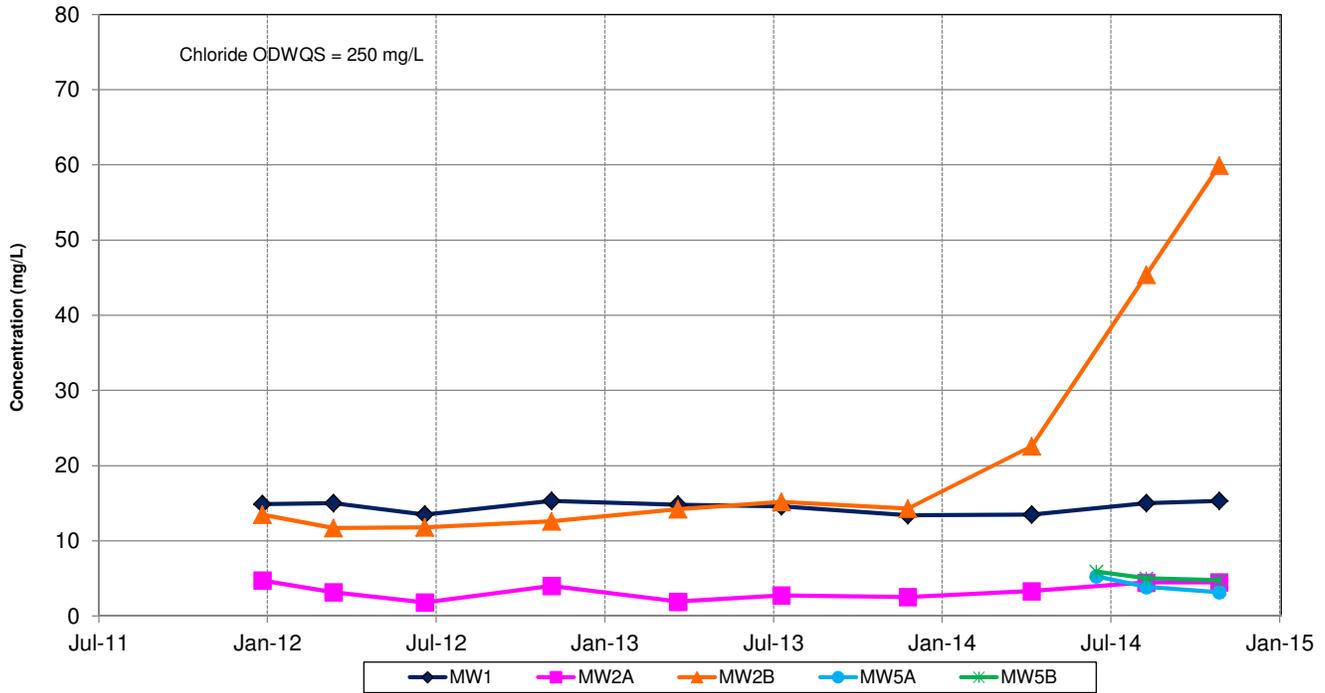
PARAMETER	UNIT	ODWQS <sup>1</sup>	MW4									MW5A			MW5B			
			Dec-11	Mar-12	Jun-12	Nov-12	Mar-13	Jul-13	Nov-13	Apr-14	Aug-14	Oct-14	Jun-14	Aug-14	Oct-14	Jun-14	Aug-14	Oct-14
Bicarbonate	mg/L		300	430	506	346	330	448	496	301	353	300	207	199	183	240	247	234
Carbonate	mg/L		<5	<5	<5	8	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	250	12.3	14.5	7.1	12.0	8.2	7.5	6.8	8.6	8.5	12.2	5.3	3.9	3.2	5.9	5.0	4.8
Sulphate	mg/L	500	50.8	47.5	47.8	60.8	38.5	62.6	62.6	23.8	31.8	32.1	16.9	11.0	5.6	96.4	91.4	95.9
Calcium	mg/L		42.7	36.4	43.1	45.9	42.2	44.7	39.0	29.0	31.9	31.3	25.2	19.4	17.4	41.2	34.4	36.2
Magnesium	mg/L		51.5	72.8	88.2	68.2	68.8	83.6	83.9	54.9	62.0	53.8	34.9	31.7	31.0	56.7	52.3	52.6
Potassium	mg/L		4.39	2.45	2.70	6.08	2.81	3.55	3.61	2.30	2.73	2.63	3.83	2.89	2.82	4.37	3.76	3.51
Sodium	mg/L	200	22.0	25.5	28.0	23.1	23.7	28.6	35.8	22.2	25.5	22.0	12.2	11.2	11.4	10.2	10.1	10.2
Boron	mg/L	5 *	0.057	0.061	0.066	0.057	0.038	0.064	0.066	0.040	0.051	0.051	0.054	0.045	0.049	0.045	0.048	0.053
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	<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	<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	<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	<0.0001

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

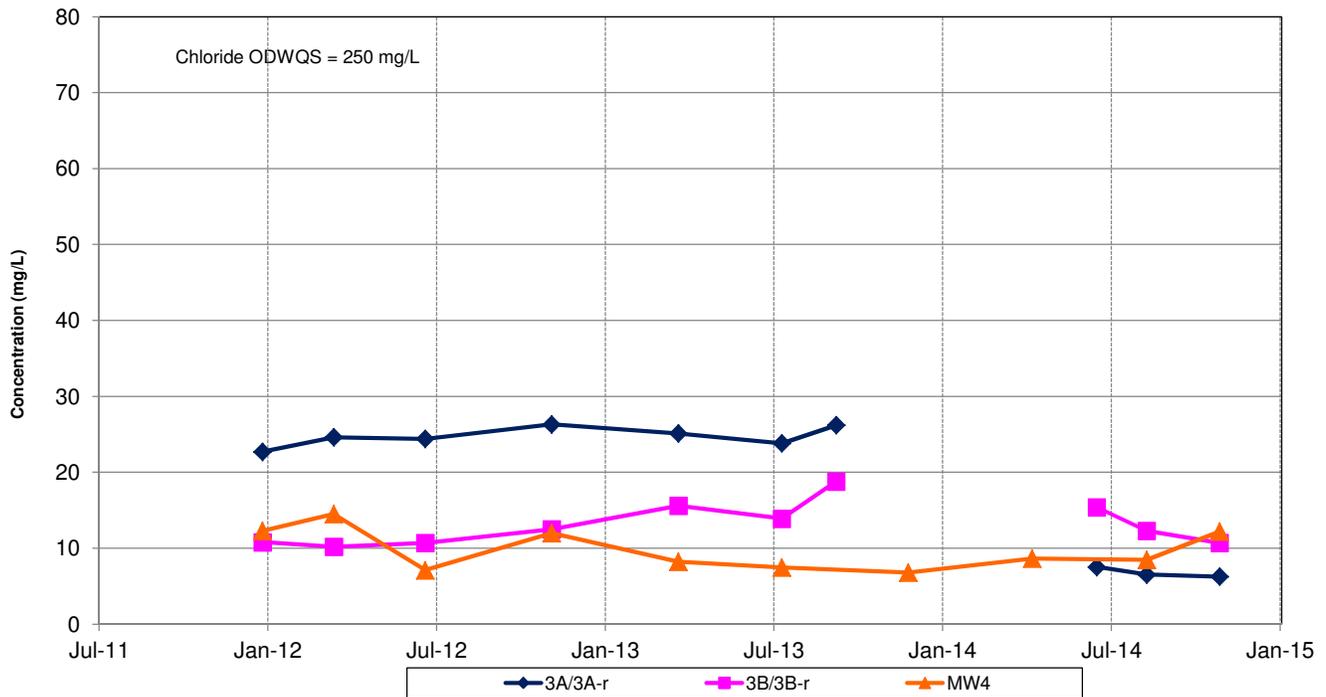
2) \* - Indicates health related drinking water standard.

**FIGURE B-1**  
**GROUNDWATER TIME CONCENTRATION GRAPHS - CHLORIDE**

**UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5**

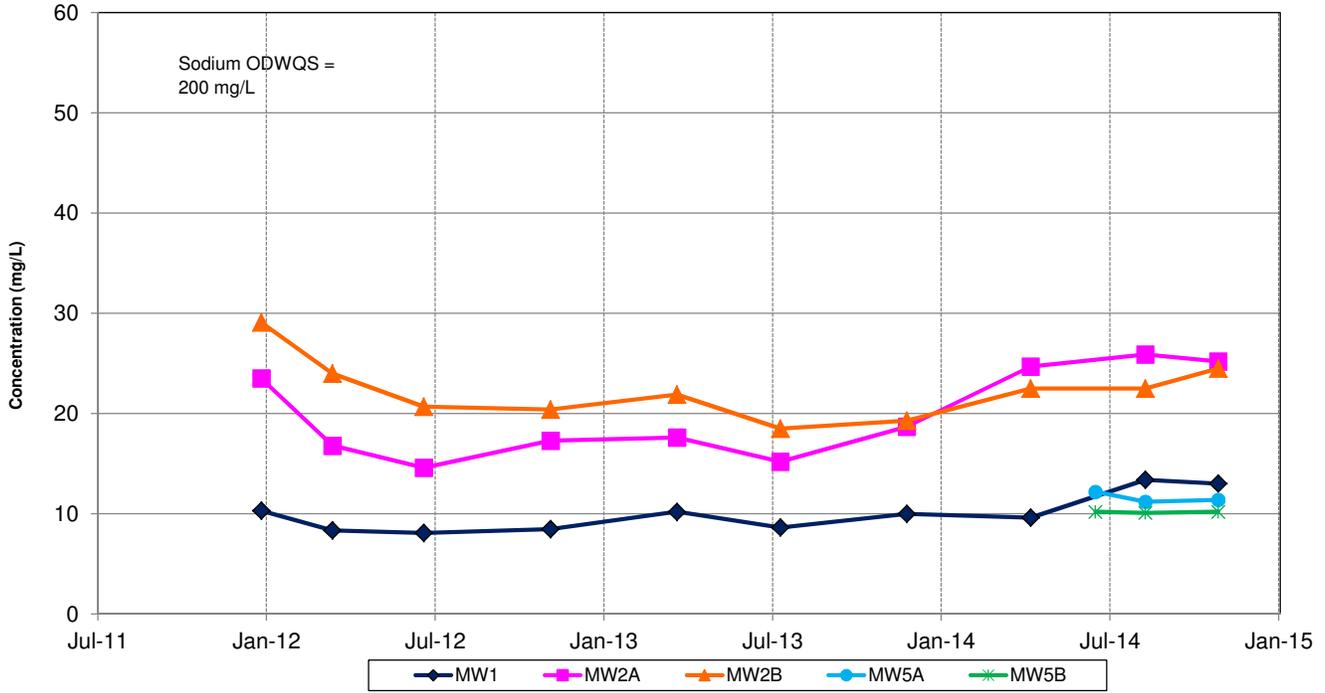


**DOWNGRAIDENT MONITORS - Boreholes 3 & 4**

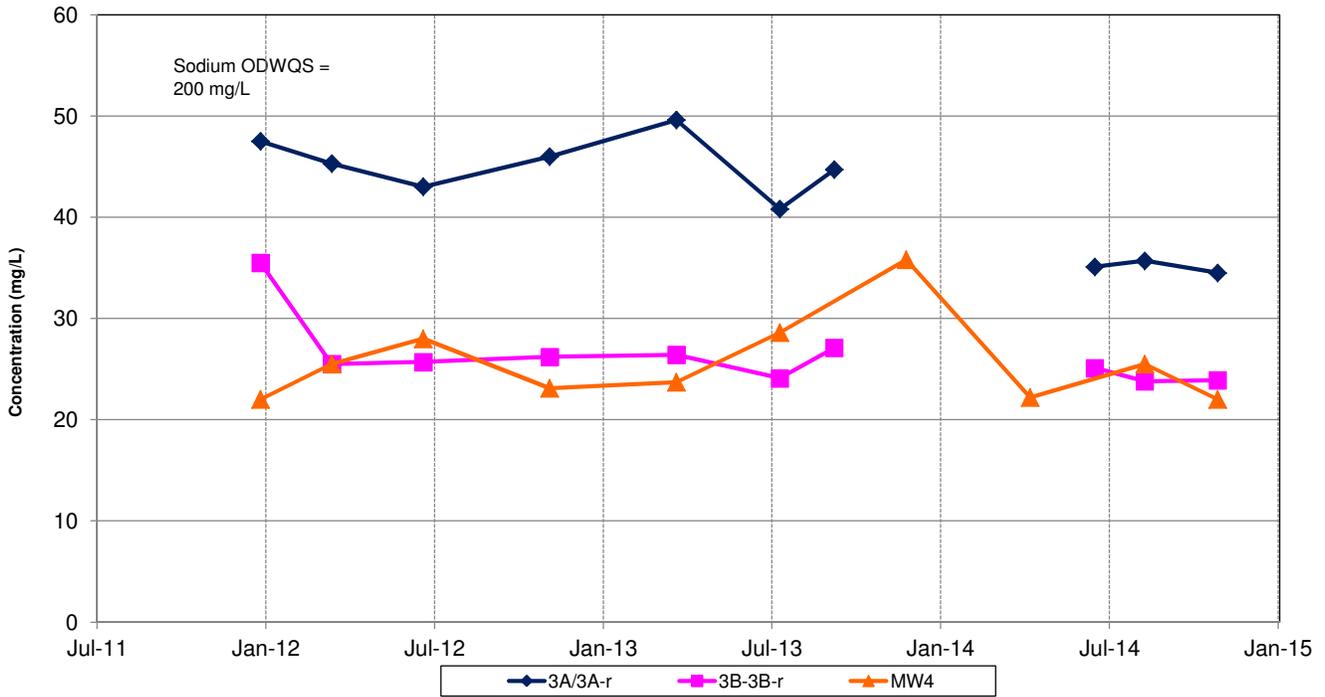


# FIGURE B-2 GROUNDWATER TIME CONCENTRATION GRAPHS - SODIUM

## UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5

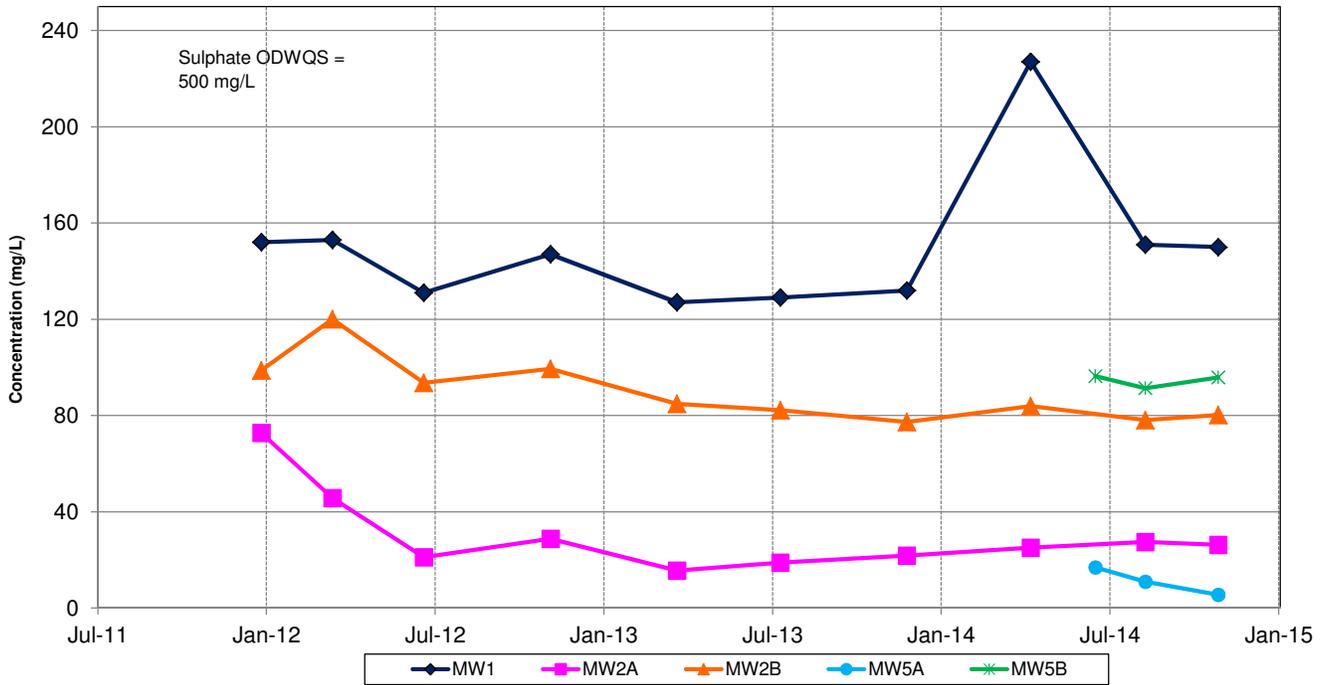


## DOWNGRAIDENT MONITORS - Boreholes 3 & 4

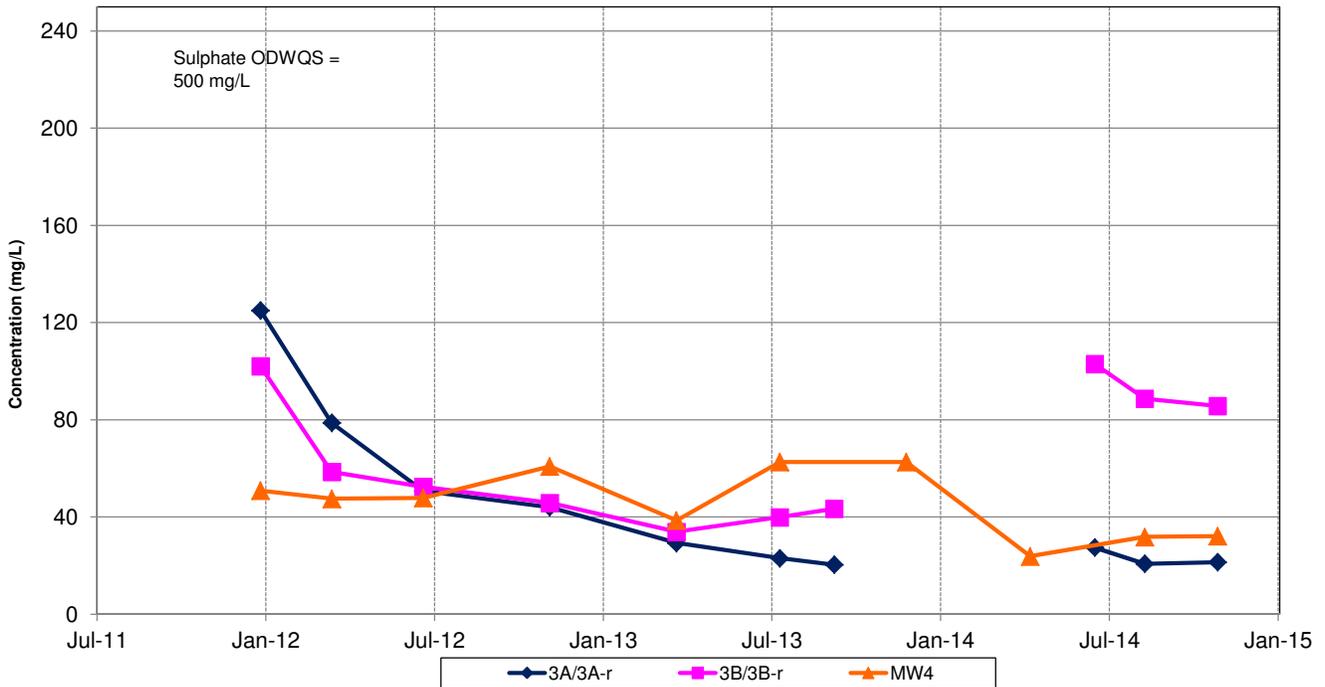


# FIGURE B-3 GROUNDWATER TIME CONCENTRATION GRAPHS - SULPHATE

## UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5

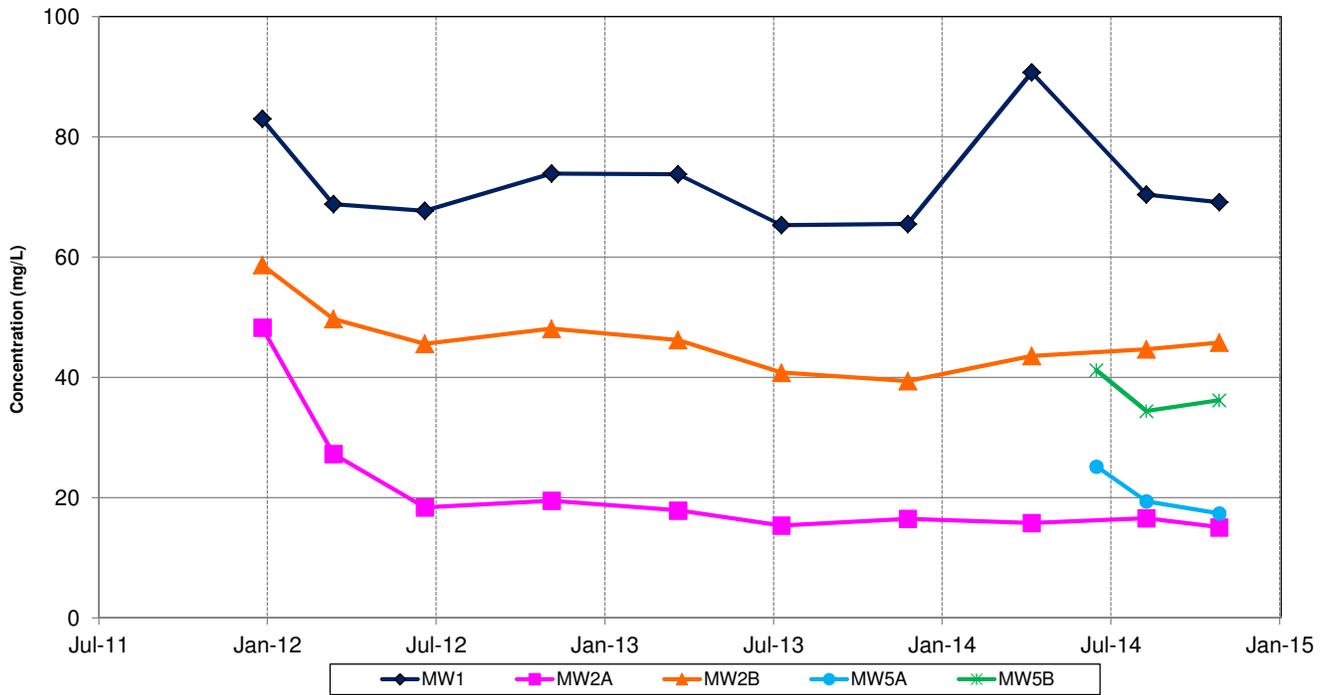


## DOWNGRAIDENT MONITORS - Boreholes 3 & 4

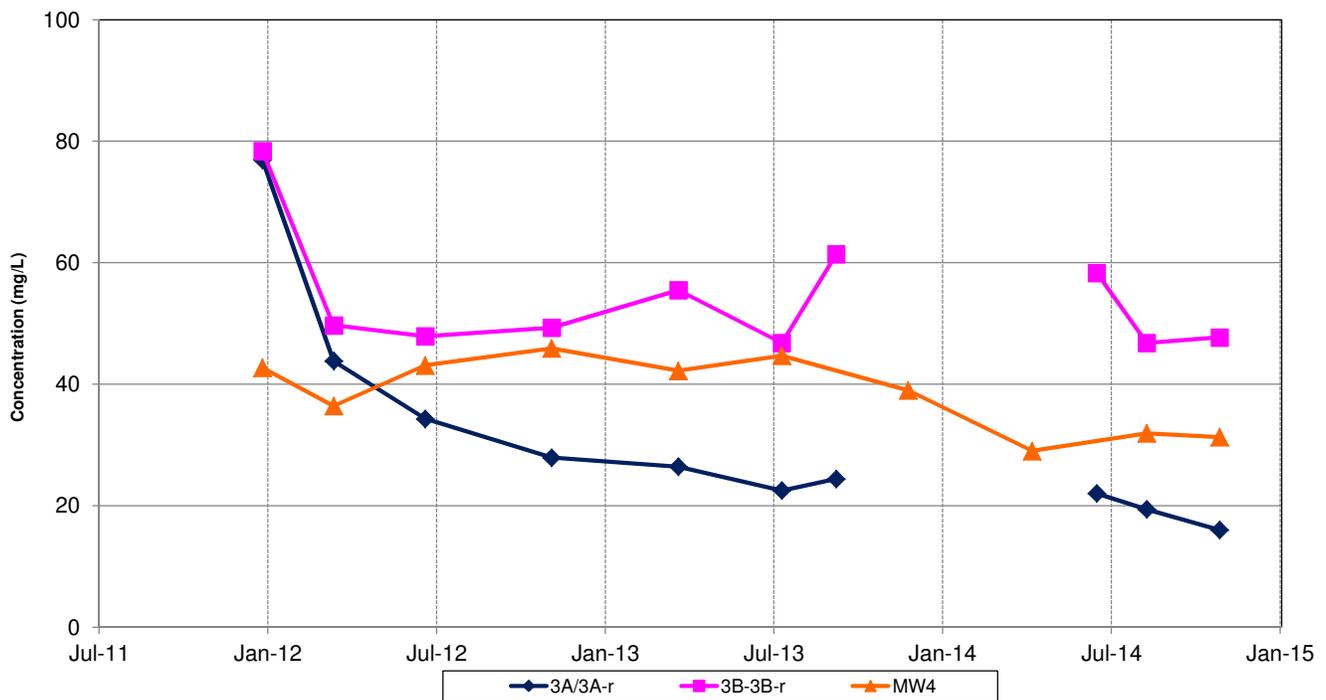


**FIGURE B-4**  
**GROUNDWATER TIME CONCENTRATION GRAPHS - CALCIUM**

**UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5**

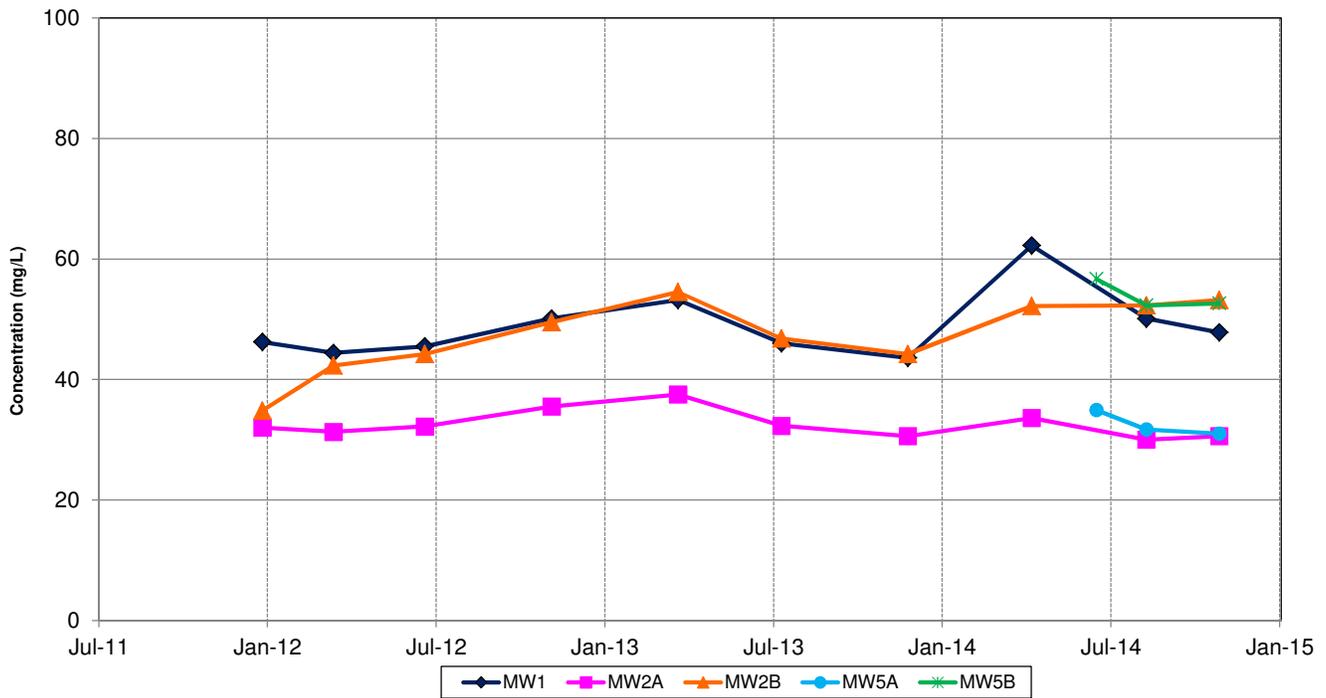


**DOWNGRAIDENT MONITORS - Boreholes 3 & 4**

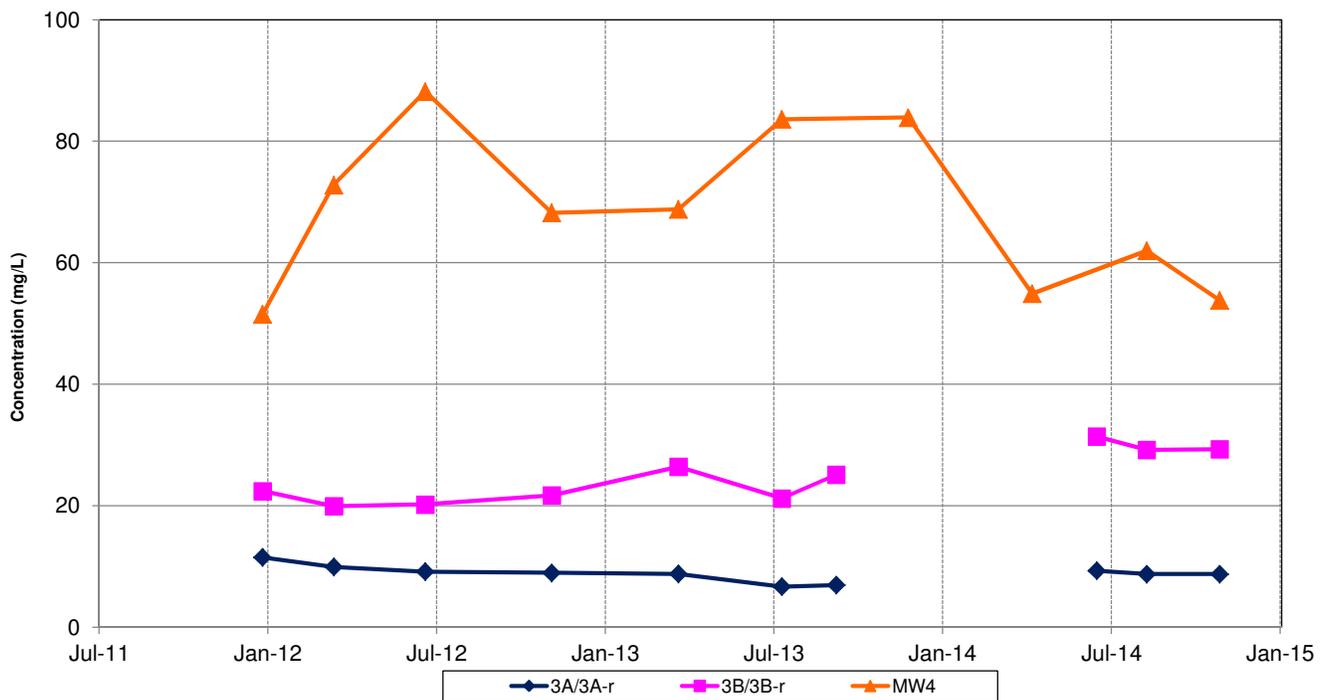


# FIGURE B-5 GROUNDWATER TIME CONCENTRATION GRAPHS - MAGNESIUM

## UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5

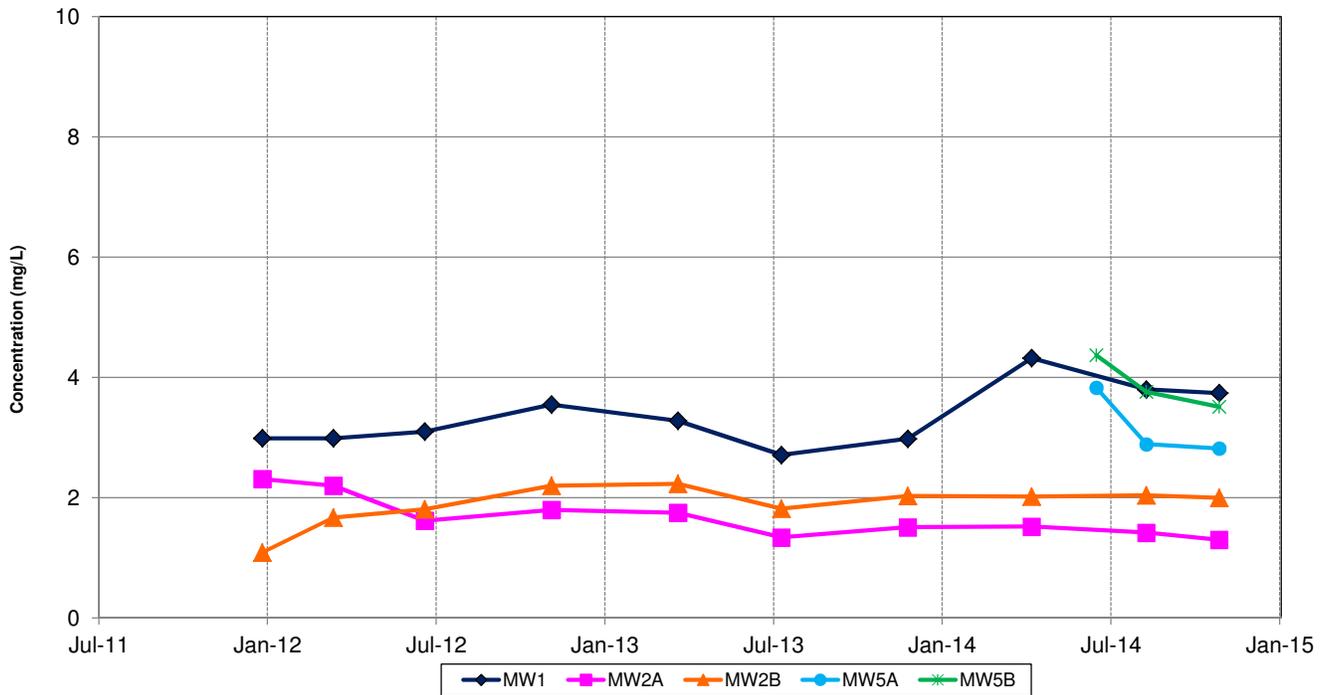


## DOWNGRAIDENT MONITORS - Boreholes 3 & 4

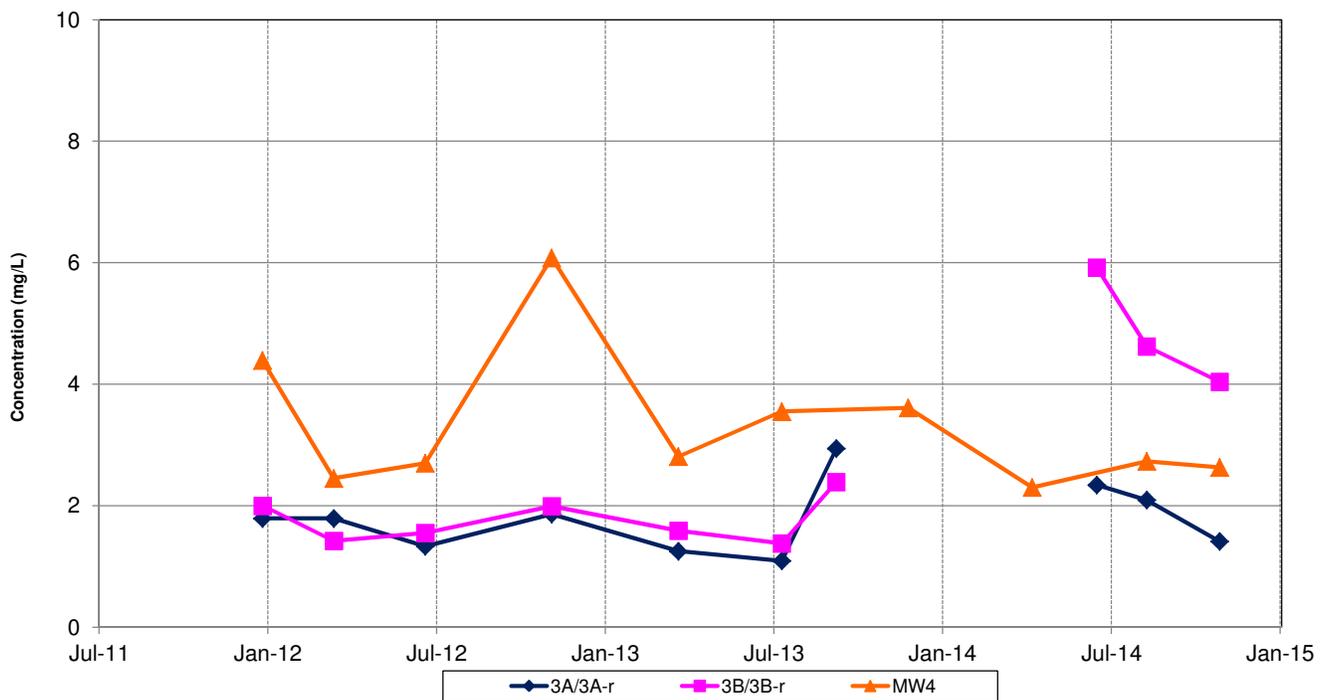


**FIGURE B-6**  
**GROUNDWATER TIME CONCENTRATION GRAPHS - POTASSIUM**

**UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5**

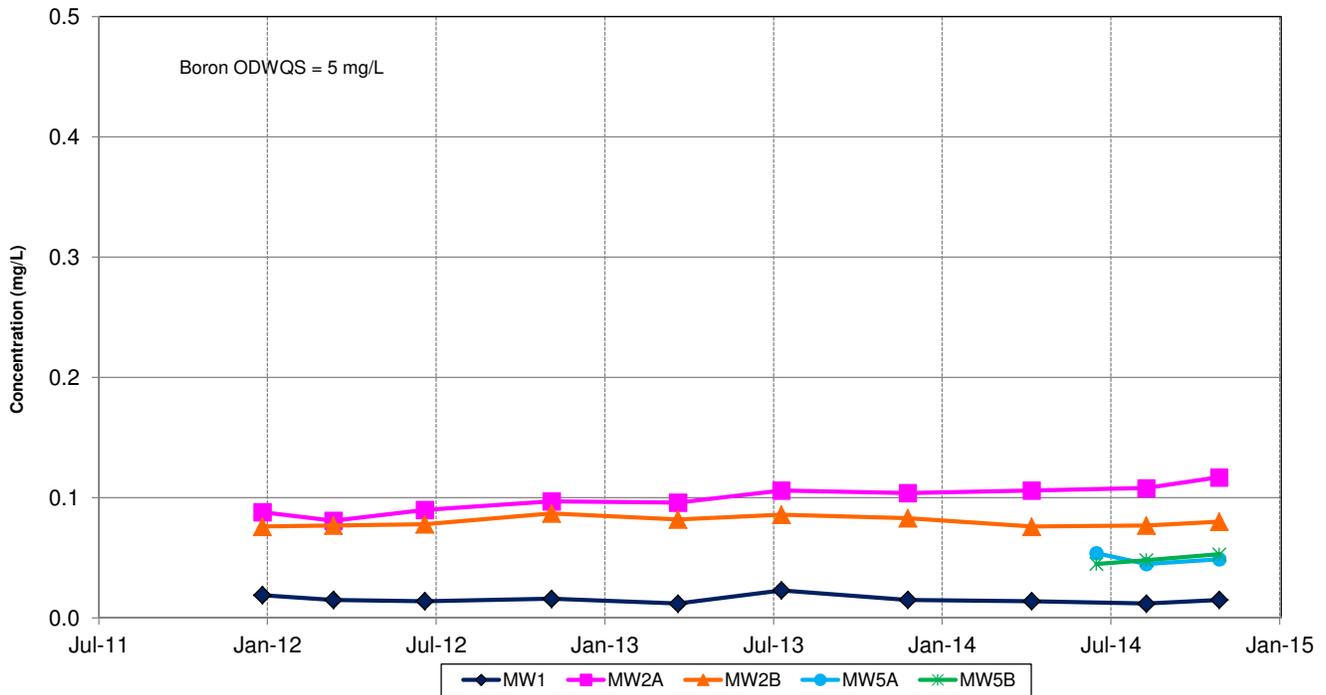


**DOWNGRAIDENT MONITORS - Boreholes 3 & 4**

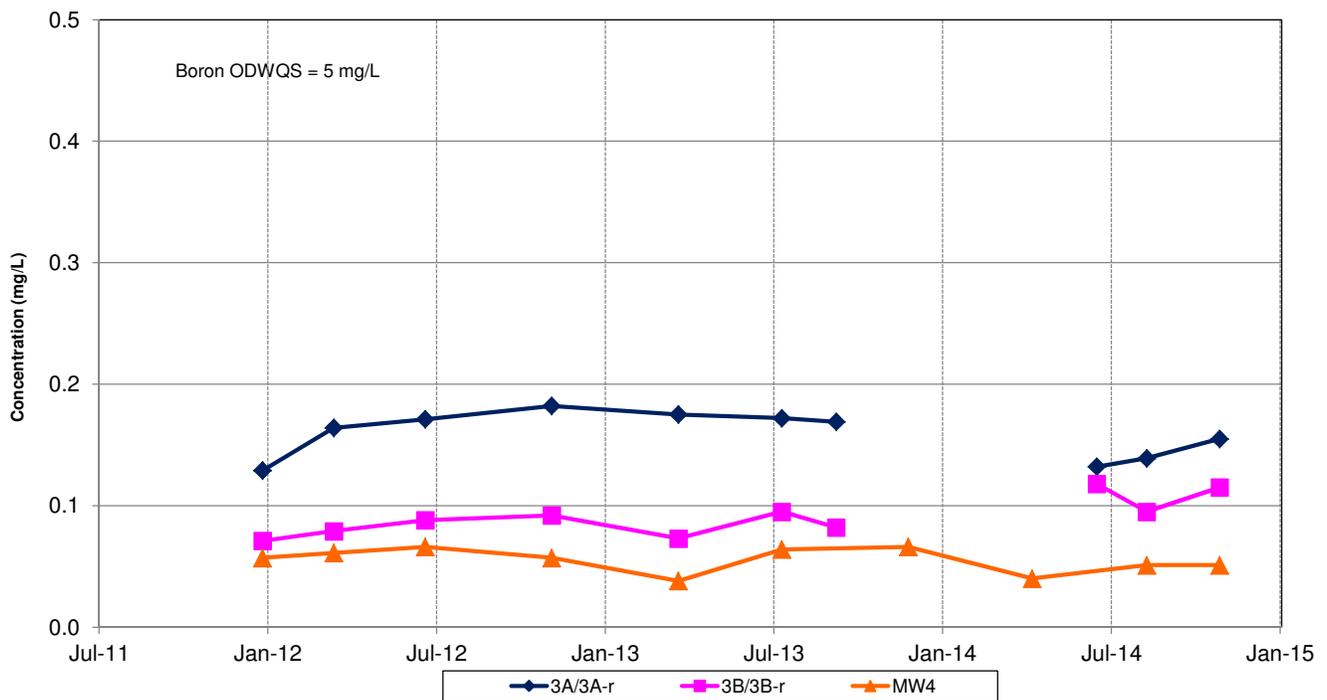


# FIGURE B-7 GROUNDWATER TIME CONCENTRATION GRAPHS - BORON

## UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5

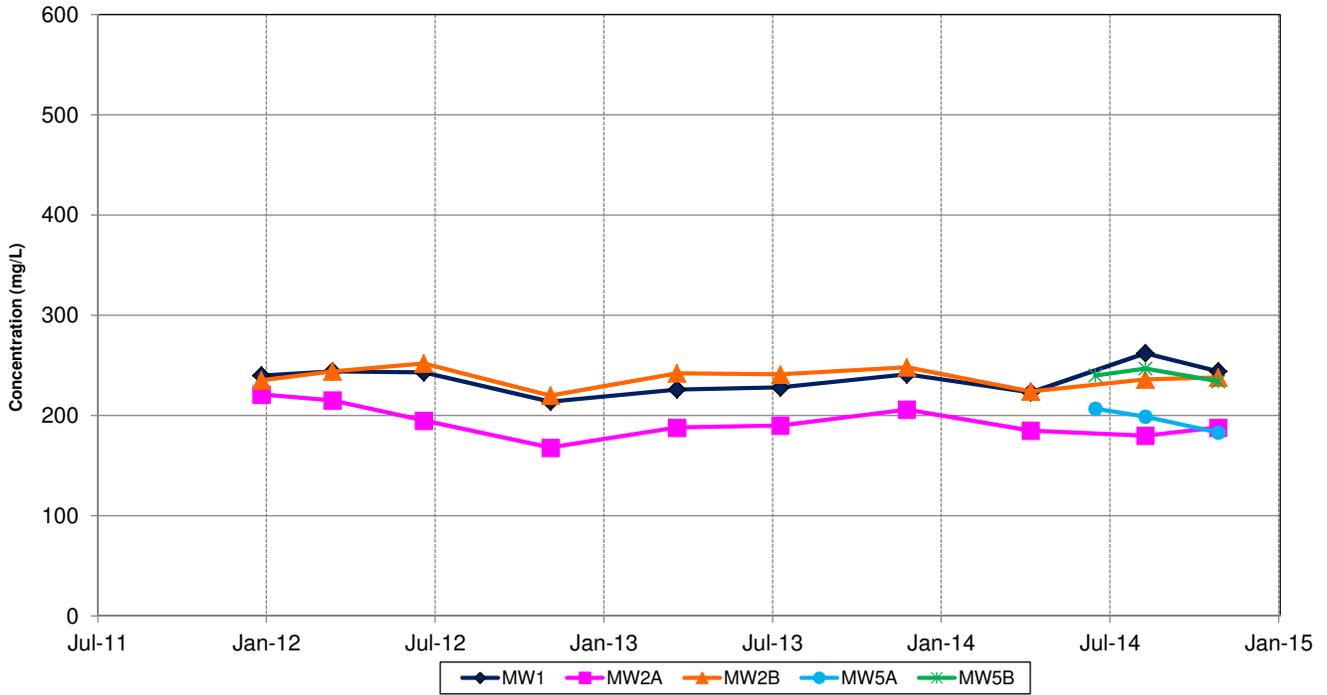


## DOWNGRAIDENT MONITORS - Boreholes 3 & 4

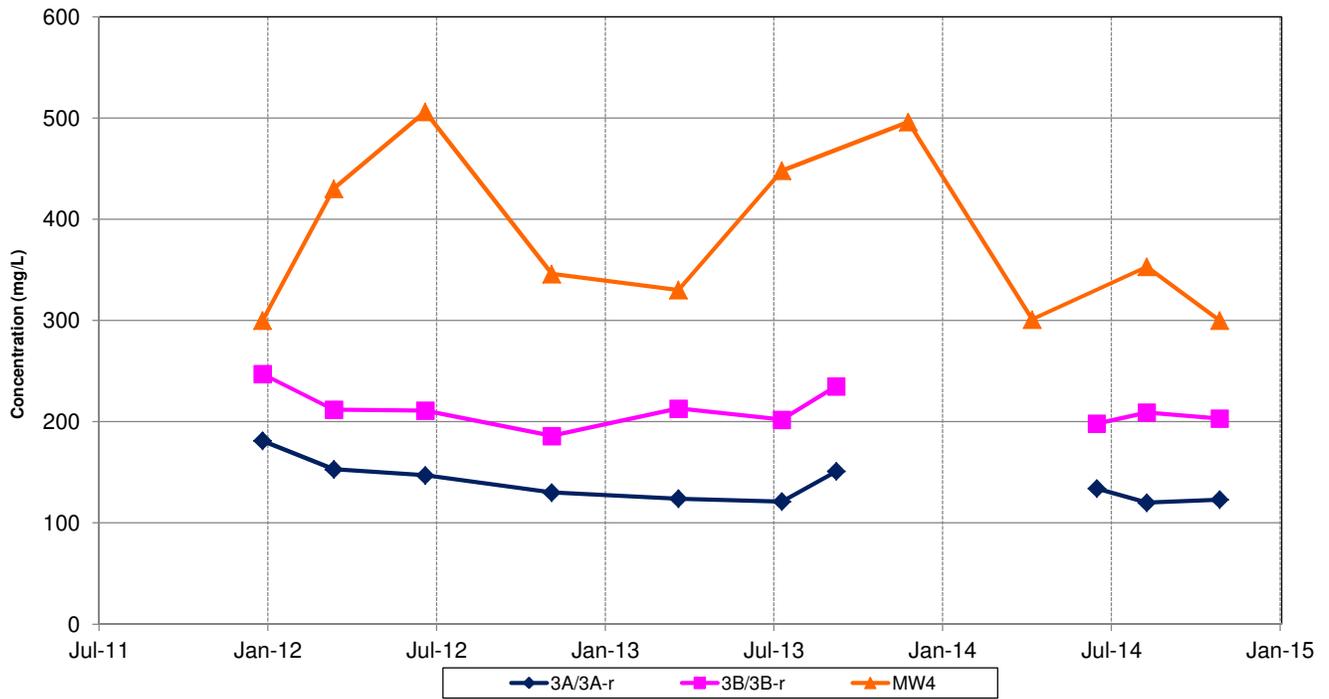


# FIGURE B-8 GROUNDWATER TIME CONCENTRATION GRAPHS - BICARBONATE

## UPGRADIENT AND ADJACENT MONITORS - Boreholes 1, 2 & 5



## DOWNGRAIDENT MONITORS - Boreholes 3 & 4



**TABLE B-3**

**FIELD DUPLICATE SAMPLES - Relative Percent Differences**

**DURHAM YORK ENERGY CENTRE - 2014 MONITORING PROGRAM**

PARAMETER	UNITS	MW4			MW5A		
		April 2014			October 2014		
		Original	Duplicate	RPD (%)	Original	Duplicate	RPD (%)
<b>Bicarbonate (as CaCO3)</b>	mg/L	301	277	<b>8</b>	183	205	<b>11</b>
<b>Boron</b>	mg/L	0.04	0.039	<b>3</b>	0.049	0.045	<b>9</b>
<b>Cadmium</b>	mg/L	<0.002	<0.002		<0.002	<0.002	
<b>Calcium</b>	mg/L	29	28.8	<b>1</b>	17.4	17.3	<b>1</b>
<b>Carbonate (as CaCO3)</b>	mg/L	<5	<5		<5	<5	
<b>Chloride</b>	mg/L	8.64	8.6	<b>0</b>	3.16	3.2	<b>1</b>
<b>Cobalt</b>	mg/L	<0.001	<0.001		0.001	0.001	<b>0</b>
<b>Lead</b>	mg/L	<0.002	<0.002		<0.002	<0.002	
<b>Magnesium</b>	mg/L	54.9	55.5	<b>1</b>	31	30.6	<b>1</b>
<b>Mercury</b>	mg/L	<0.0001	<0.0001		<0.0001	<0.0001	
<b>Potassium</b>	mg/L	2.3	2.31	<b>0</b>	2.82	2.8	<b>1</b>
<b>Sodium</b>	mg/L	22.2	22.3	<b>0</b>	11.4	11.3	<b>1</b>
<b>Sulphate</b>	mg/L	23.8	23.9	<b>0</b>	5.56	5.68	<b>2</b>

NOTES: 1) Blank indicates parameter not analysed.

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



# AGAT Laboratories

## Certificate of Analysis

AGAT WORK ORDER: 14T828396

PROJECT NO: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Steve Taziar

### Groundwater - F

DATE RECEIVED: 2014-04-10

DATE REPORTED: 2014-04-17

Parameter	Unit	SAMPLE DESCRIPTION:		MW1		MW2A		MW2B		MW4		Duplicate	
		G / S	RDL	Water	4/9/2014	Water	4/9/2014	Water	4/9/2014	Water	4/9/2014	Water	4/9/2014
Bicarbonate (as CaCO3)	mg/L	5	5	223	185	224	301	277					
Carbonate (as CaCO3)	mg/L	5	5	<5	<5	<5	<5	<5					
Chloride	mg/L	(250)	0.50	13.5	3.32	22.6	8.64	8.60					
Sulphate	mg/L	(500)	0.50	227	25.1	84.0	23.8	23.9					
Calcium	mg/L		0.05	90.7	15.8	43.6	29.0	28.8					
Magnesium	mg/L		0.05	62.2	33.6	52.2	54.9	55.5					
Sodium	mg/L	20 (200)	0.05	9.60	24.7	22.5	22.2	22.3					
Potassium	mg/L		0.05	4.32	1.52	2.02	2.30	2.31					
Boron	mg/L	5	0.010	0.014	0.106	0.076	0.040	0.039					
Cadmium	mg/L	0.005	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					
Lead	mg/L	0.01	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					

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to O.Reg.169/03(mg/L)  
5275466-5275647 The RDLs change for anions to reflect the dilution required to keep the analytes within a calibration range of the instrument.

*Elizabeth Poloniska*

**Certified By:**



**AGAT** Laboratories

# Guideline Violation

AGAT WORK ORDER: 14T828396

PROJECT NO: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Steve Taziar

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
5275625	MW2A	O.Reg.169/03(mg/L)	Groundwater - F	Sodium	20 (200)	24.7
5275629	MW2B	O.Reg.169/03(mg/L)	Groundwater - F	Sodium	20 (200)	22.5
5275636	MW4	O.Reg.169/03(mg/L)	Groundwater - F	Sodium	20 (200)	22.2
5275647	Duplicate	O.Reg.169/03(mg/L)	Groundwater - F	Sodium	20 (200)	22.3

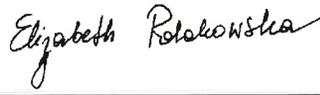
## Quality Assurance

CLIENT NAME: WSP CANADA INC.  
 PROJECT NO: 111-26648-00

AGAT WORK ORDER: 14T828396  
 ATTENTION TO: Steve Taziar

Water Analysis																
RPT Date: Apr 17, 2014			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

<b>Groundwater - F</b>															
Chloride	5275466	5275466	13.5	13.2	2.3%	< 0.10	93%	90%	110%	95%	90%	110%	110%	80%	120%
Sulphate	5275466	5275466	227	224	1.3%	< 0.10	97%	90%	110%	98%	90%	110%	NA	80%	120%
Calcium	5277863		45.1	45.1	0.0%	< 0.05	104%	90%	110%	106%	90%	110%	100%	70%	130%
Magnesium	5277863		18.5	18.6	0.7%	< 0.05	102%	90%	110%	104%	90%	110%	101%	70%	130%
Sodium	5277863		6.99	6.91	1.2%	< 0.05	109%	90%	110%	108%	90%	110%	104%	70%	130%
Potassium	5277863		2.46	2.45	0.1%	< 0.05	105%	90%	110%	108%	90%	110%	106%	70%	130%
Boron	1		0.033	0.032	3.1%	< 0.010	95%	90%	110%	98%	90%	110%	95%	70%	130%
Cadmium	1		< 0.002	< 0.002	0.0%	< 0.002	100%	90%	110%	107%	90%	110%	108%	70%	130%
Cobalt	1		0.003	0.003	0.0%	< 0.001	93%	90%	110%	105%	90%	110%	99%	70%	130%
Lead	1		< 0.002	< 0.002	0.0%	< 0.002	99%	90%	110%	110%	90%	110%	104%	70%	130%
Mercury	1		< 0.0001	< 0.0001	0.0%	< 0.0001	100%	90%	110%	105%	90%	110%	98%	80%	120%

**Certified By:** 

## Method Summary

**CLIENT NAME: WSP CANADA INC.**
**AGAT WORK ORDER: 14T828396**
**PROJECT NO: 111-26648-00**
**ATTENTION TO: Steve Taziar**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Water Analysis</b>			
Bicarbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Carbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS



Laboratories

# Certificate of Analysis

AGAT WORK ORDER: 14T854599

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

SAMPLING SITE:

ATTENTION TO: Steve Taziar

SAMPLED BY:

## Steve Taziar - Ground Water - GW-F Parameters

DATE RECEIVED: 2014-06-20

DATE REPORTED: 2014-06-30

Parameter	Unit	SAMPLE DESCRIPTION:			MW3A		MW3B		MW5A		MW5B	
		G / S	RDL	DATE SAMPLED:	Water	6/18/2014	Water	6/18/2014	Water	6/18/2014	Water	6/18/2014
Bicarbonate (as CaCO <sub>3</sub> )	mg/L		5	134		198		207		240		240
Carbonate (as CaCO <sub>3</sub> )	mg/L		5	<5		<5		<5		<5		<5
Chloride	mg/L	(250)	0.10	7.53		15.4		5.29		5.93		5.93
Sulphate	mg/L	(500)	0.10	27.4		103		16.9		96.4		96.4
Calcium	mg/L		0.05	22.0		58.3		25.2		41.2		41.2
Magnesium	mg/L		0.05	9.27		31.4		34.9		56.7		56.7
Sodium	mg/L	20 (200)	0.05	35.1		25.1		12.2		10.2		10.2
Potassium	mg/L		0.05	2.34		5.92		3.83		4.37		4.37
Boron	mg/L	5	0.010	0.132		0.118		0.054		0.045		0.045
Cadmium	mg/L	0.005	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
Lead	mg/L	0.01	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

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to O Reg. 169/03(mg/L)  
5502511-5502534 Samples were diluted prior to analysis for Anions in order to minimize any matrix interference; the RDLs were adjusted to reflect the dilution.

*Elizabeth Rotkowskie*

**Certified By:**



**AGAT** Laboratories

# Guideline Violation

AGAT WORK ORDER: 14T854599

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Steve Taziar

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
5502511	MW3A	O.Reg.169/03(mg/L)	Steve Taziar - Ground Water - GW-F Parameters	Sodium	20 (200)	35.1
5502522	MW3B	O.Reg.169/03(mg/L)	Steve Taziar - Ground Water - GW-F Parameters	Sodium	20 (200)	25.1

## Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 14T854599

PROJECT: 111-26648-00

ATTENTION TO: Steve Taziar

SAMPLING SITE:

SAMPLED BY:

### Water Analysis

RPT Date: Jun 30, 2014			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

**Steve Taziar - Ground Water - GW-F Parameters**

Bicarbonate (as CaCO <sub>3</sub> )	5499145		103	101	1.4%	< 5	NA			NA			NA		
Carbonate (as CaCO <sub>3</sub> )	5499145		<5	<5	0.0%	< 5	NA			NA			NA		
Chloride	5502534	5502534	5.93	5.90	0.6%	< 0.10	93%	90%	110%	95%	90%	110%	98%	80%	120%
Sulphate	5502534	5502534	96.4	95.7	0.7%	< 0.10	96%	90%	110%	99%	90%	110%	98%	80%	120%
Calcium	5500995		0.29	0.27	5.6%	< 0.05	103%	90%	110%	97%	90%	110%	99%	70%	130%
Magnesium	5500995		0.06	<0.05	0.0%	< 0.05	102%	90%	110%	96%	90%	110%	97%	70%	130%
Sodium	5500995		64.6	63.6	1.5%	< 0.05	94%	90%	110%	90%	90%	110%	89%	70%	130%
Potassium	5500995		0.36	0.32	11.1%	< 0.05	100%	90%	110%	96%	90%	110%	95%	70%	130%
Boron	1	5502511	0.132	0.136	3.0%	< 0.010	107%	90%	110%	110%	90%	110%	90%	70%	130%
Cadmium	1	5502511	< 0.002	< 0.002	0.0%	< 0.002	99%	90%	110%	103%	90%	110%	109%	70%	130%
Cobalt	1	5502511	< 0.001	< 0.001	0.0%	< 0.001	95%	90%	110%	95%	90%	110%	90%	70%	130%
Lead	1	5502511	< 0.002	< 0.002	0.0%	< 0.002	98%	90%	110%	97%	90%	110%	93%	70%	130%
Mercury	1		< 0.0001	< 0.0001	0.0%	< 0.0001	99%	90%	110%	103%	90%	110%	97%	80%	120%

Comments: NA Signifies Not Applicable.

**Certified By:**


## Method Summary

**CLIENT NAME: WSP CANADA INC.**
**PROJECT: 111-26648-00**
**SAMPLING SITE:**
**AGAT WORK ORDER: 14T854599**
**ATTENTION TO: Steve Taziar**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Water Analysis</b>			
Bicarbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Carbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS





# AGAT Laboratories

## Certificate of Analysis

AGAT WORK ORDER: 14T874679

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

SAMPLING SITE:

ATTENTION TO: Steve Taziar

SAMPLED BY: Eric Taylor

DATE RECEIVED: 2014-08-12		DATE REPORTED: 2014-08-19					
Groundwater - GW-F Parameters							
Parameter	Unit	SAMPLE DESCRIPTION:		MW5A		MW5B	
		G / S	RDL	Water	8/11/2014	Water	8/11/2014
Bicarbonate (as CaCO3)	mg/L	209	5	353	199	5	247
Carbonate (as CaCO3)	mg/L	<5	5	<5	<5	5	<5
Chloride	mg/L	12.3	0.20	8.46	3.87	0.10	5.01
Sulphate	mg/L	86.7	0.20	31.8	11.0	0.10	91.4
Calcium	mg/L	46.8	0.05	31.9	19.4	0.05	34.4
Magnesium	mg/L	29.2	0.05	62.0	31.7	0.05	52.3
Sodium	mg/L	23.8	0.05	25.5	11.2	0.05	10.1
Potassium	mg/L	4.62	0.05	2.73	2.89	0.05	3.76
Boron	mg/L	0.095	0.010	0.051	0.045	0.010	0.048
Cadmium	mg/L	<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
Lead	mg/L	<0.002	0.002	<0.002	<0.002	0.002	<0.002
Mercury	mg/L	<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)  
5684120-5684144 Samples required dilution prior to analysis for Anions in order to keep the analytes within the calibration range of the instruments and to minimize any matrix interferences; the RDLs were adjusted to reflect the dilution

**Certified By:**



**AGAT** Laboratories

# Guideline Violation

AGAT WORK ORDER: 14T874679

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Steve Taziar

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
5684126	MW2A	O.Reg.169/03(mg/L)	Groundwater - GW-F Parameters	Sodium	20 (200)	25.9
5684129	MW2B	O.Reg.169/03(mg/L)	Groundwater - GW-F Parameters	Sodium	20 (200)	22.5
5684132	MW3A	O.Reg.169/03(mg/L)	Groundwater - GW-F Parameters	Sodium	20 (200)	35.7
5684135	MW3B	O.Reg.169/03(mg/L)	Groundwater - GW-F Parameters	Sodium	20 (200)	23.8
5684138	MW4	O.Reg.169/03(mg/L)	Groundwater - GW-F Parameters	Sodium	20 (200)	25.5



## Quality Assurance

CLIENT NAME: WSP CANADA INC.  
 PROJECT: 111-26648-00  
 SAMPLING SITE:

AGAT WORK ORDER: 14T874679  
 ATTENTION TO: Steve Taziar  
 SAMPLED BY: Eric Taylor

### Water Analysis

RPT Date: Aug 19, 2014			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
<b>Groundwater - GW-F Parameters</b>																
Bicarbonate (as CaCO <sub>3</sub> )	5685513		36	37	2.7%	< 5	NA			NA			NA			
Carbonate (as CaCO <sub>3</sub> )	5685513		<5	<5	0.0%	< 5	NA			NA			NA			
Chloride	5685563		99.1	97.6	1.5%	< 0.10	92%	90% 110%	92%	90% 110%	106%	80% 120%				
Sulphate	5685563		97.6	96.0	1.7%	< 0.10	96%	90% 110%	98%	90% 110%	101%	80% 120%				
Calcium	5684120	5684120	70.4	69.8	0.9%	< 0.05	97%	90% 110%	95%	90% 110%	97%	70% 130%				
Magnesium	5684120	5684120	50.1	49.6	1.0%	< 0.05	97%	90% 110%	95%	90% 110%	99%	70% 130%				
Sodium	5684120	5684120	13.4	13.3	0.7%	< 0.05	99%	90% 110%	99%	90% 110%	103%	70% 130%				
Potassium	5684120	5684120	3.80	3.76	1.1%	< 0.05	98%	90% 110%	98%	90% 110%	104%	70% 130%				
Boron	1		0.045	0.044	2.2%	< 0.010	109%	90% 110%	102%	90% 110%	98%	70% 130%				
Cadmium	1		< 0.002	< 0.002	0.0%	< 0.002	103%	90% 110%	107%	90% 110%	106%	70% 130%				
Cobalt	1		0.004	0.004	0.0%	< 0.001	98%	90% 110%	105%	90% 110%	111%	70% 130%				
Lead	1		< 0.002	< 0.002	0.0%	< 0.002	95%	90% 110%	104%	90% 110%	100%	70% 130%				
Mercury	5686257		< 0.0001	< 0.0001	0.0%	< 0.0001	103%	90% 110%	101%	90% 110%	100%	80% 120%				

Comments: NA signifies Not Applicable.

**Certified By:**

## Method Summary

**CLIENT NAME: WSP CANADA INC.**
**PROJECT: 111-26648-00**
**SAMPLING SITE:**
**AGAT WORK ORDER: 14T874679**
**ATTENTION TO: Steve Taziar**
**SAMPLED BY: Eric Taylor**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Water Analysis</b>			
Bicarbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Carbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS



# AGAT Laboratories

## Certificate of Analysis

AGAT WORK ORDER: 14T909397

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

SAMPLING SITE:

ATTENTION TO: Steve Taziar

SAMPLED BY: Eric Taylor

### Steve Taziar - Groundwater - Group F Parameters

DATE RECEIVED: 2014-10-30

DATE REPORTED: 2014-11-10

Parameter	Unit	SAMPLE DESCRIPTION:		MW1		MW2A		MW2B		MW3A	
		G / S	RDL	DATE SAMPLED:	Water	RDL	DATE SAMPLED:	Water	RDL	DATE SAMPLED:	Water
Bicarbonate (as CaCO3)	mg/L	5	5	10/29/2014	244	6019054	188	6019057	238	6019059	123
Carbonate (as CaCO3)	mg/L	5	5		<5		<5		<5		<5
Chloride	mg/L	0.50	0.50		15.3		4.47		59.9		6.24
Sulphate	mg/L	0.50	0.50		150		26.3		80.2		21.4
Calcium	mg/L	0.05	0.05		69.1		15.1		45.8		16.0
Magnesium	mg/L	0.05	0.05		47.8		30.6		53.2		8.74
Sodium	mg/L	0.05	0.05		13.0		25.2		24.5		34.5
Potassium	mg/L	0.05	0.05		3.74		1.30		2.00		1.41
Boron	mg/L	0.010	0.010		0.015		0.117		0.080		0.155
Cadmium	mg/L	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
Lead	mg/L	0.002	0.002		<0.002		<0.002		<0.002		<0.002
Mercury	mg/L	0.0001	0.0001		<0.0001		<0.0001		<0.0001		<0.0001

**Certified By:**



**AGAT** Laboratories

# Certificate of Analysis

AGAT WORK ORDER: 14T909397

PROJECT: 111-26648-00

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

CLIENT NAME: WSP CANADA INC.

SAMPLING SITE:

ATTENTION TO: Steve Taziar

SAMPLED BY: Eric Taylor

## Steve Taziar - Groundwater - Group F Parameters

DATE RECEIVED: 2014-10-30

DATE REPORTED: 2014-11-10

Parameter	Unit	SAMPLE DESCRIPTION:		MW3B		MW4		MW5A		MW5B		Duplicate	
		G / S	RDL	Water	10/29/2014	Water	10/29/2014	Water	10/29/2014	Water	10/29/2014	Water	10/29/2014
Bicarbonate (as CaCO <sub>3</sub> )	mg/L	5	203	<5	300	5	183	5	234	5	205	5	205
Carbonate (as CaCO <sub>3</sub> )	mg/L	5	<5	<5	<5	5	<5	<5	<5	5	<5	5	<5
Chloride	mg/L	0.20	10.7	12.2	0.10	0.10	3.16	0.20	4.78	0.10	3.20	0.10	3.20
Sulphate	mg/L	0.20	85.7	32.1	0.10	0.20	5.56	0.20	95.9	0.10	5.68	0.10	5.68
Calcium	mg/L	0.05	47.7	31.3	0.05	0.05	17.4	0.05	36.2	0.05	17.3	0.05	17.3
Magnesium	mg/L	0.05	29.3	53.8	0.05	0.05	31.0	0.05	52.6	0.05	30.6	0.05	30.6
Sodium	mg/L	0.05	23.9	22.0	0.05	0.05	11.4	0.05	10.2	0.05	11.3	0.05	11.3
Potassium	mg/L	0.05	4.04	2.63	0.05	0.05	2.82	0.05	3.51	0.05	2.80	0.05	2.80
Boron	mg/L	0.010	0.115	0.051	0.010	0.010	0.049	0.010	0.063	0.010	0.045	0.010	0.045
Cadmium	mg/L	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	0.001	0.001
Lead	mg/L	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	0.0001	<0.0001	<0.0001	0.0001	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  
6019054-6019077 Samples required dilution prior to analysis for Anions in order to keep the analytes within the calibration range of the instrument; the RDLs were adjusted to reflect the dilution.

**Certified By:**



## Quality Assurance

CLIENT NAME: WSP CANADA INC.  
 PROJECT: 111-26648-00  
 SAMPLING SITE:

AGAT WORK ORDER: 14T909397  
 ATTENTION TO: Steve Taziar  
 SAMPLED BY: Eric Taylor

### Water Analysis

RPT Date: Nov 10, 2014			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

**Steve Taziar - Groundwater - Group F Parameters**

Bicarbonate (as CaCO3)	6019994		193	196	1.5%	< 5	NA			NA			NA		
Carbonate (as CaCO3)	6019994		<5	<5	0.0%	< 5	NA			NA			NA		
Chloride	6019054	6019054	15.3	14.8	3.3%	< 0.10	93%	90%	110%	100%	90%	110%	103%	80%	120%
Sulphate	6019054	6019054	150	149	0.7%	< 0.10	100%	90%	110%	99%	90%	110%	101%	80%	120%
Calcium	6023428		35.9	35.4	1.4%	< 0.05	100%	90%	110%	98%	90%	110%	92%	70%	130%
Magnesium	6023428		6.74	6.67	1.0%	< 0.05	98%	90%	110%	97%	90%	110%	89%	70%	130%
Sodium	6023428		6.16	6.09	1.1%	< 0.05	101%	90%	110%	100%	90%	110%	92%	70%	130%
Potassium	6023428		1.84	1.81	1.6%	< 0.05	99%	90%	110%	97%	90%	110%	93%	70%	130%
Boron	6020489	6019077	0.045	0.047	4.3%	< 0.010	107%	90%	110%	98%	90%	110%	107%	70%	130%
Cadmium	6020489	6019077	< 0.002	< 0.002	0.0%	< 0.002	95%	90%	110%	102%	90%	110%	106%	70%	130%
Cobalt	6020489	6019077	0.001	0.001	0.0%	< 0.001	100%	90%	110%	96%	90%	110%	106%	70%	130%
Lead	6020489	6019077	< 0.002	< 0.002	0.0%	< 0.002	92%	90%	110%	96%	90%	110%	98%	70%	130%
Mercury	6019054	6019054	< 0.0001	< 0.0001	0.0%	< 0.0001	107%	90%	110%	107%	90%	110%	110%	80%	120%

Comments: NA Signifies Not Applicable.

**Certified By:**



## Method Summary

CLIENT NAME: WSP CANADA INC.

PROJECT: 111-26648-00

SAMPLING SITE:

AGAT WORK ORDER: 14T909397

ATTENTION TO: Steve Taziar

SAMPLED BY: Eric Taylor

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Water Analysis</b>			
Bicarbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Carbonate (as CaCO <sub>3</sub> )	INOR-93-6000	SM 2320 B	PC TITRATE
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS

# 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

<b>Waste Disposal Site Name</b>	Durham York Energy Centre
<b>Location (e.g. street address, lot, concession)</b>	Osborne Road, south of South Service Road, southeast of Courtice Rd / Highway 401
<b>GPS Location (taken within the property boundary at front gate/ front entry)</b>	680660, 4860506, Zone 17, NAD 83
<b>Municipality</b>	Municipality of Clarington, in the Regional Municipality of Durham
<b>Client and/or Site Owner</b>	Regional Municipalities of Durham and York
<b>Monitoring Period (Year)</b>	2014
This Monitoring Report is being submitted under the following:	
<b>Certificate of Approval No.:</b>	7306-8FDKNX
<b>Director's Order No.:</b>	
<b>Provincial Officer's Order No.:</b>	
<b>Other:</b>	

Report Submission Frequency	<input checked="" type="radio"/> Annual <input type="radio"/> Other	
The site is:	<input checked="" type="radio"/> Active <input type="radio"/> Inactive <input type="radio"/> 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?	<input type="radio"/> Yes <input checked="" type="radio"/> 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)	<input type="radio"/> Yes <input checked="" type="radio"/> 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:

<p>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:</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>If no, list exceptions (Type Here):</p>
<p>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):</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Not Applicable</p>	<p>If no, list exceptions below or attach information.</p>

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

<b>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.</b>	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Not Applicable	
<b>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:</b>	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> Not Applicable	If no, list exceptions below or attach additional information.
<b>Groundwater Sampling Location</b>	<b>Description/Explanation for change (change in name or location, additions, deletions)</b>	<b>Date</b>
		Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
<b>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):</b>	<input checked="" type="radio"/> Yes <input type="radio"/> No	If no, specify (Type Here):

## Sampling and Monitoring Program Results/WDS Conditions and Assessment:

<p>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.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	
<p>6) The site meets compliance and assessment criteria.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	
<p>7) The site continues to perform as anticipated. There have been no unusual trends/ changes in measured leachate and groundwater levels or concentrations.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>If no, list exceptions and explain reason for increase/change (Type Here):</p>
<p>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>i.</i> The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and  <i>ii.</i> Seasonal and annual water levels and water quality fluctuations are well understood.</p>	<p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>	<p>Note which practice(s):</p> <p><input type="checkbox"/> (a)  <input checked="" type="checkbox"/> (b)  <input type="checkbox"/> (c)</p>
<p>9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):</p>	<p><input type="radio"/> Yes  <input checked="" type="radio"/> No  <input type="radio"/> Not Applicable</p>	

## 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:

27-Apr-2015

## 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

<b>Name:</b>	Stephen J. Taziar, P.Eng		
<b>Seal:</b>	Add Image 		
<b>Signature:</b>		<b>Date:</b>	27-Apr-2015
<b>CEP Contact Information:</b>	Type Here		
<b>Company:</b>	WSP Canada Inc.		
<b>Address:</b>	126 Don Hillock Drive, Suite 2, Aurora, ON, L4G 0G9		
<b>Telephone No.:</b>	(905) 750-3080	<b>Fax No. :</b>	(905) 727-0463
<b>E-mail Address:</b>	stephen.taziar@wspgroup.com		
<b>Co-signers for additional expertise provided:</b>			
<b>Signature:</b>		<b>Date:</b>	Select Date
<b>Signature:</b>		<b>Date:</b>	Select Date