APPENDIX IR42-1 HYDROGEOLOGY TECHNICAL DATA REPORT UPDATE

Appendix IR42-1 Hydrogeology Technical Data Report Update
May 2019

SPRINGBANK OFF-STREAM RESERVOIR PROJECT Environmental Impact Assessment

Hydrogeology Technical Data Report Update

Prepared for:
Alberta Transportation

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May 2019

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

Abbreviations

3D CSM	three-dimensional conceptual site model
ASTM	American Society for Testing and Materials
AWWID	Alberta Water Well Information Database
ASL	above sea level
BGL	below ground level
cfu/100 mL	colony forming units per 100 millilitre
CSA	Canadian Standards Association
DEM	digital elevation model
DOC	dissolved organic carbon
GCDWQ	Guideline for Canadian Drinking Water Quality
GIS	geographic information system
GOWN	groundwater observation well network
HPC	heterotrophic plate count
EIA	Environmental Impact Assessment
m	metres
mg/L	milligram per litre
mpn/100 mL	most probable number per 100 millilitres
µg/L	microgram per litre
m ASL	metres above sea level
m BGL	metres below ground level
m^3/day	cubic metres per day

LAA	local assessment area
LiDAR	light detection and ranging
PVC	polyvinyl chloride
PDA	Project Development Area
QA/QC	quality assurance and quality control
RAA	regional assessment area
the Project	Springbank Off-stream Reservoir Project

1.0 INTRODUCTION

This technical data report provides updated information on groundwater resources that supports the EIA for the Springbank Off-stream Reservoir Project (the Project). This update was prepared in response to information requests received from AEP, the Canadian Environmental Assessment Agency (CEA Agency), and feedback from Indigenous groups.

Specifically, this report presents a consolidated update and replacement to the two reports in Volume 4, Appendix I of the EIA: Hydrogeology Baseline Technical Data Report, and Groundwater Numerical Modelling Technical Data Report.

The principal updates include:

- a geographically expanded RAA, which now covers an expanded area south of the Elbow River Valley, including the Tsuut'ina Nation Reserve within the Elbow River watershed
- an expanded baseline assessment with additional information for areas south of the Elbow River Valley
- an expanded numerical groundwater flow model in accordance with the expanded RAA
- additional model updates based upon Information Requests received from the National Resources Conservation Board (NRCB), AEP, and the CEA Agency following their review of the EIA filed in March 2018.

The remaining four main technical sections of this report are:

- 2, Methods
- 3, 3D CSM Results
- 4, Numerical Model Construction and Calibration
- 5, Model Simulations of Potential Effects on Groundwater

Sections 2 and 3 present the updated hydrogeology baseline assessment. This includes new information prepared for the expanded areas of the RAA and re-presents information that was previously presented and did not change as a result of that expanded area (i.e., some baseline information within the original RAA area did not change, but it is re-presented herein for continuity).

Sections 4 and 5 present the updated numerical groundwater flow model and simulation results. While the overall scope and objective of the modeling remains to support the assessment of Project effects on groundwater, the geographic extent of the model domain has been expanded and some model parameters have been updated in response to some of the Information Requests. The operational scenarios that are simulated by the model include dry operations and flood operations/post-flood operations related to a design flood.

2.0 METHODS

2.1 DATA COMPILATION AND PRELIMINARY CONCEPTUAL HYDROSTRATIGRAPHIC FRAMEWORK DEVELOPMENT

The preliminary assessment of existing hydrogeological conditions involved compilation and review of data from various publicly available sources, including the following regional reports (among others):

- Surficial Geology of Alberta Foothills and Rocky Mountains (Map 150) (AGS 1980)
- Surficial Geology of Alberta (Map 601) (Fenton et al. 2013)
- Quaternary Geology of Southern Alberta (Map 207) (Shetsen 1987)
- Bedrock Topography of Alberta (Map 602) (MacCormack et al. 2015)
- Geology of the Alberta Rocky Mountains and Foothills (Map 560) (Pana and Elgr 2013)
- Bedrock Geology of Alberta (Map 600) (Prior et al. 2013)
- Prairie Farm Rehabilitation Administration Regional Groundwater Resource Assessment (HCL 2002)
- Alberta Environment Water Well Information Database (AWWID)
- AMEC (2014) Preliminary Geotechnical Investigation
- Stratigraphic Framework of the Uppermost Cretaceous to Paleocene Strata of the Alberta Basin (Jerzykiewicz 1997)
- Hydrogeology of the Canmore Corridor and Northwestern Kananaskis Country (Toop and de la Cruz 2002)

In addition to these data sources, a geological mapping of outcrops that could be accessed within the RAA was completed. Mapping of 18 outcrops was completed in March 2016. The objectives of the mapping were to determine the distribution of lithological units, orientation of the bedding planes, fracture characteristics, and to estimate the strength of the bedrock material.

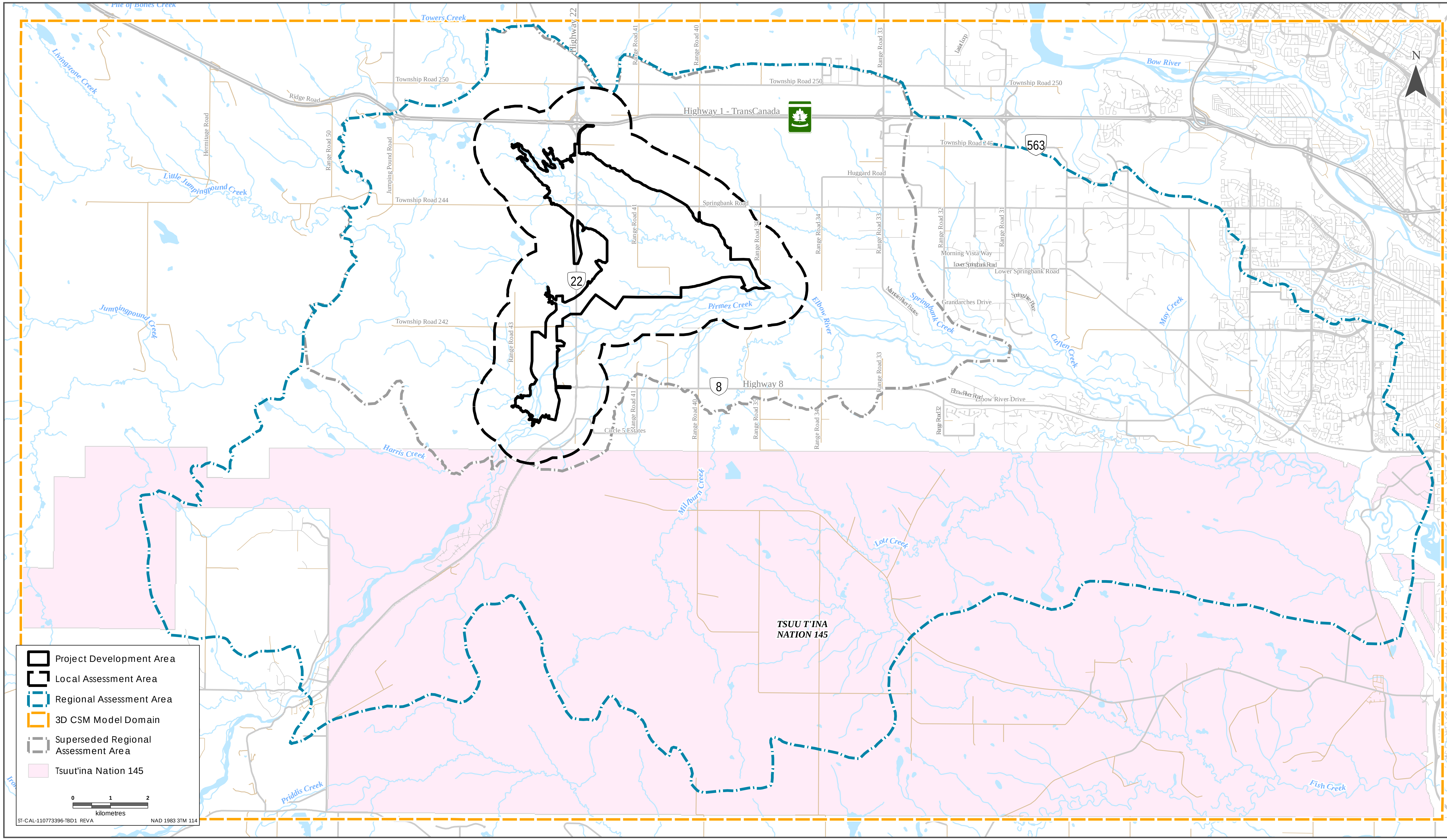
Where outcrops along the Elbow River could not easily be accessed to the west of Highway 22, they were scanned using ground-based light detection and ranging (LiDAR). This work was completed primarily for geotechnical purposes but was also used to support the development of the conceptual hydrostratigraphic framework for the expanded RAA.

All the information and data noted above were reviewed and used to create a preliminary conceptual hydrostratigraphic framework for the region. The preliminary framework was used in conjunction with the Project design to determine appropriate hydrogeology RAA and LAA and to guide the hydrogeological field program for the Project. Details regarding the framework and subsequent modelling process are presented in Section 2.6.

2.2 GROUNDWATER RESOURCES ASSESSMENT AREAS

The boundaries of the groundwater resources assessment areas were defined as the area over which potential interactions between the Project and groundwater resources could occur. The horizontal boundaries are presented in Figure 2-1. The vertical boundaries are defined by the ground surface as the uppermost surface and an arbitrary lower surface at an elevation of 1,000 m ASL. An arbitrary bound to the bottom of the RAA is chosen since the bedrock structure of the RAA consists of dipping bedrock units and several subcrops that preclude use of a single stratigraphic contact to establish a lower boundary. The groundwater resources assessment areas are defined as follows:

- PDA is the area of the physical Project footprint and consists of the area of physical disturbance associated with the diversion structure, diversion channel, dam and reservoir.
- LAA includes the PDA plus a 1-km buffer surrounding the PDA to address potential localized hydrogeological effects, including water level and water quality changes near Project infrastructure and localized changes in groundwater levels near the off-stream reservoir and dam. The LAA is the maximum area within which Project-related groundwater effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA includes the PDA and adjacent areas where Project-related groundwater effects may be expected to occur.
- RAA supports physically-based boundary conditions for the numerical groundwater model. The expanded RAA covers approximately 43,050 ha (the original area of the RAA reported in the EIA was 14,000 ha) and is bounded by a surface and shallow groundwater flow divide in the north, the composite of the subwatersheds of three small tributaries to the Elbow River in the northwest, the Elbow River watershed boundary to the south, with the eastern/downstream extent bounded by a subwatershed just west of Glenmore Reservoir.



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Groundwater Resources Assessment Area

Figure 2-1

2.3 DRILLING AND MONITORING WELL INSTALLATION

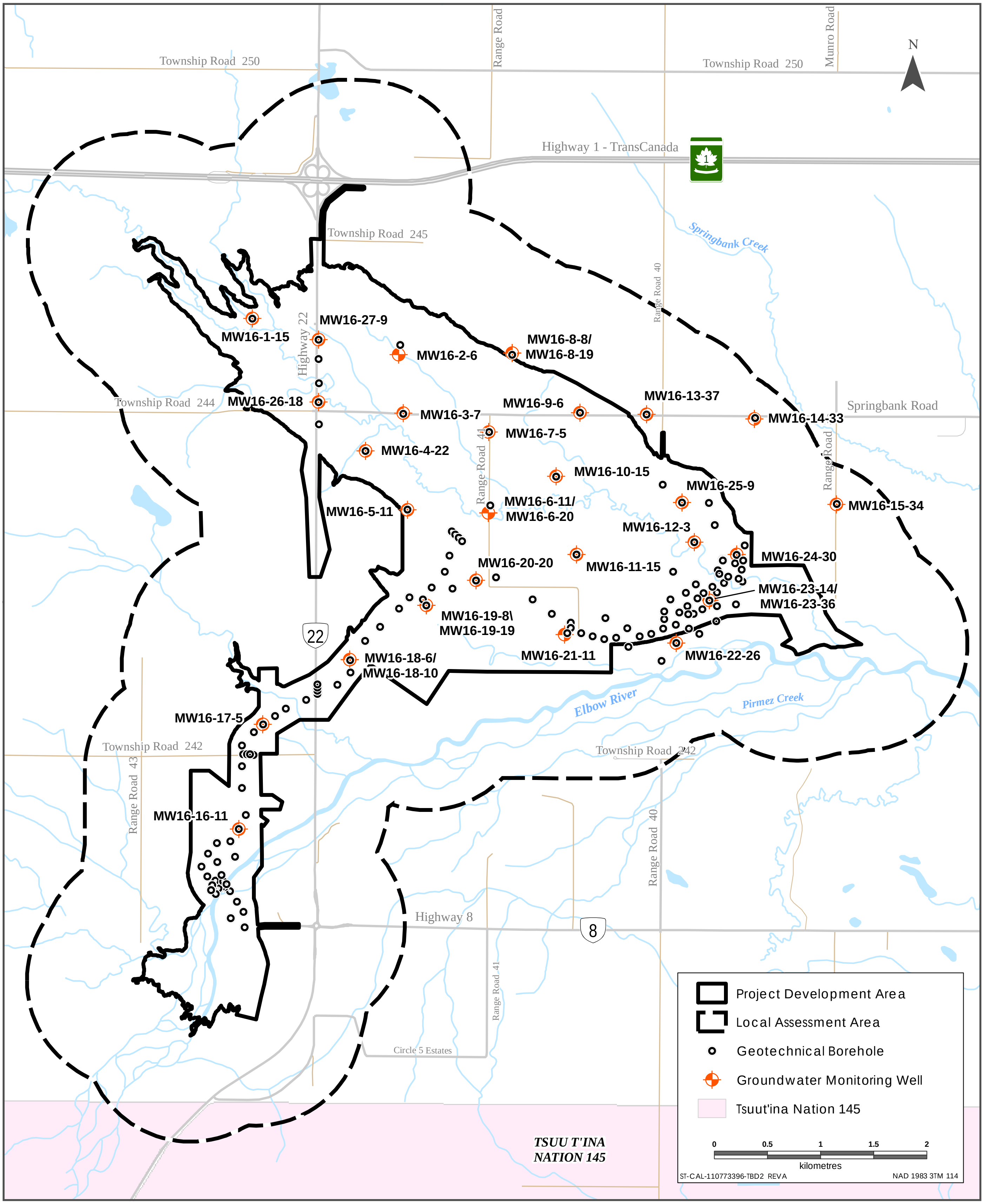
The hydrogeological field program plan was developed based on the existing hydrogeologic information presented in Section 2.1 and the Project design. The planned geotechnical field program was also reviewed to reduce redundancies in drilling locations such that information from both investigations could be better used in a synergistic manner. Table 2-1 summarizes the instrumentation installed during the borehole drilling and monitoring well installation program. The borehole and monitoring well locations are presented in Figure 2-2. The locations were chosen based on the information in the preliminary hydrostratigraphic framework, as well as land access restrictions and physical constraints identified in the field, including underground utilities, pipeline right-of-way, and drilling rig access restrictions.

Prior to drilling, borehole locations were staked in the field. Once staked, the locations were surveyed, and utility sweeps were conducted around each borehole location. Alberta One Call underground utility locates were then completed.

The field program included drilling the following boreholes (summarized in Table 2-1) which were completed to characterize the hydrostratigraphy of the LAA:

- 17 shallow boreholes completed to depths ranging from 3.1 m to 25.9 m BGL to assess the unconsolidated Quaternary aged deposits
- 15 deep boreholes completed to depths ranging from 10.5 m to 42.7 m BGL to characterize the upper bedrock units

The installations summarized above also included nested installations at five locations, with one well completed in the unconsolidated deposits and one well completed deeper in bedrock in the same location. The nested installations were completed to characterize the deeper hydrostratigraphy and to determine the vertical hydraulic gradients beneath the LAA.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Groundwater Monitoring Well and Geotechnical Borehole Locations

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Figure 2-2

Table 2-1 Monitoring Well Completion Details

Well Name	Borehole Name	3TM East[1]	3TM North[1]	Ground Elevation (m ASL)	Total Borehole Depth (m BGL)	Screen from (m BGL)	Screen to (m BGL)	Water Level Elevation - September 2016 (m ASL)	Completion Unit	Pressure Transducer/ Logger Installed	Response Test Completed
MW16-1-15	GW1	5659967.3	-33327.5	1211.71	16.8	12.2	15.2	1207.83	Sandstone	Yes	Yes
MW16-2-6	GW2	5659623.9	-31947.3	1204.26	13.7	3.1	6.1	1203.52	Glaciolacustrine Clay		
MW16-3-7	GW3	5659073.5	-31904.4	1201.07	7.6	3.7	6.7	1199.89	Glaciolacustrine Clay and Silt		
MW16-4-22	GW4	5658717.4	-32259.3	1204.30	22.9	18.6	21.6	1200.97	Sandstone		Yes
MW16-5-11	GW5	5658164.7	-31863.2	1210.63	22.9	8.2	11.3	1208.32	Sandstone		
MW16-6-11	GW6S	5658135.3	-31100.5	1195.44	10.7	7.3	10.4	1195.28	Glacial Till	Yes	
MW16-6-20	GW6D	5658133.9	-31100.4	1195.51	22.9	18.9	21.9	1195.37	Claystone/Siltstone	Yes	Yes
MW16-7-5	GW7	5658895.2	-31098.8	1199.28	9.1	2.1	5.2	1198.14	Glaciolacustrine Clay and Silt	Yes	
MW16-8-8	GW8S	5659641.1	-30875.7	1218.16	7.9	6.1	7.6	1212.02	Glacial Till	Yes	
MW16-8-19	GW8D	5659641.2	-30877.5	1218.13	20.4	16.5	18.6	1213.88	Sandstone	Yes	Yes
MW16-9-6	GW9	5659076.8	-30236.4	1204.52	6.1	4.3	5.8	1204.29	Glaciolacustrine Clay and Silt		Yes
MW16-10-15	GW10	5658478.2	-30461.4	1195.40	18.3	12.2	15.2	1192.75	Glacial Till		Yes
MW16-11-15	GW11	5657742.9	-30269.8	1193.68	15.2	11.6	14.6	1193.06	Glacial Till		
MW16-12-3	GW12	5657858.3	-29160.3	1189.98	12.2	1.5	3.1	1187.23	Glacial Till	Yes	
MW16-13-37	GW13	5659064.0	-29610.3	1222.34	37.2	33.5	36.6		Claystone		
MW16-14-33	GW14	5659018.4	-28592.2	1202.24	33.5	30.5	33.5	1175.75	Siltstone/Claystone		
MW16-15-34	GW15	5658214.9	-27818.8	1190.10	35	32.9	34.4	1172.94	Siltstone	Yes	
MW16-16-11	DC-9	5655154.3	-33453.6	1227.47	14.1	7.6	10.7	1226.12	Glacial Till		
MW16-17-5	DC-15	5656140.6	-33226.5	1213.52	11.2	3.7	5.2	1208.97	Glaciolacustrine Clay		
MW16-18-6	DC-21S	5656749.5	-32406.6	1216.04	6.1	4	5.5	1212.69	Basal Silt and Sand	Yes	
MW16-18-10	DC-21D	5656750.6	-32406.7	1216.03	12.5	9.1	10.6	1212.94	Claystone		Yes
MW16-19-8	DC-25S	5657262.2	-31684.6	1202.73	7.6	6.1	7.6	1198.88	Basal Silt and Sand		
MW16-19-19	DC-25D	5657263.2	-31684.5	1202.80	23.2	17.1	18.6	1200.02	Sandstone		Yes
MW16-20-21	D2	5657498.6	-31218.4	1206.60	21.3	19.8	21.3	1191.40	Sandstone		
MW16-21-11	D9	5656987.1	-30383.8	1202.61	14.1	9	10.5	1193.00	Sandstone		
MW16-22-26	D27	5656907.3	-29330.9	1190.70	27.4	22.9	25.9	1182.94	Glacial Till		
MW16-23-14	D36S	5657309.6	-29019.7	1190.54	14	11	14	1186.74	Glacial Till		
MW16-23-36	D36D	5657308.3	-29019.3	1190.56	45.7	35.68	37.18	1187.18	Siltstone		
MW16-24-30	D51	5657740.5	-28761.8	1194.50	30.8	29	30.5	1186.37	Sandstone		Yes

Table 2-1 Monitoring Well Completion Details

Well Name	Borehole Name	3TM East[1]	3TM North[1]	Ground Elevation (m ASL)	Total Borehole Depth (m BGL)	Screen from (m BGL)	Screen to (m BGL)	Water Level Elevation - September 2016 (m ASL)	Completion Unit	Pressure Transducer/ Logger Installed	Response Test Completed
MW16-25-9	BS3	5658231.0	-29274.7	1197.44	9.4	6.1	9.1	1190.50	Glacial Till		Yes
MW16-26-18	H6	5659178.1	-32702.7	1204.56	18.3	15.8	18.3	1204.41	Claystone	Yes	
MW16-27-12	H9	5659766.2	-32702.3	1207.67	18.9	10.1	11.6	1207.45	Glacial Till		

NOTE:
[1] Coordinate system is NAD83 3TM 114

The 32 boreholes and monitoring wells were completed between May 1 and August 29, 2016. The drilling program was completed in conjunction with the geotechnical drilling program, which was conducted from March 21 to August 25, 2016. The hydrogeology drilling program was completed by All-Service Drilling and included a combination of auger, ODEX and rotary coring. A hydrogeologist was on-site for the drilling and monitoring well installations, and performed the following tasks:

- coordinating land access
- reviewing borehole locations and utility locates
- supervising subcontractors
- logging of the auger cuttings, ODEX returns and core
- determining appropriate well completion intervals based on field observations

To maintain consistency with the geotechnical drilling program, the borehole names for the monitoring wells that overlap between the geotechnical and hydrogeological drilling programs include a prefix to reference the following Project components:

- D – dam
- DC – diversion channel
- DS – river structures (service spillway and diversion inlet)
- BS – borrow source
- H – highway embankment and bridge

Boreholes with the monitoring wells installed use the prefix “MW” for monitoring well, followed by the year of installation, a unique well identifier and the approximate completion depth in metres. For example, monitoring well MW16-1-15 was completed in 2016 at location 1 and the bottom of the completion interval is at a depth of approximately 15 m BGL.

Drilling of the unconsolidated material above bedrock was completed using a track- or truck-mounted auger drilling rig. Drilling through the bedrock material involved a combination of auger drilling where conditions would allow (if weathered or weakly lithified bedrock was encountered), air rotary, and rotary coring where required as part of the geotechnical field program.

Samples were collected at varying intervals in conjunction with the geotechnical drilling program and included undisturbed Shelby tube samples and bulk samples of auger cuttings. Samples were stored in moisture-tight containers and transported to a laboratory in Calgary for testing. While most sampling and testing was specific to the geotechnical investigation, the following tests were also used to support the hydrogeological assessment:

- moisture content (ASTM D2216, CSA A23.2-11A)
- particle size distribution by sieve analysis (ASTM D422)

- particle size distribution by hydrometer (ASTM D422)
- permeability test, flexible wall/falling head (ASTM D5084)

Borehole logs for each hydrogeological drilling location are presented in Attachment A.

The shallower monitoring wells were installed with screened intervals within the first water-bearing unit encountered. The deeper (bedrock) monitoring wells were installed in the first water-bearing bedrock unit, excluding the weathered upper portion of the bedrock, which was generally in hydraulic communication with the unconsolidated deposits.

Monitoring wells were constructed of 51 mm (2”) flush threaded Schedule 40 polyvinyl chloride (PVC) pipe and end caps. Well screens were constructed from flush threaded 10 slot (0.010”) PVC. The length of well screens varied from 1.5 to 3.1 m depending on the characteristics of the water-bearing interval encountered. Shorter screens were used where discrete water-bearing intervals could be identified and targeted, while longer screens were used where water-bearing intervals were thicker or not easily identifiable. Monitoring wells were completed with either flush-mounted protectors or aboveground steel casing protectors installed over the PVC well casing, depending on landowner requirements. Monitoring well completion details are presented in the borehole logs in Attachment A.

Following drilling and completion of the monitoring wells, each well was developed by pumping until most fines were removed or until dry (in the case of low-yielding wells). The purpose of development was to remove fine-grained materials from around the filter pack, improve the hydraulic efficiency of the filter pack and improve hydraulic communication between the filter pack and geologic formation. Well development results in more representative groundwater samples, hydraulic head measurements, and improved hydraulic conductivity estimates.

A horizontal and vertical (geodetic) survey of new monitoring well locations was completed, which allowed for the determination of accurate top of well-casing elevations and water-level elevations based on depth to water measurements. Precise elevation control is required for interpretation of hydraulic gradients and groundwater flow. Survey coordinates for the well locations are presented in Table 2-1.

2.4 HYDRAULIC CONDUCTIVITY TESTING

After the new monitoring wells were developed and water levels had recovered to static, rising head response tests were completed at 10 representative monitoring wells to collect information to estimate the hydraulic conductivity of the materials adjacent to the completion intervals.

In addition to the single well response tests, packer testing was completed as part of the geotechnical drilling program. In total, 37 single packer permeability tests were conducted in five boreholes to determine the permeability of the bedrock interval. The tests were completed at the base of the borehole after the borehole had been advanced to its maximum depth.

2.5 GROUNDWATER MONITORING AND ANALYSIS

The groundwater monitoring and sampling program was conducted between September 27 and October 6, 2016. It included the following tasks:

- measuring and recording depth to water and depth to bottom of well (total depth)
- purging each monitor of three well volumes or until they were essentially dry, using a combination of dedicated bailers and electric pumps
- obtaining field measurements of temperature, pH and electrical conductivity at the time of sample collection
- labelling sample containers with the monitor number, date of collection and analyses required, prior to collection of the sample
- collection and preservation (where required) of representative groundwater samples in laboratory-supplied containers
- collection of blind duplicate samples for quality assurance and quality control (QA/QC) purposes
- transport of samples in temperature-moderated coolers and submission of samples to Maxxam Analytics laboratory in Calgary, Alberta

In total, 31 of the 32 new monitoring wells were monitored and sampled. The remaining monitoring well (MW16-13-37) could not be located and may have been destroyed during re-grading and addition of gravel to fix rutting caused during the drilling program. In total, 33 samples, including two duplicate QA/QC samples, were submitted for analysis of the following parameters in order to characterize existing groundwater chemistry:

- routine chemistry parameters
- dissolved metals (including low-level mercury)
- total mercury (low level)
- nutrients (ammonia, total Kjeldahl nitrogen, orthophosphate, phosphorus)
- dissolved organic carbon (DOC)
- benzene, toluene, ethylbenzene, xylenes and F1 to F2 fraction hydrocarbons
- bacteriological parameters (heterotrophic plate count, total coliforms, fecal coliforms)

Data logging pressure transducers were installed in 10 monitoring wells during the groundwater monitoring program to record ongoing pressure data. The locations of the data logging pressure transducers were chosen to achieve spatial distribution across the LAA and to include the various hydrostratigraphic units. One barometric pressure transducer was also deployed to record atmospheric pressure required to correct the pressure data from the other unvented transducers installed in monitoring wells. All loggers were set to record pressure data on an hourly basis. The data was downloaded from the loggers and used to calculate potentiometric elevations calibrated with manual field measurements.

2.5.1 Quality Assurance and Quality Control

Quality assurance and quality control protocols were implemented during sample collection, storage and transport, including:

- use of disposable nitrile gloves and dedicated bailers for purging monitoring wells and collecting samples
- decontamination and rinsing of the water level meter and water quality probe with demineralized water between each monitoring well
- storage of samples at moderate temperature in coolers during storage and transport
- collection of duplicate groundwater samples during monitoring
- submission of samples to Maxxam Analytics Inc., a Canadian Association for Laboratory Accreditation accredited laboratory, under standard chain of custody protocols

Duplicate groundwater samples were collected as part of the QA/QC program to evaluate the precision or reproducibility of the analytical data between samples. Two blind, duplicate samples were submitted along with the groundwater sample submissions.

2.6 DEVELOPMENT OF THE THREE-DIMENSIONAL CONCEPTUAL SITE MODEL

This section summarizes the process used to construct the 3D conceptual site model (3D CSM). A discussion of the salient features of the 3D CSM is presented in Section 3.1 along with related mapping products derived from the 3D CSM generation and workflow.

The publicly available historical data summarized in Section 2.1 and the Project-specific field data were used to build a 3D CSM for the groundwater resources within the RAA. The 3D CSM covers approximately 81,000 ha as an orthogonal domain that contains the 43,050 ha RAA.

The intent of the 3D CSM was to synthesize the available data to:

- improve the understanding of the local and regional physiographic setting
- develop a hydrostratigraphic framework of the RAA with consistent topology
- provide the basis for the numerical groundwater flow model

The 3D CSM platform allows for more effective conceptualization and clearly demonstrates the relationships between the geology, hydrogeology, monitoring network and other physical features of the RAA. The larger area covered by the 3D CSM also allows data from outside the RAA to improve the resolution of the geological/hydrogeological framework inside the RAA. The 3D volumes created in the model can also be exported directly for use in numerical modelling software.

LiDAR data for the RAA were obtained from AltaLIS to form the topographical layer of the model. The AltaLIS "LiDAR 15 DEM" data were processed into 15-m post spacing with an accuracy of 30 cm, which is used to create a high-resolution digital elevation model (DEM). Recent air photo coverage of the RAA, regional maps and GIS shapefiles were also added to the model and overlaid on the topography.

Construction of the modelled surfaces and volumes was based on the compilation of stratigraphic structure elevation interpretations (picks) from the borehole drilling program described in Section 2.2, additional picks from selected records held in the Alberta Water Well Information Database (AWWID), mapped bedrock outcrop locations and bedrock elevation picks from the HCL (2002) regional groundwater assessment of the area. Regional geological reports and mapping products described in Section 2.1 were also used to guide the interpretation of the hydrostratigraphic framework. In total, 2,050 unique well records obtained through project-specific field work and through analysis of public data resources were used to generate the geological and hydrogeological framework of the RAA.

Lithological data for areas within the LAA used the 32 borehole logs from the hydrogeological field investigation and the additional 125 borehole logs from the geotechnical investigation. Additional lithological data for both the LAA and RAA were obtained from bedrock elevation picks established by HCL (2002), recent water well drilling records from the AWWID postdating the HCL (2002) analysis, and interpretations based on regional mapping products discussed in Section 2.1. In total, 1,745 bedrock elevation picks from the HCL (2002) report were incorporated into the model; well records that did not encounter bedrock were culled from the data used in the 3D CSM.

Development of the hydrostratigraphic framework within the LAA was derived primarily from the interpretation of borehole lithologies and descriptions. For areas outside the LAA, the unconsolidated deposits were interpreted based on AGS Map 601 (Fenton et al. 2013) and assumed unit thicknesses based on drilling results within the LAA. An additional 149 AWWID records that were not considered in the HCL (2002) analysis that were outside the LAA (but within the RAA) were added to the model to provide additional interpretation and verification of the modelled surfaces.

Figure 2-3 presents the distribution of the monitoring wells, AWWID drilling records and HCL (2002) bedrock picks across the 3D CSM domain.

The compiled hydrostratigraphic picks were used to develop the 3D CSM using Leapfrog Works™ software. The modelling was completed in an iterative process whereby reinterpretation or culling of boreholes that were inconsistent with the overall hydrostratigraphic framework was conducted during each iteration.

An interpreted water table surface—for the unconsolidated deposits and potentiometric surface for the bedrock units—was created for the RAA. A potentiometric surface represents the elevation to which water rises in an open standpipe due to pressure in the aquifer. Where the potentiometric surface is not confined, it is equivalent to the water table in the unconfined areas of the aquifer. To compare and analyze the potential effects of confining conditions, a water table surface (phreatic surface) for the surficial geology and a potentiometric surface from deeper within the bedrock unit have been prepared and compared against each other.

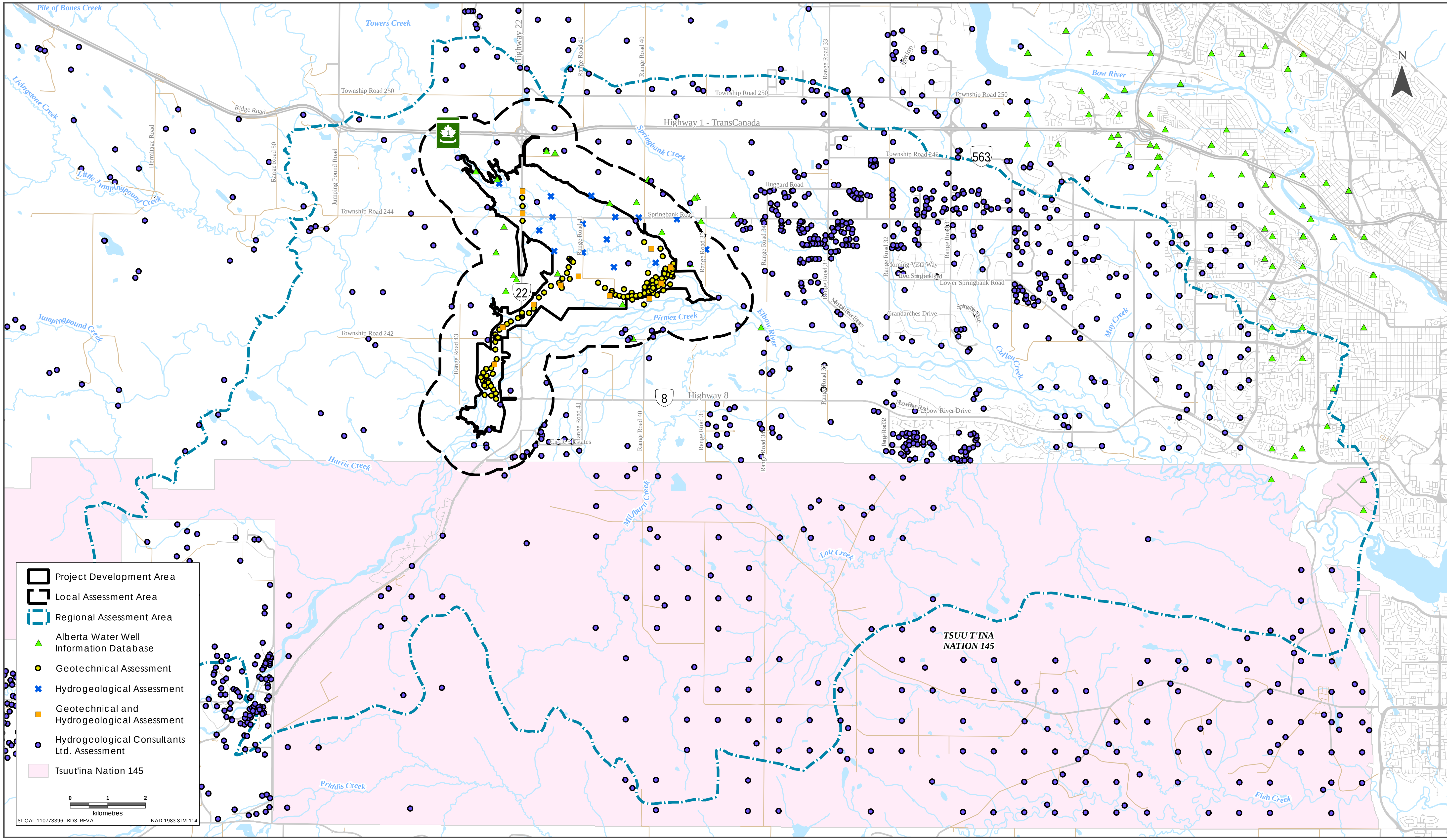
The water table surface in the unconsolidated deposits is based on a combination of Project-specific groundwater monitoring data, water level data from AWWID drilling records with a total depth of less than 20 m BGL, and surface water elevations where shallow groundwater intersects the land surface (e.g., dugouts, wetlands, creeks, groundwater springs). The water levels within the LAA are well described, based on the data gathered during the Project-specific field program. Outside the LAA, water levels were derived from the AWWID and LiDAR data. Hydraulic head values were calculated based on elevations obtained from the LiDAR data for the Project and the recorded non-pumping static water levels in the database. Once these water table specific hydraulic head data were compiled, the water table surface was interpolated using geostatistical methods. A conditional statement was then applied to the interpolated water table surface to limit the areas it was predicted to be above land surface to the ground surface elevation.

Data on water levels that were stored in the AWWID required processing to records that are not representative of the upper bedrock units. Water levels for individual well records in the AWWID were manually removed if:

- wells were completed at depths greater than 80 m BGL
- they appeared anomalous compared with water levels in nearby groundwater wells
- the completion interval was inconsistent with surrounding wells

In the case of multiple adjacent completions, the well with the uppermost completion interval was used to reduce the possible effect of vertical hydraulic gradients on the gridded potentiometric surface.

Despite screening of the data, variations in the potentiometric surfaces may have also resulted from uncertainty in the elevation control based on the digital elevation model (DEM), temporal variations in water level measurements, pumping conditions at measured or nearby wells, multiple aquifer completions, vertical hydraulic gradients, and groundwater flow.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Lithological Data Used in the 3D CSM

Figure 2-3

3.0 3D CSM RESULTS FOR THE HYDROSTRATIGRAPHIC FRAMEWORK

The conceptual hydrostratigraphic framework for the LAA and RAA presented in this section is based on the 3D CSM.

Figure 3-1a presents an oblique view of the 3D CSM looking from the east with the RAA boundary overlain on the model and air photograph for reference. Figure 3-1a also shows the Tsuut'ina Nation 145 Reserve as a transparent polygon on the air photograph for reference. It should be noted that all the oblique views of the model except for the bedrock subcrop areas (Figure 3-4) are shown in the same orientation. Figure 3-1b shows the same view with a transparent model domain with all the lithological interval data integrated into the 3D model. The detail on Figure 3-1b depicts the multi-coloured interval data representing different geological media projected onto each borehole trace.

The black intervals represent undifferentiated bedrock material, as was reported in borehole logs from the AWWID. This convention is used to present the bedrock as a single volume in the 3D CSM. However, in the Project-specific boreholes where the bedrock lithology has been described in detail, the more porous and permeable intervals (sandstone and siltstone) are depicted in red, while the less permeable intervals are depicted in grey (claystone, mudstone and shale). Above the bedrock, the unconsolidated deposits are depicted on the borehole traces as follows:

- yellow – basal silt, sand and gravel
- green – till
- dark brown – glaciolacustrine clay
- orange – recent fluvial sand and gravel

Minor coal seams and thin bentonite beds were also noted in some boreholes but are not visible at the scale of the figure.

A regional stratigraphic column that shows the generalized stratigraphy beneath the expanded RAA is depicted in Figure 3-2. Brief descriptions of each stratigraphic unit, and a discussion of the additional salient features of the model are presented below. The descriptions and interpretation are based on the existing geological data sources summarized in Section 2.6 and information gathered as part of the hydrogeological and geotechnical field programs for the Project, as described in Sections 2.3 to 2.5.

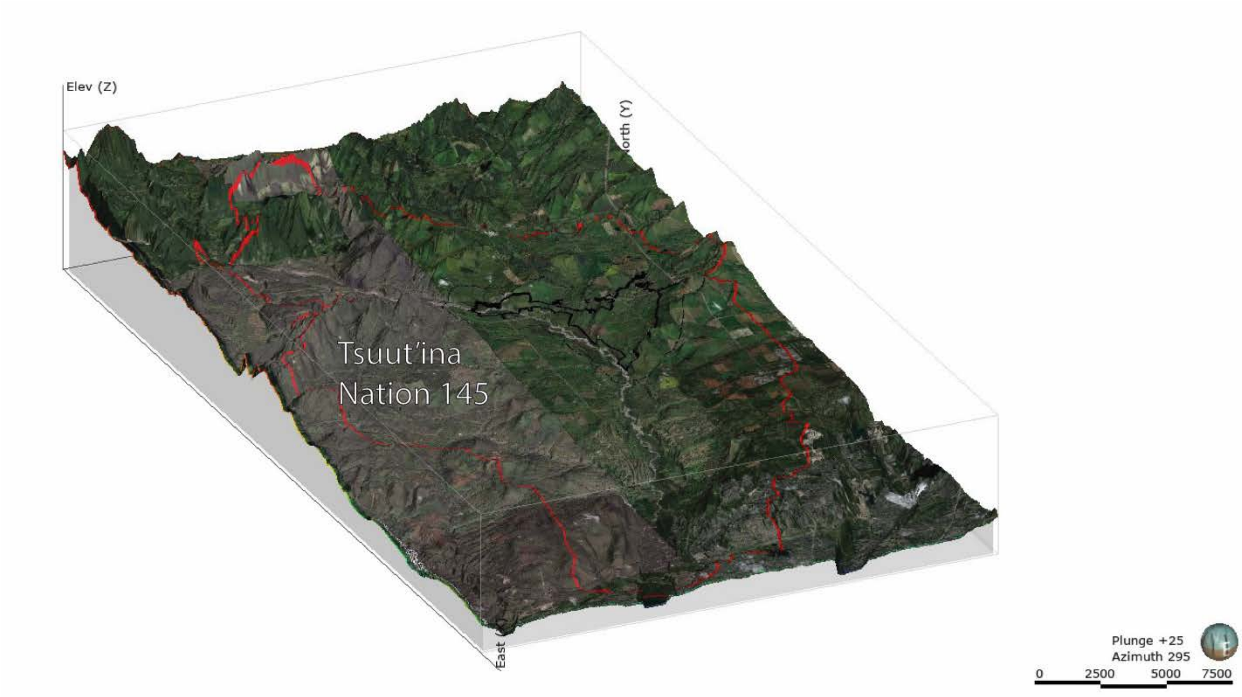


Figure 3-1a Oblique Angle Overview of 3D CSM

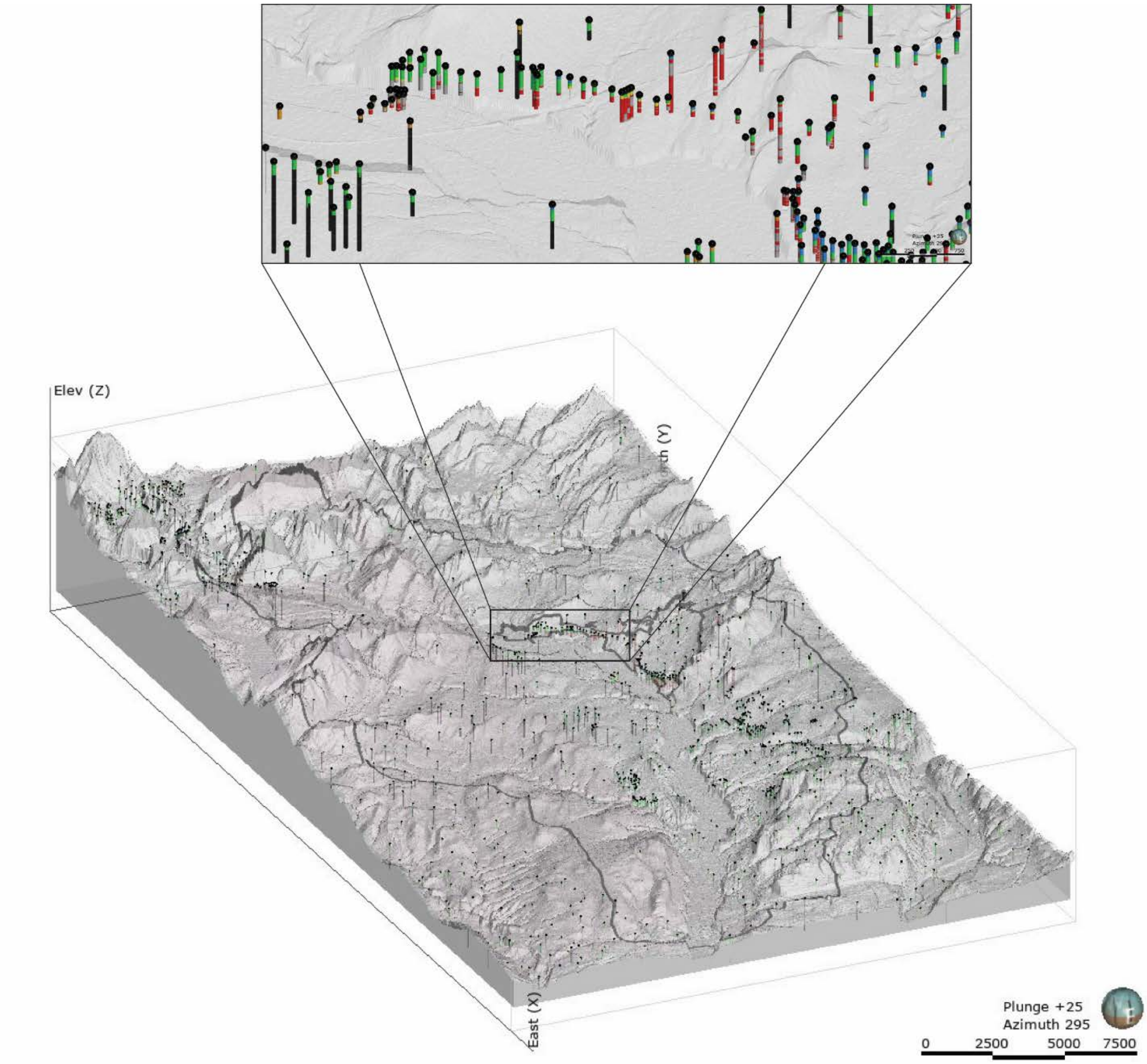


Figure 3-1b Overview of 3D CSM Subsurface Data Distribution

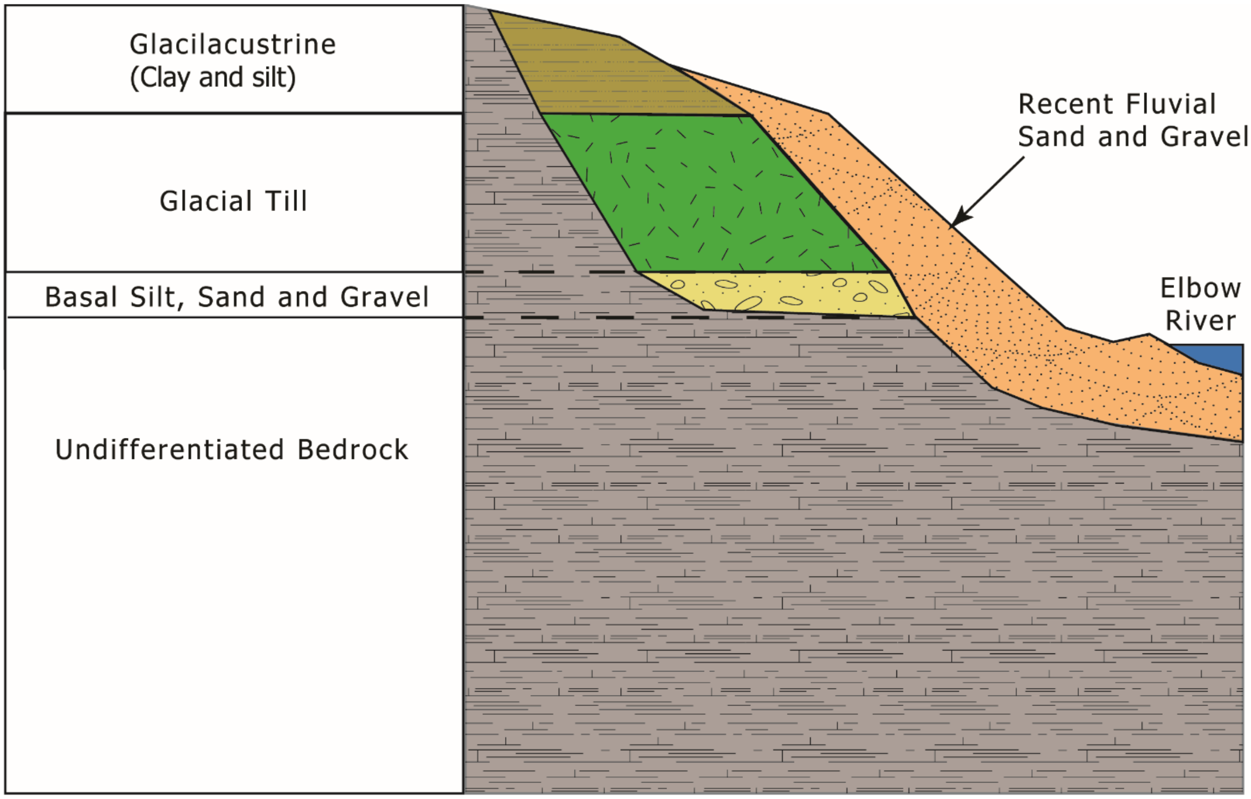


Figure 3-2 Regional Stratigraphic Column

3.1 TOPOGRAPHY

The ground surface topography of the RAA is depicted by the DEM in Figure 3-3. The Tsuut'ina Nation Reserve and the hydrogeology PDA and LAA are also shown as an overlay for reference. Areas of higher elevation are denoted by red, and they grade down to areas of relatively low elevation, denoted by blue as shown on the colour scale. The topographic elevation ranges from approximately 1,365 m ASL on the bedrock ridges in the southwest corner of the RAA to approximately 1,125 m ASL along Elbow River at the eastern boundary.

The topography on the north side of the RAA consists of a series of ridges and valleys that are oriented northwest to southeast. The topography of most of the RAA is generally controlled by the bedrock structure, particularly in the southwest and, to a lesser extent, the patterns of glacial sediment deposition modify the topography in lower areas. Prominent ridges through the RAA are a result of formations that are more resistive to weathering; the valleys in between the ridges are more easily weathered or recessive.

Near Elbow River and Jumpingpound Creek, the terrain is incised with one or more fluvial terraces within the river valleys. Hummocky regions have low to moderate relief, with gentle slopes that vary between 2% and 15%. Areas with low relief are generally underlain by till or glaciolacustrine sediments, while areas of moderate relief are underlain by till and glaciofluvial sediments. Outcrops of bedrock occur along ridges in the lower areas of the RAA and are moderately weathered and fractured but are generally covered by a thick sequence of unconsolidated sediment.

There are topographic highs in areas both north and south of Elbow River in the southwest portion of the RAA, which are interpreted to be deformed bedrock features with a thin veneer of overlying unconsolidated sediment.

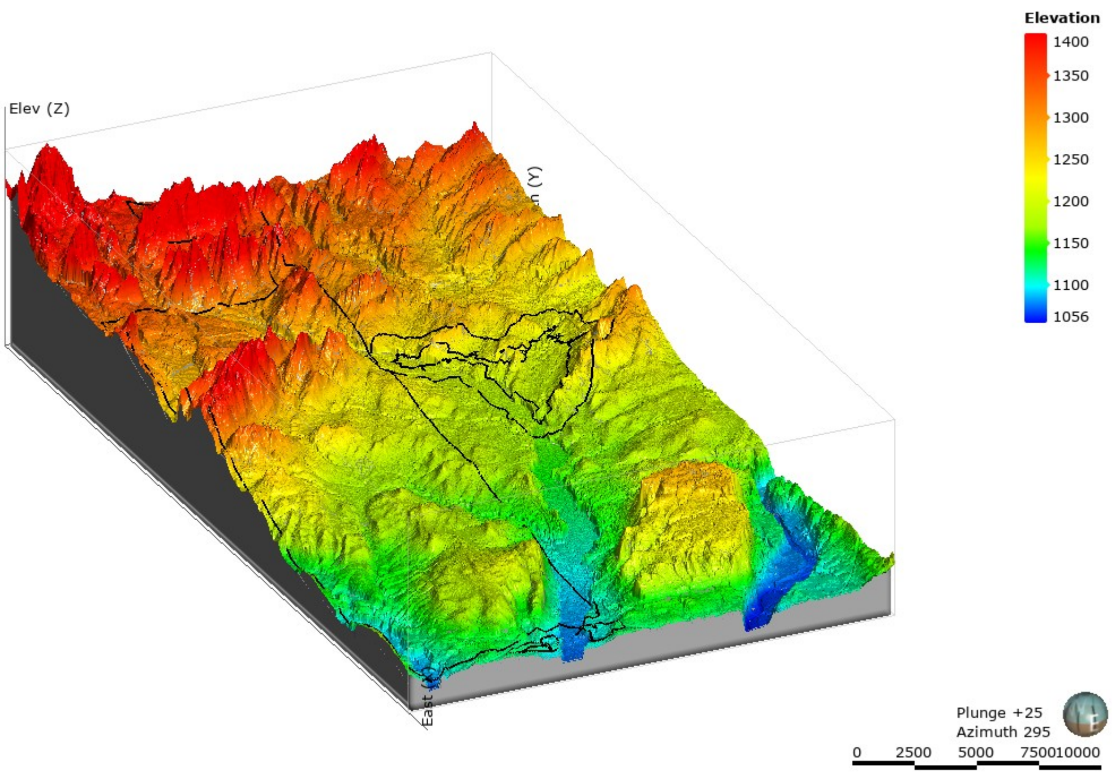


Figure 3-3 Topography of the Expanded RAA

3.1.1 Bedrock

The bedrock surface within the RAA was shaped by, primarily, tectonism and associated formation of the Rocky Mountains to the west, glacial erosion/deposition, and erosional incision of modern-day river channels. The RAA is located in the disturbed belt that forms a transitional zone (foothills) between the Rocky Mountains to the west and prairie to the east. Bedrock topography is depicted in Figure 3-4. The Tsuut'ina Nation Reserve, PDA, and the hydrogeology LAA are also shown as an overlay for reference.

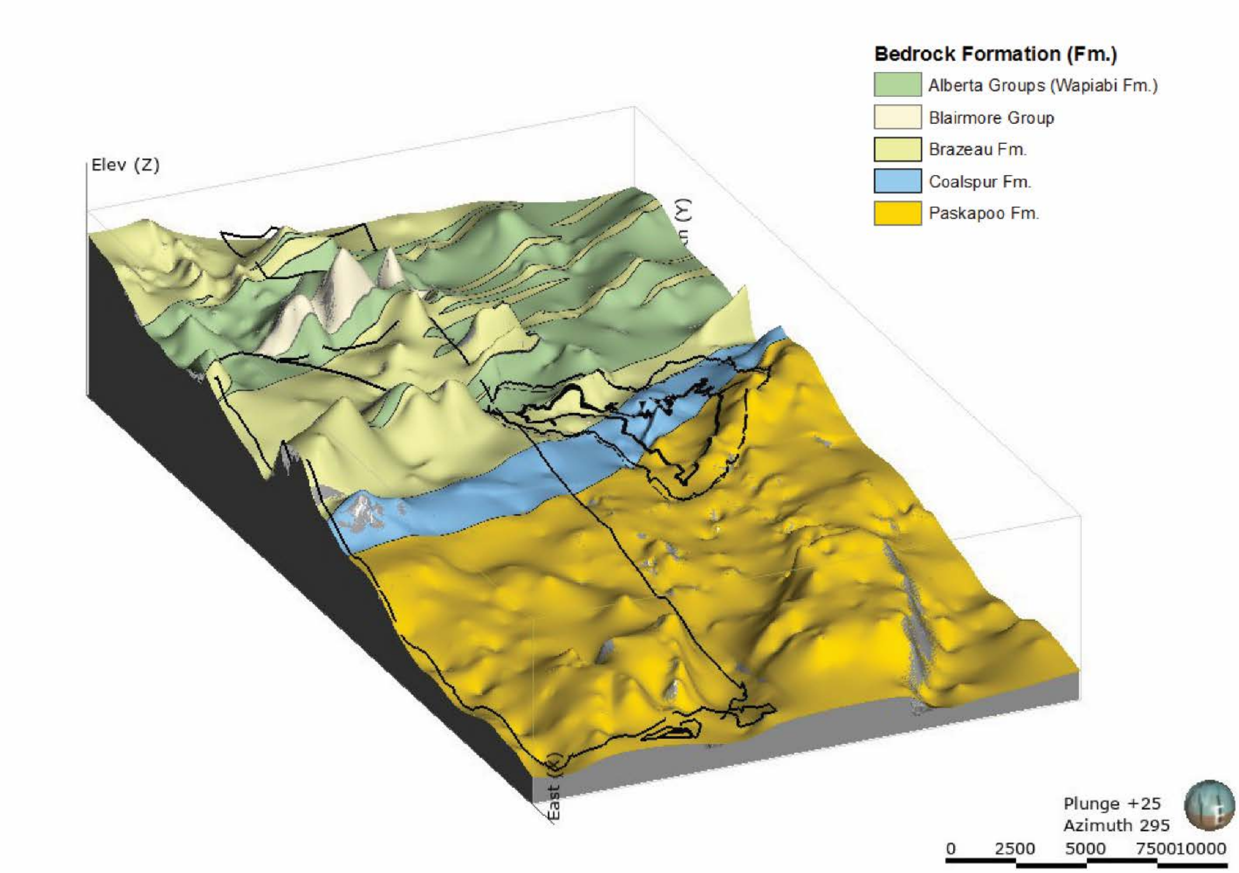


Figure 3-4 Bedrock Topography and Subcrop Formations

The bedrock units encountered beneath the quaternary deposits are presented below from oldest to youngest (this generally coincides with how they appear from west to east across the RAA except for the Blairmore Group:

- Blairmore Group. The Lower Cretaceous Blairmore Group dominantly composed of fluvial sediments. The two fluvial formations belonging to the upper Blairmore Group include the Beaver Mines and Mill Creek formations (Langenberg et al., 2000). This unit subcrops over a small topographically elevated area in the southwest of the RAA.
- Wapiabi Formation. The Upper Cretaceous-aged Wapiabi Formation of the Alberta Group is generally composed of shale and mudstone with minor siltstone, with the exception of the Chungo and Marshybank Members, which are sandstone dominated (Pana and Elgr 2013).
- Brazeau Formation. The Upper Cretaceous-aged Brazeau Formation is composed primarily of sandstone and laminated siltstone, along with olive green mudstone and granule to pebble conglomerate in the lower part. The upper part is composed of greenish-grey to dark grey mudstone, siltstone and greenish-grey sandstone. Thin coal and coaly shale beds and thin bentonite layers also occur in the upper part (Prior et al. 2013). In the foothills, the Brazeau Formation is the approximate lateral equivalent of the Scollard Formation on the plains (Hamblin 2010).
- Coalspur Formation. This Upper Cretaceous to Tertiary aged deposit formed as a marginal marine fluvial infill of the foreland basin. The Coalspur Formation is composed of thinly bedded to massive sandstone, siltstone, light grey to olive green mudstone, shale, coaly shale, coal seams and minor volcanic tuff in the lower portions (Pana and Elgr 2013).
- Paskapoo Formation. The Tertiary-aged Paskapoo Formation is made up of thick tabular sandstone, siltstone and mudstone (Glass 1990). The sandstones are fine to coarse grained and are cliff forming. The Paskapoo Formation also contains a significant amount of shale, carbonaceous shale, siltstone, rare coals seams and shell beds (Pana and Elgr 2013). In the central Rocky Mountains and foothills, the Paskapoo Formation is dominated by recessively weathering, grey to greenish-grey mudstone and siltstone with subordinate pale grey, thick- to thin-bedded, commonly cross-stratified sandstone; minor conglomerate; mollusc coquina; and coal (Prior et al. 2013). The Paskapoo Formation is the primary bedrock aquifer in the Elbow River watershed. Due to the stratigraphy of the layers of sandstone and shale within this formation, multiple aquifers occur at various depths in the rock (Waterline 2011). In the Project area, the yield value for the Paskapoo Formation aquifer is 35–175 m^3/day (Waterline 2011).

The approximate subcrop boundaries of the bedrock units are presented in Figure 3-4 and are based on regional mapping by Pana and Elgr (2013), except for the contact between the Coalspur and Brazeau Formations. This contact was reinterpreted by Jerzykiewicz (1997) based on observation and description of the entrance conglomerate in outcrop along Highway 22. The entrance conglomerate marks the boundary between these two formations, and its presence was confirmed in the field.

In the 3D CSM, the bedrock units were not differentiated from one another in a plan sense or vertically for the following reasons:

- All bedrock units were found to have similar lithologies (alternating sandstone, siltstone and claystone) and were inferred to have similar hydraulic properties.
- Substantial fracturing was noted in the bedrock, but no spatial relationships between fracture angle, intensity or connectivity could be identified.
- No spatial correlation in hydraulic conductivity values was noted.
- Regional mapping by HCL (2002) indicated that the permeable units of the Brazeau, Coalspur and Paskapoo Formations have the same range of apparent transmissivity in the RAA, as discussed in Section 3.3.
- Marker horizons or distinguishing lithological characteristics required to make positive formation assignments were not identified on the borehole logs or in the core at the depths of the investigation.

The bedrock descriptions (included on the borehole logs in Attachment A) generally consist of varying thicknesses of alternating siltstone, sandstone mudstone and claystone. Descriptions of each of these lithological are as follows:

- Sandstone occurrence is grey to brown, fine to medium-grained sandstone ranging from completely unlithified to well cemented and dry. Significant fracturing was noted in many intervals, with oxidation common along fracture planes. The upper sandstone beds beneath the unconsolidated deposits were highly weathered. Thicknesses of individual sandstone beds ranged from thin, centimetre-scale beds to a maximum of 15.3 m and an average thickness of 2.5 m.
- Siltstone occurrence is grey to brown and, in some intervals, greenish-grey siltstone. It is extremely weak and friable to well cemented, and it is highly fractured in some intervals, with oxidation along fracture planes. The average thickness of the interbedded siltstone beds is 2.5 m.
- Claystone occurence is medium grey to brown, generally blocky and not fissile-like shale. It is dry except where fractures are saturated. Fracturing varied from completely unfractured to, more often, highly fractured with oxidation and alteration of clay along fractures. Claystone was interbedded with the other lithologies described above, with an average thickness 1.9 m for each of the interbedded layers.

Based on regional mapping by Pana and Elgr (2013), the Brazeau thrust fault is located in the western portion of the LAA between the proposed diversion structure and the existing Highway 22 bridge; however, it was not identified in borehole or outcrop during the course of the field program. The thrust fault (reverse fault dipping less than 45°) has pushed the hanging wall block in the west over the footwall block in the east. Thrust faults in the region result in older formations being thrust over younger formations. Although the fault was not identified, steeply dipping bedding angles were noted in the western portions of the LAA compared to sub-horizontal bedding in the east. This transition may mark the approximate location of the thrust fault.

3.1.2 Unconsolidated Sediment above Bedrock

As noted in Figure 3-2, the bedrock is shown as undifferentiated in grey at the base of the model. Moving upward in succession, the coarse-grained material at the base of the till is shown in yellow, and the till is shown in green. The glaciolacustrine clay is depicted in dark brown, and the recent fluvial deposits along the Elbow and Jumping Pound Rivers are depicted in orange. Each of these hydrostratigraphic units is described and spatial distribution within the CSM the domain is presented below.

3.1.2.1 Basal Silt, Sand and Gravel

In some portions of the LAA, a coarser grained unit occurs above the bedrock at the base of the till. This unit is most prominent near the Elbow River valley and consists of a mixture of brown sand, silt and gravel with variable fines. The distribution of the basal silt, sand and gravel deposits is shown in yellow in Figure 3-5. The Tsuut'ina Nation Reserve, PDA, and the hydrogeology LAA are also shown as an overlay for reference. While this unit may be more widespread within the RAA than the distribution shown, the data density in the PDA and LAA is sufficient, based on Project-specific data to allow correlation and mapping of this unit. An isopach thickness map of the basal silt, sand and gravel unit is presented for the LAA in Figure 3-6.

This unit was described in outcrop along Elbow River; outcrops were generally 0.5 m to 1.0 m thick and consist of clast-dominated diamicton. White and orange staining was noted, which indicates oxidation and mineral precipitation processes.

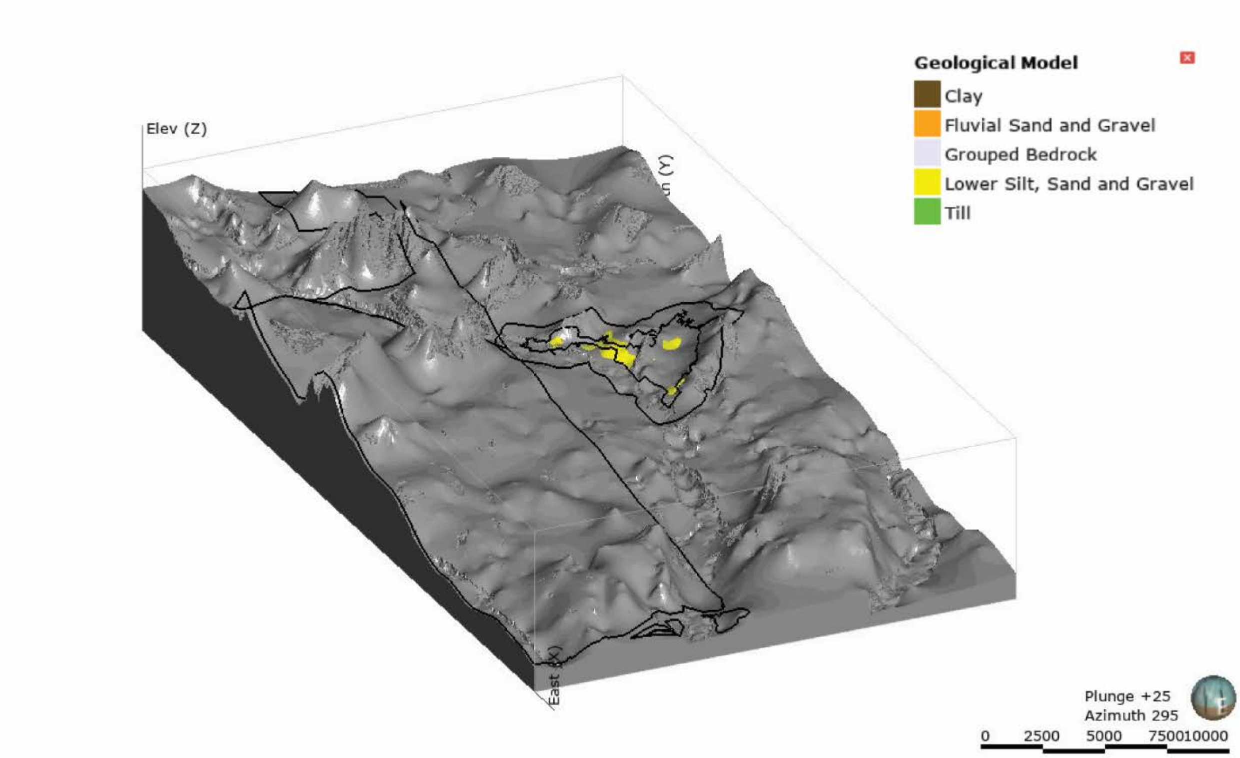
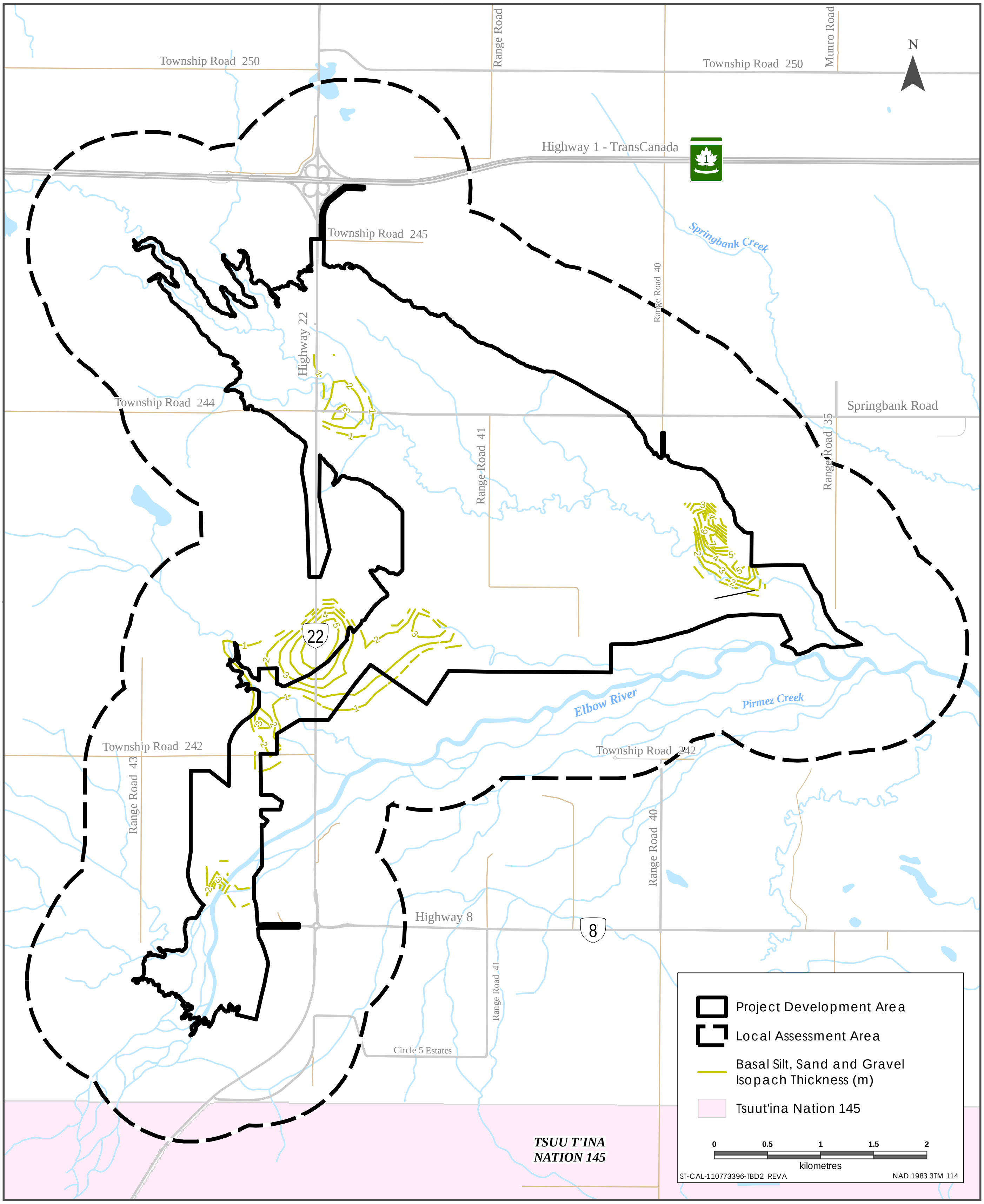


Figure 3-5 Distribution of Basal Silt, Sand and Gravel



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Isopach Map of the Basal Silt, Sand and Gravel

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Figure 3-6

3.1.2.2 Till

The unconsolidated deposits present beneath the majority of the RAA consist of Pleistocene Age glaciolacustrine clay and till (Fenton et al. 2013; Moran 1986). In the RAA, the till material was deposited by glacial ice as basal or lateral moraines. Based on the field observations and laboratory grain size analyses completed as part of the geotechnical drilling program, the till in the LAA is composed of a heterogeneous mixture of approximately equal parts clay and silt, a lower proportion of sand, and minor gravel. Silt and sand lenses are also present within the heterogeneous matrix. The till is described as generally stiff to very stiff or hard, medium to high plastic clay with silt and more minor sand.

Two main till sub-units are summarized as follows:

- Brown-grey subglacial till is dark brown to grey sandy, silty, clay with variable gravel. The till is described as hard with low to medium plasticity. The brow-grey subglacial till was encountered throughout the dam and diversion footprint. Cobble-sized clasts within the matrix were rounded to sub-rounded sandstones and carbonates.
- Upper brown till is a massive, matrix-supported, olive brown to brown, medium plastic clay, clay and silt with sand content increasing with depth. This unit was encountered in boreholes in the dam footprint and eastern portion of the diversion channel.

The till sub-units described above are not modelled in the 3D CSM due to their uncertain structure and because they share similar aquifer/aquitard properties.

The distribution of till across the RAA is depicted in green in Figure 3-7. The Tsuut'ina Nation Reserve, PDA, and the hydrogeology LAA are also shown as an overlay for reference. Figure 3-8 presents an isopach thickness map of the till material.

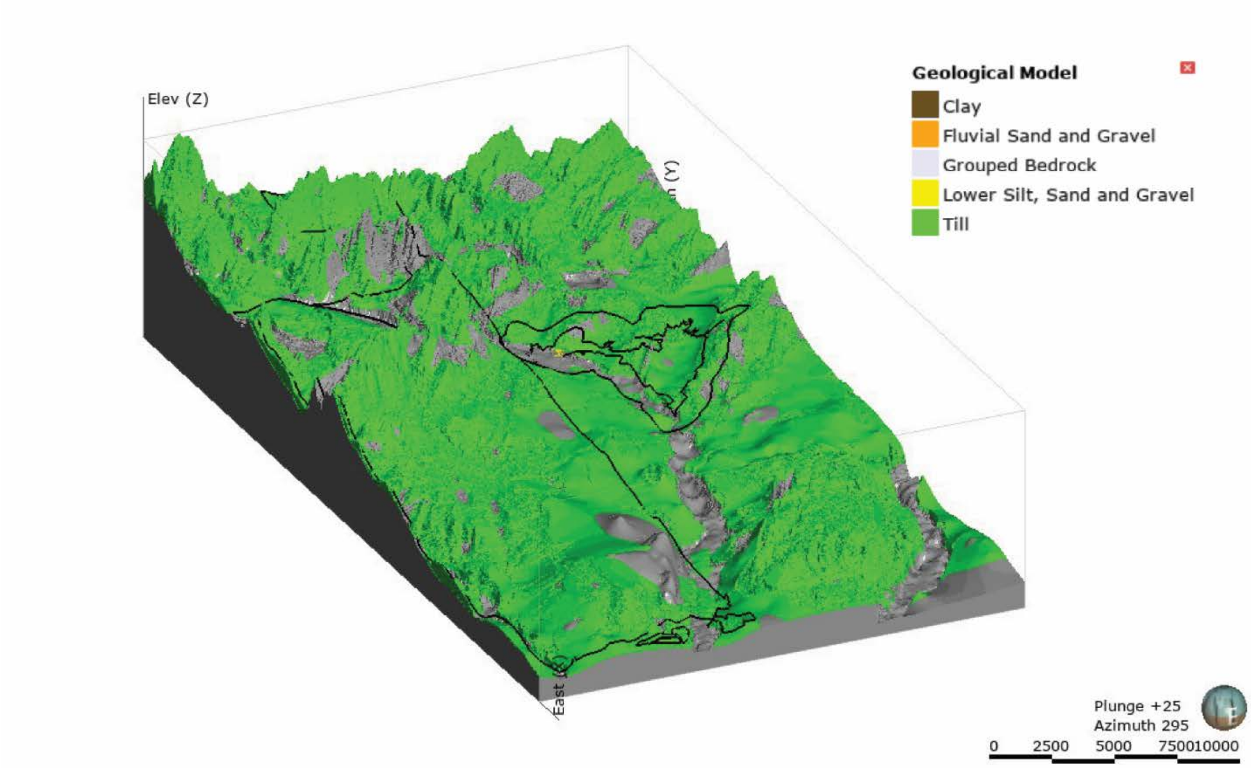

Figure 3-7 Distribution of Till

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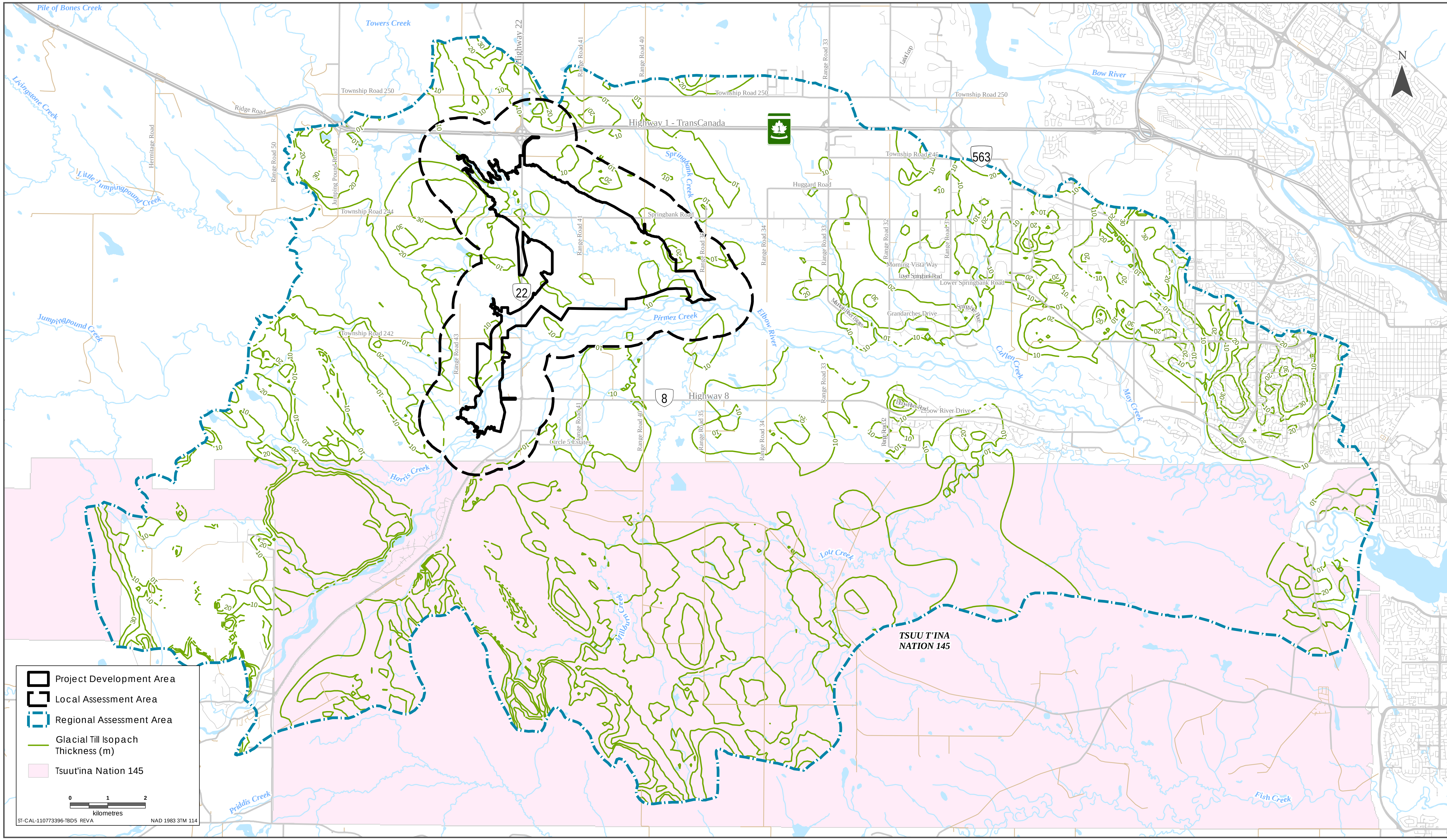
ENVIRONMENTAL IMPACT ASSESSMENT
HYDROGEOLOGY TECHNICAL DATA REPORT UPDATE

3D CSM Results for The Hydrostratigraphic FRamework
May 2019



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Glacial Till

Figure 3-8

3.1.2.3 Glaciolacustrine Deposits

Glaciolacustrine clay overlies the till in the low-lying areas of the LAA. The silty clay was deposited in Glacial Lake Calgary, a proglacial lake formed by ice damming during the last deglaciation. The glaciolacustrine deposits are named the Calgary Formation (Moran 1986).

The distribution of this unit is presented in blue in Figure 3-9. The Tsuut'ina Nation Reserve, PDA, and the hydrogeology LAA are also shown as an overlay for reference. Figure 3-10 presents an Isopach thickness map of the glaciolacustrine unit. Within the LAA, the glaciolacustrine clay averaged 5.3 m thick in the boreholes where it was encountered.

Based on the field observations and laboratory grain size analyses, the glaciolacustrine clay in the LAA is composed of 50% to 70% clay, 30% to 40% silt and a minor proportion of sand. Typical of a lacustrine deposit, the clay was found to be laminated with silt and fine sand. This layering has resulted in relatively high hydraulic conductivities and anisotropy ratios (horizontal hydraulic conductivity: vertical hydraulic conductivity) compared to the underlying till; groundwater preferentially flows through the silt. The laminations and rhythmic bedding of the glaciolacustrine deposits can be observed along the banks of Elbow River in the RAA. Further discussion of hydraulic properties and groundwater flow is presented in Section 3.2.

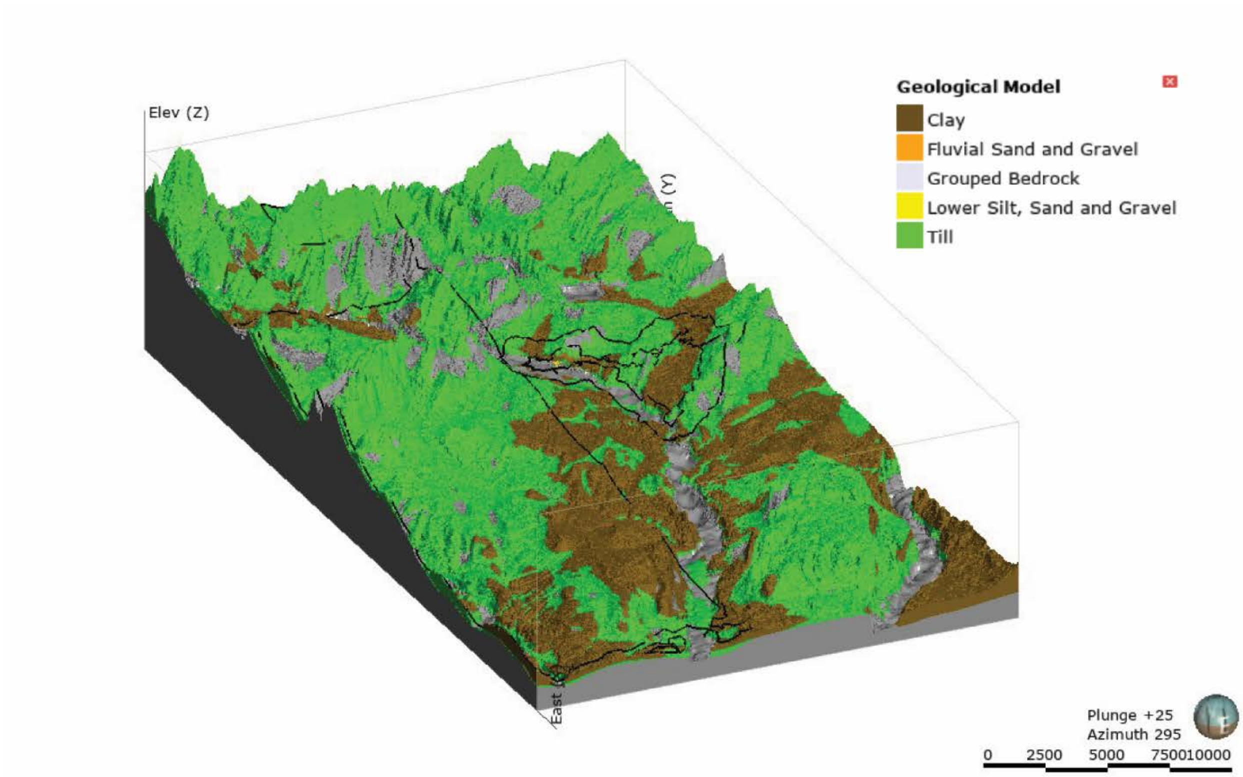
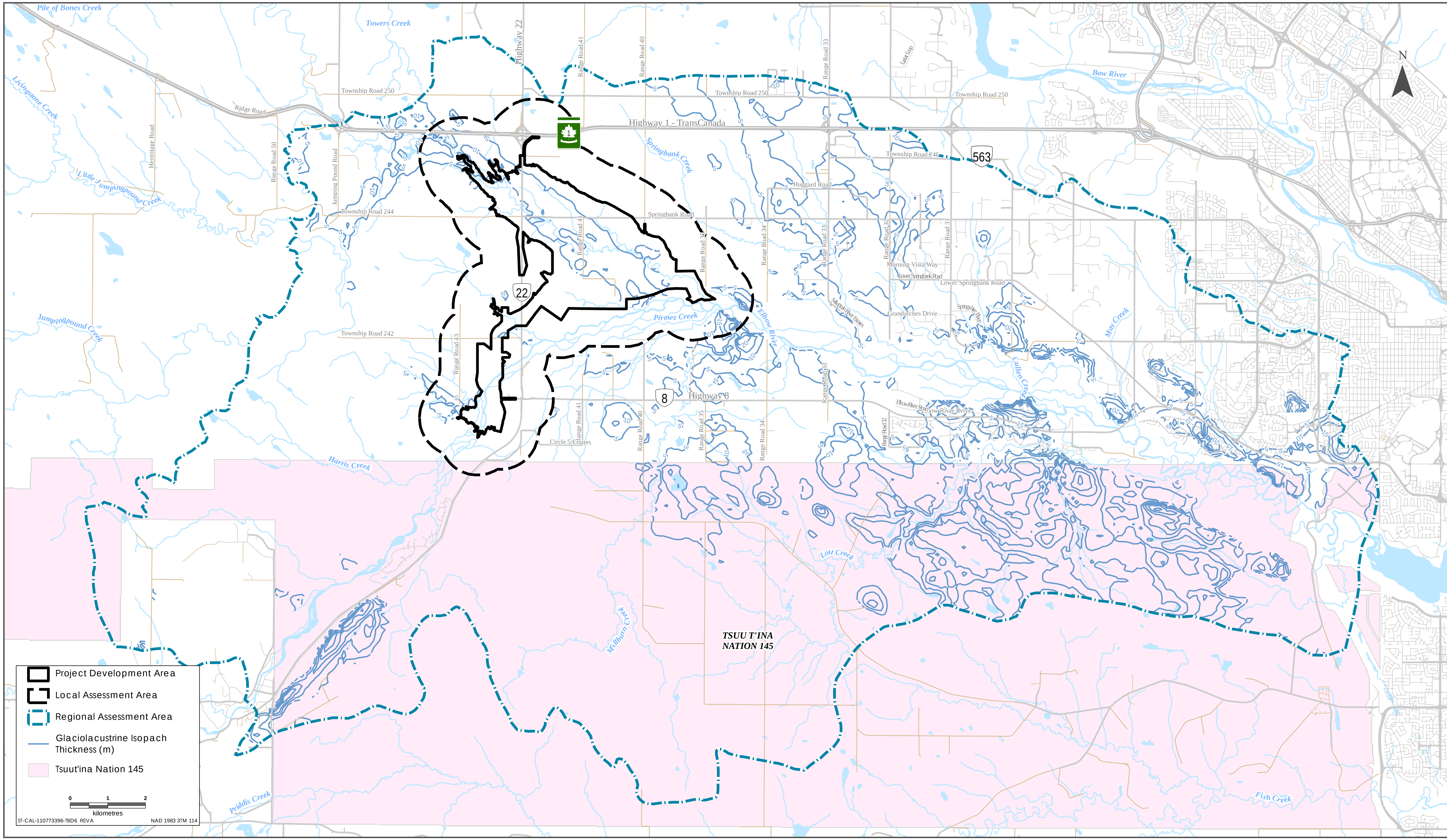


Figure 3-9 Distribution of Glaciolacustrine Deposits (Clay)



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Glaciolacustrine Deposits

Figure 3-10

3.1.2.4 Recent Fluvial Deposits

Post-glacial, fluvial channel sediments are in the Elbow River valley that extends across the RAA and in the Jumpingpound Creek channel in the western portion of the RAA. These sediments developed as the high-energy rivers, eroded and exported material from upstream areas and deposited coarse alluvium (sand and gravel) in the river channel. Localized areas of overbank deposits consisting of fluvial silt are also present (Moran 1986). The deposition of alluvium over Quaternary deposits or bedrock in the valleys resulted in the formation of alluvial aquifers, which are an important source of groundwater for the river and residents.

The alluvial aquifers provide temporary storage for water from Elbow River and Jumpingpound Creek during floods; the water is naturally released back into the rivers from bank storage after a flood recedes. Groundwater from the alluvial aquifer of Elbow River is essential in maintaining baseflow. Yields for the Elbow River alluvial aquifer range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

Geologically recent (post-glacial) fluvial deposits are depicted in orange in Figure 3-11, and they are described in the geotechnical logs for boreholes completed near the proposed diversion structure. The Tsuut'ina Nation Reserve, PDA, and the hydrogeology LAA are also shown as an overlay for reference on Figure 3-11. The fluvial deposits in this area are described as silty gravel with more minor sand, cobbles and boulders. An isopach map of the interpreted thickness of the fluvial deposits is presented in Figure 3-12.

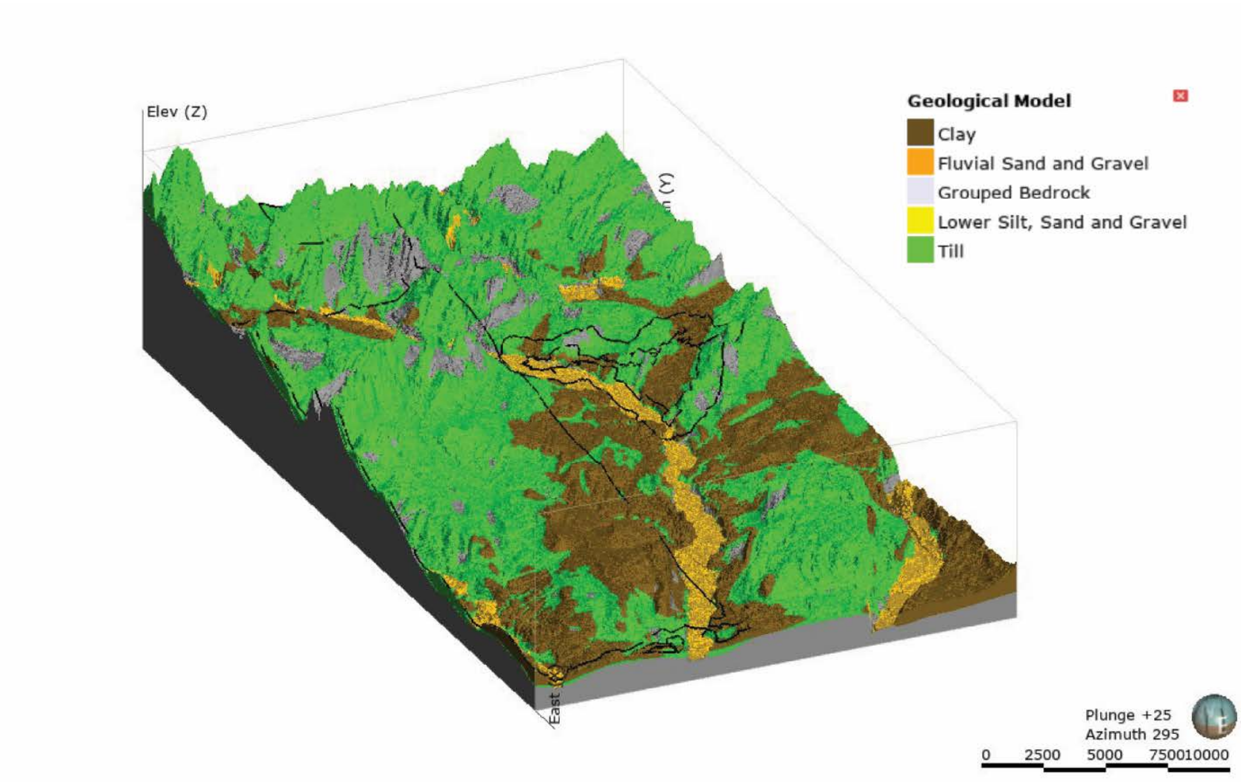
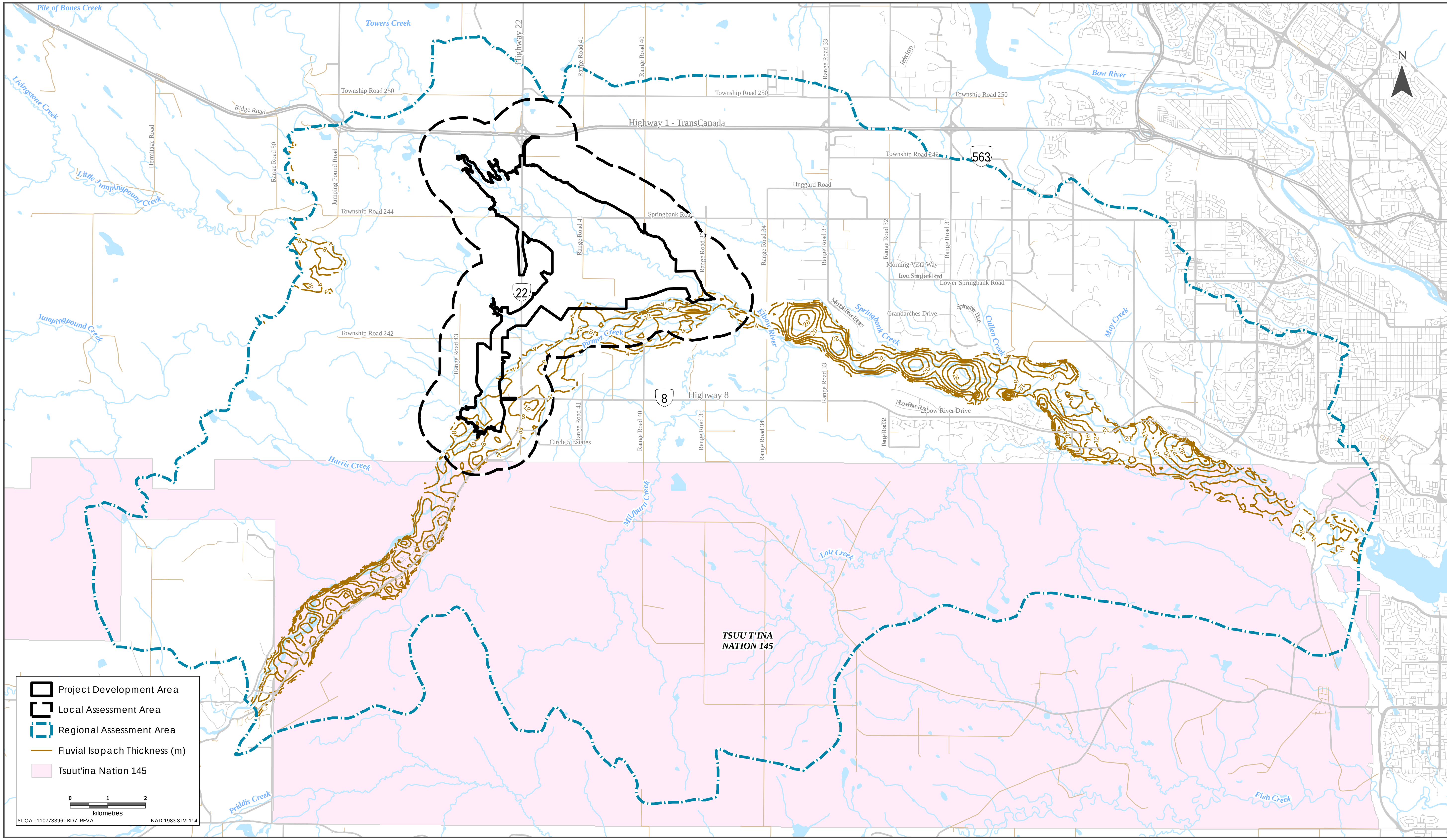


Figure 3-11 Distribution of Recent Fluvial Deposits



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Isopach Map of the Recent Fluvial Deposits

Figure 3-12

3.1.3 Cross-Sections

The locations of five hydrogeological cross-sections A–A′ to E-E' in the RAA are shown on Figure 3-13. The locations of the cross-sections were chosen such that A-A' to C-C' intersect the PDA and LAA in different orientations. Sections D-D' and E-E' intersect other areas of the RAA that are not rendered in section by Sections A-A' through C-C'. The cross-section lines provide coverage throughout the RAA and used to generate the cross-section profiles presented in Figure 3-14 to Figure 3-18.

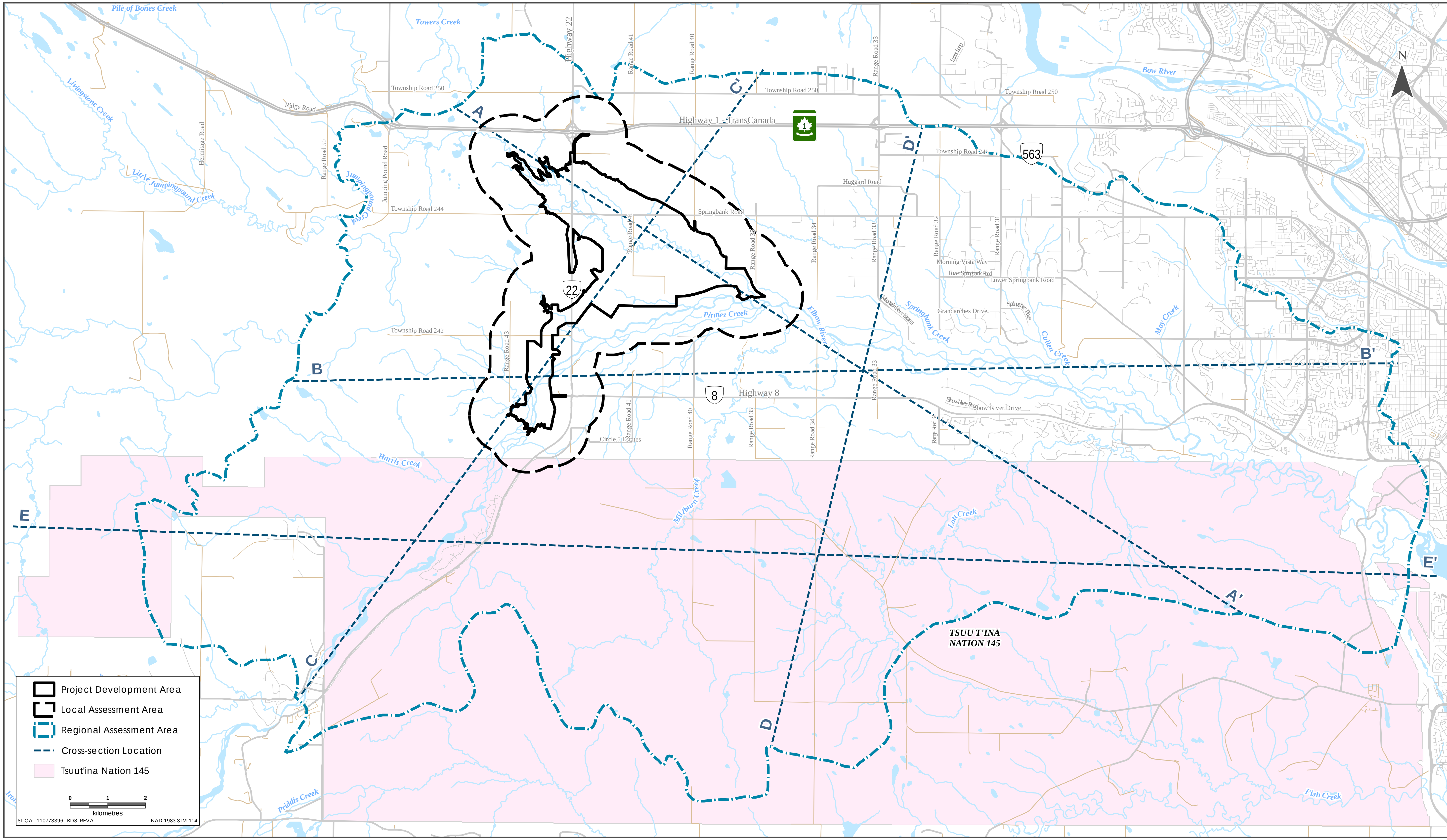
The cross-sections cut through the entire RAA and show the major hydrostratigraphic units from ground surface to the undifferentiated bedrock. The borehole traces presented on the sections are the locations of lithological data control points. Boreholes within 200 m to 500 m of each cross-section are projected onto the section (depending on the data density) and topographic change in and out of the plane of section. This was done to create clear images that did not project too many well traces on to section to reduce the obscuring effect on the rest of the image.

The cross-sections are annotated with notable features and boundaries including Tsuut'ina Nation Reserve 145, the PDA, LAA, and Elbow River. Cross-sections A-A' through C-C' include an inset of the PDA and LAA at a larger scale to see the detail and data control point density used to accurately model the PDA and LAA within the larger, regional-scale framework of the RAA. Cross-section B-B' (Figure 3-15) has an inset of the PDA and LAA focused on the diversion channel and shows the future channel geometry in cross-section. All cross-sections present both the interpreted water table surface and the interpreted bedrock potentiometric surface. Conceptual groundwater flow system arrows are also presented in cross-section to highlight groundwater flow divides at local, intermediate and regional scales. The conceptual flow arrows represent flow in section only. In some cases, the dominant flow vector direction would be perpendicular to the cross-section; e.g., flow is dominantly into the page, towards the Elbow River in cross-section E-E'.

The cross-sections presented indicate several important concepts related to the hydrogeological framework and reinforce conceptual decisions related to application of boundary conditions in the numerical model presented in Sections 4.0 through 6.0. Key hydrogeological framework features used for the conceptual boundary conditions include:

- High topographic relief with variable land surface gradients are present within the RAA related to erosional unconformities and high energy fluvial processes.
- Limited lateral extent of low permeability confining layers lead to limited areas of interpreted confined conditions together with semi confined conditions evident in some areas. However, the majority of the RAA appears to act as an unconfined system with minor overpressures in areas with competent confining layer sediment.

- Comparison of the interpreted water table surface to the bedrock potentiometric surface indicates there are potentially perched water tables in the unconsolidated sediment above bedrock, particularly in elevated recharge areas.
- The heads throughout the RAA appear to be very close to a hydrostatic pressure distribution and associated groundwater flow regime.
- In areas that there is a deviation from hydrostatic pressure distribution, there are generally two interpretive explanations:
  - Topographically elevated areas with water table elevation well above that of the bedrock potentiometric surface are related to development of perched aquifers, above the contiguous regional water table (generally hosted by the bedrock in elevated areas).
  - Areas where the potentiometric surface elevation exceeds that of the water table is likely to indicate semi-confined conditions.
- The regional water table is variably hosted by all hydrostratigraphic units given the topographic variability. In some topographically elevated areas, the unconsolidated material is unsaturated, and the water table is hosted by the bedrock. In other areas, the unconsolidated material hosts the water table. As such, head maps are not provided for specific hydrostratigraphic units, but rather an interpreted water table map and a bedrock potentiometric surface map is provided.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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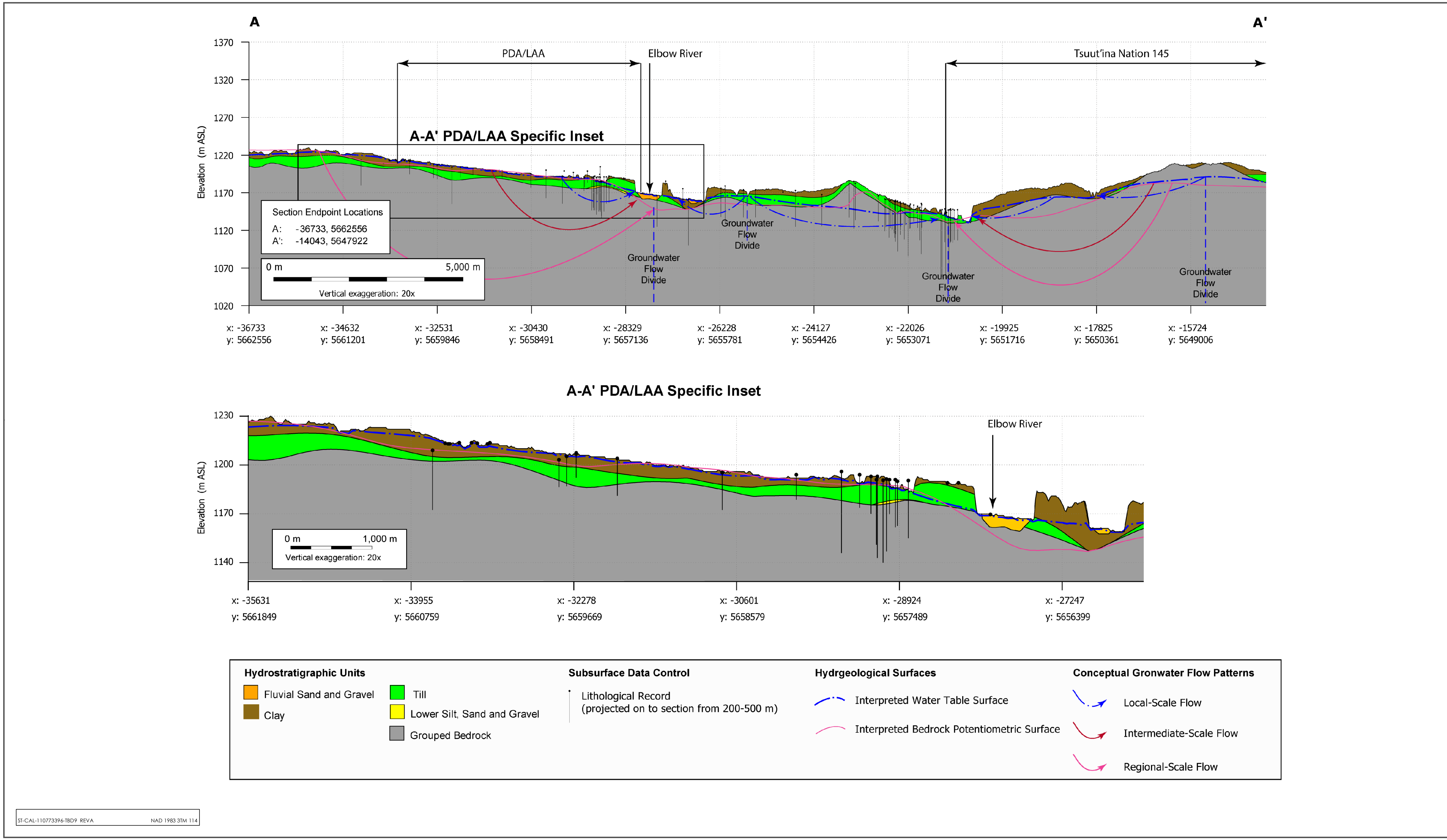
Hydrostratigraphic Cross-section Locations

Figure 3-13



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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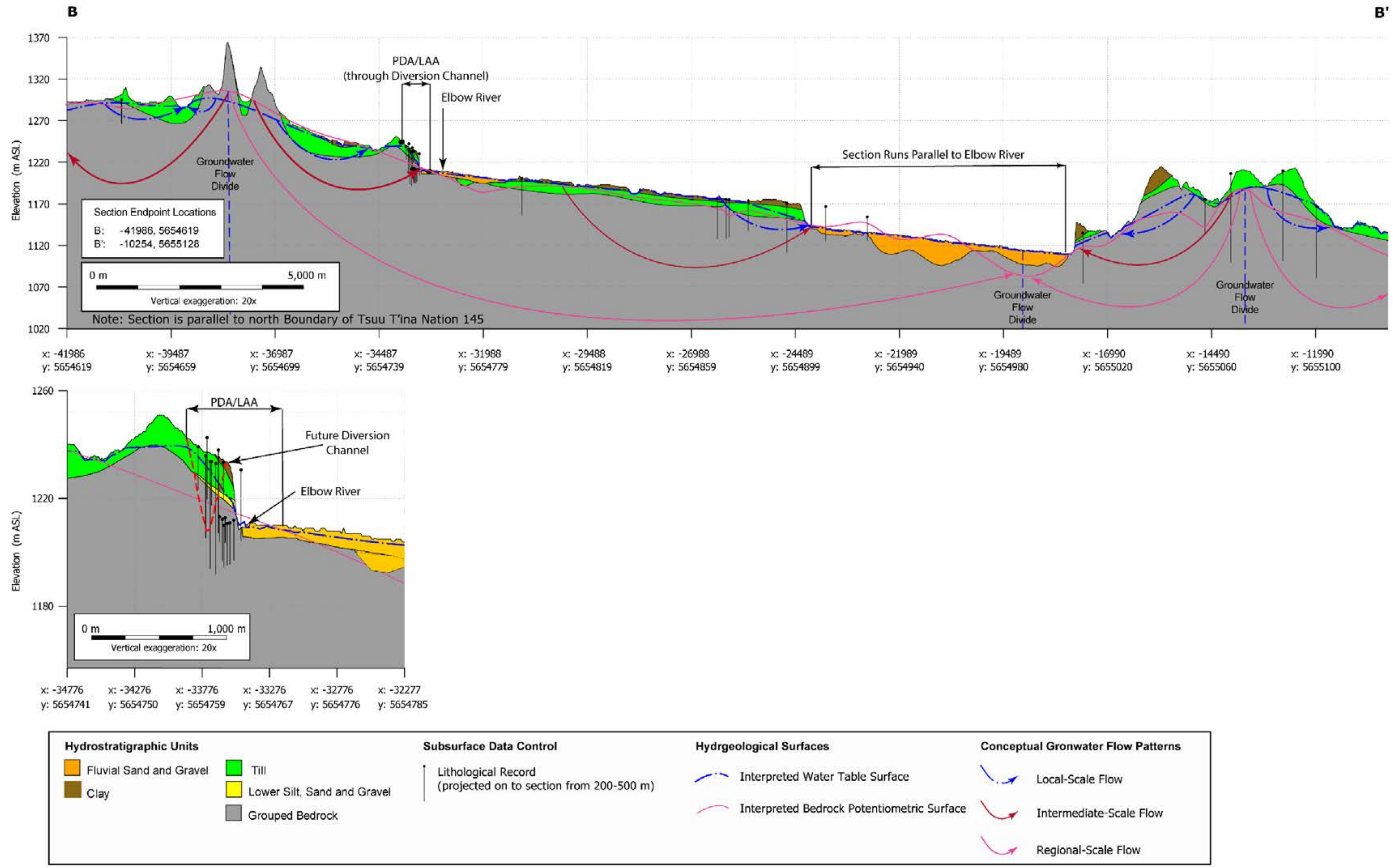
Geological Cross-Section A-A'

Figure 3-14



ST-CAL-110773396-TB10 REVA NAD 1983 3TM 114

Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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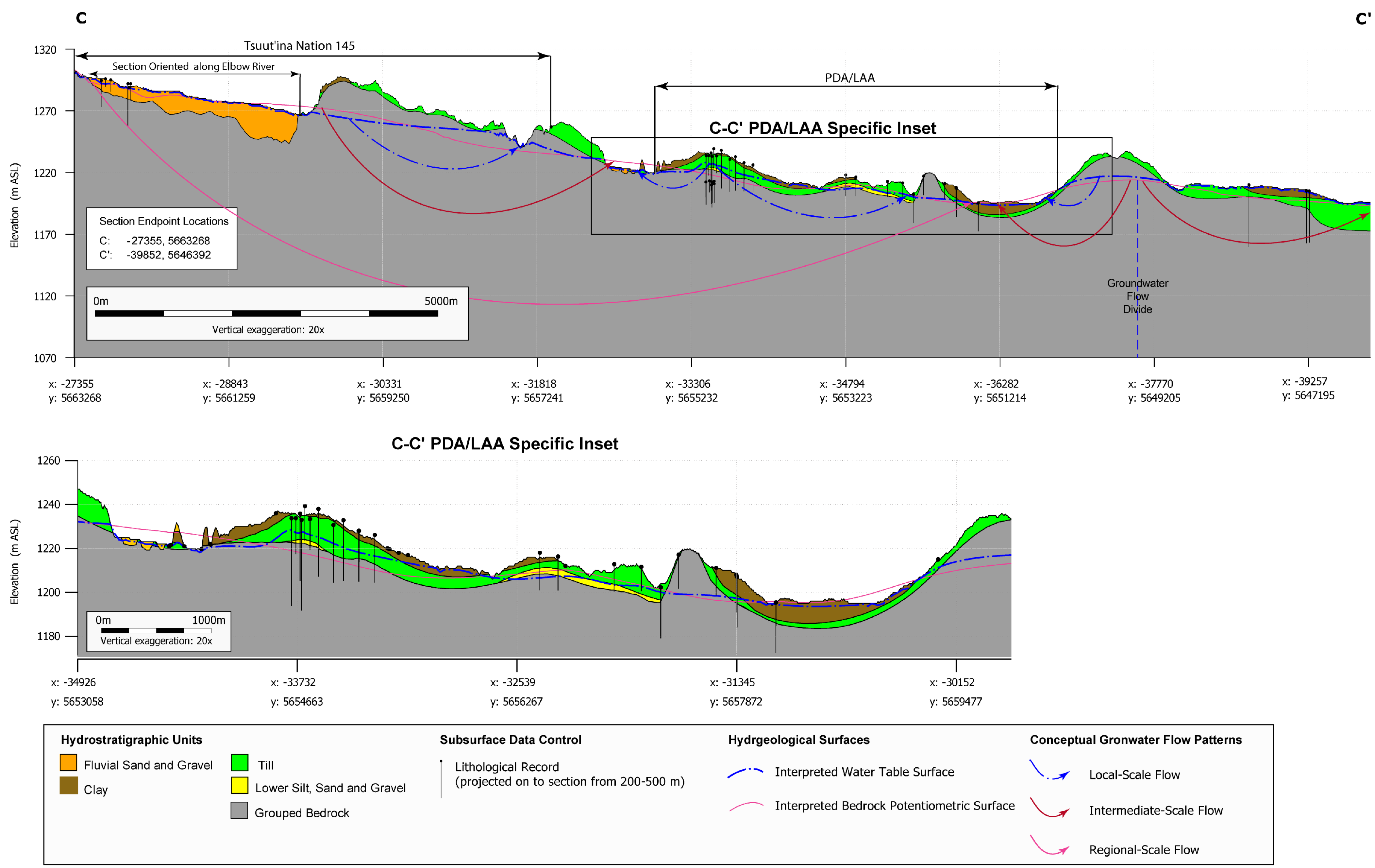
Geological Cross-Section B-B'

Figure 3-15



ST-CAL-110773396-TB11 REVA NAD 1983 3TM 114

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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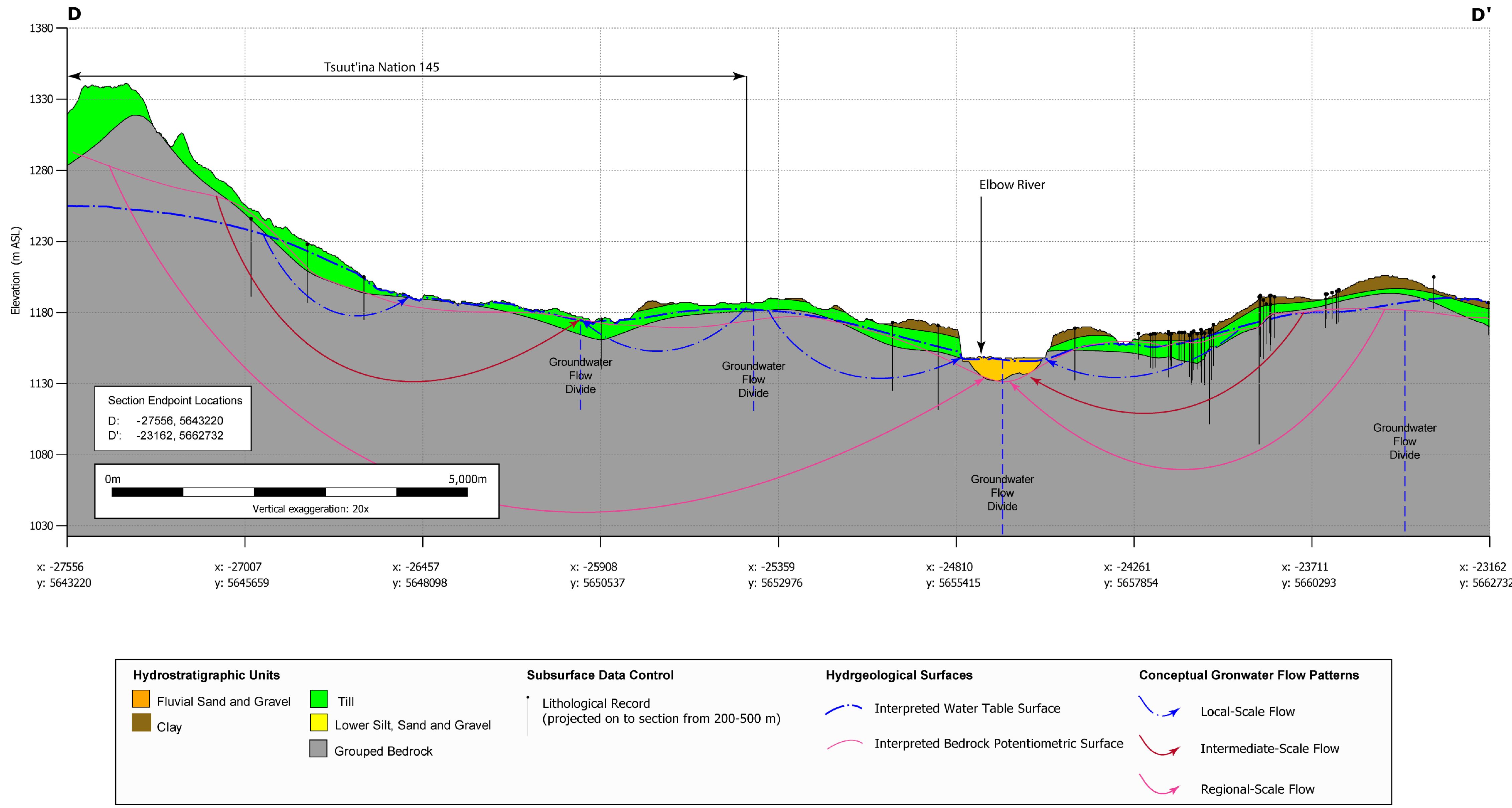
Geological Cross-Section C-C'

Figure 3-16



ST-CAL-110773396-TB12 REVA NAD 1983 3TM 114

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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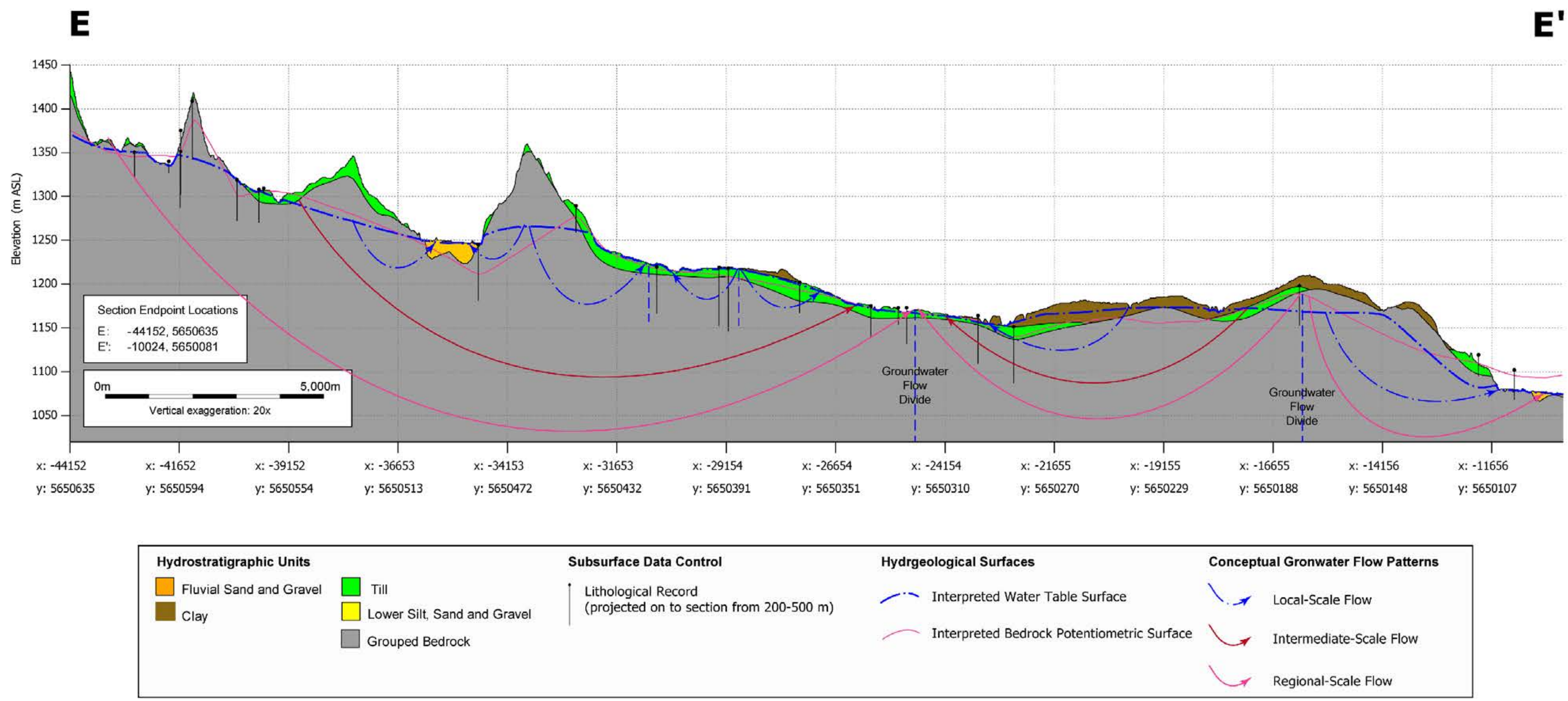
Geological Cross-Section D-D'

Figure 3-17



ST-CAL-110773396-TB13 REVA NAD 1983 3TM 114

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Geological Cross-Section E-E'

Figure 3-18

3.2 GROUNDWATER LEVELS AND FLOW REGIMES

Both the water table surface and the potentiometric surface were developed though geostatistical interpolation of water level measurements obtained during the 2016 groundwater monitoring program (see Section 2.5) along with water levels from the AWWID and surface water elevations of waterbodies within the RAA, based on LiDAR data. Further discussion of the methods used to create the potentiometric surfaces is provided in Section 2.6.

3.2.1 Hydraulic Conductivity

The hydraulic conductivity values of the material adjacent to the monitoring well completion intervals were based on the results of the single well response tests. The test results were interpreted using a combination of analytical methods and solutions depending on the characteristics of the aquifer or aquitard and the response curves generated. The analytical solutions used included Hvorslev (1951), Bouwer and Rice (1976), and the Kansas Geological Survey (KGS) model (Hyder et al. 1994). The response test analyses are presented in Attachment A. A summary of the hydraulic conductivity estimates is presented in Table 3-1.

Table 3-1 Single Well Response Test Hydraulic Conductivity Estimates

Well Name	Completion Depth (m BGL)	Completion Lithology	Hydrostratigraphic Unit	Estimated Hydraulic Conductivity (m/s)		
				Hvorslev (1951)	KGS (Hyder et. al. 1994)	Bouwer-Rice (1976)
MW16-1-15	15.2	Sandstone	Bedrock	1.2E-06	2.3E-06	-
MW16-4-22	21.6	Sandstone	Bedrock	8.8E-07	1.9E-06	-
MW16-6-20	21.9	Claystone/Siltstone	Bedrock	2.8E-09	3.8E-09	-
MW16-8-19	18.6	Sandstone	Bedrock	6.3E-07	2.2E-06	-
MW16-9-6	5.8	Glaciolacustrine clay and silt	Glaciolacustrine Deposits	5.3E-08	2.2E-07	-
MW16-10-15	15.2	Till	Till	2.5E-10	6.3E-10	-
MW16-18-10	10.6	Claystone	Bedrock	4.2E-06	9.6E-06	-
MW16-19-19	18.6	Sandstone	Bedrock	3.1E-06	9.2E-06	-
MW16-24-30	30.5	Sandstone	Bedrock	1.5E-05	-	-
MW16-25-9	9.1	Till	Till	2.4E-10	-	8.2E-10

Based on the single well response tests, the hydraulic conductivity of the unconsolidated deposits ranged from 2.4 x 10^{-10} m/s in the till to 2.2 x 10^{-7} m/s in the clay and silt of the glaciolacustrine deposits. Hydraulic conductivity estimates in the bedrock monitoring wells ranged from 2.8 x 10^{-9} m/s in the siltstone and claystone to 1.5 x 10^{-5} m/s in the sandstone. The geometric mean hydraulic conductivity of the response tests completed in the bedrock wells (using the Hvorslev (1951) analysis) was 8.7 x 10^{-7} m/s.

The results of the 37 single-packer permeability tests completed as part of the geotechnical field investigation program are summarized in Table 3-2. The hydraulic conductivities estimated from the packer testing ranged from 6.1 x 10^{-8} m/s to 6.5 x 10^{-5} m/s, with a geometric mean value of 1.2 x 10^{-6} m/s.

Table 3-2 Single Packer Permeability Test Hydraulic Conductivity Estimates

Borehole Name	Packer Test Depth (m BGL)	Completion Lithology	Estimated Hydraulic Conductivity (m/s)
D29	21.7-24.7	claystone/siltstone	2.6E-07
	24.7-27.7	claystone/sandstone	6.1E-08
	27.2-30.2	claystone/siltstone/ Sandstone	1.1E-07
	30.7-33.7	claystone/siltstone	1.9E-07
	33.7-36.7	claystone/sandstone	2.5E-07
	36.7-39.7	claystone/sandstone	8.2E-08
	39.7-42.7	sandstone/claystone	4.1E-07
D35	14.2-17.2	sandstone/claystone	6.5E-05
	17.2-20.2	siltstone/claystone	3.8E-06
	20.2-23.2	claystone/siltstone	6.4E-07
	23.2-26.2	siltstone/claystone	2.1E-06
	26.2-29.2	sandstone	9.0E-06
	29.2-32.2	sandstone/claystone	9.0E-06
	32.2-35.2	siltstone	4.2E-06
	35.2-38.2	claystone/siltstone	2.2E-07
	38.2-41.2	siltstone/sandstone	1.3E-06
	41.2-44.2	sandstone/siltstone	1.4E-07
D38	15.2-18.2	siltstone/claystone	4.3E-05
	18.7-21.7	claystone	3.0E-07
	21.7-24.7	siltstone/claystone	3.2E-06
	24.7-27.7	claystone/sandstone	4.5E-07
	27.7-30.7	siltstone/claystone	1.9E-06
	30.7-33.7	sandstone	2.3E-06
	33.7-36.7	sandstone	2.8E-05
	36.7-39.7	siltstone/sandstone	4.9E-06
	39.7-42.7	siltstone/claystone	1.5E-06
	42.7-45.7	siltstone/claystone	3.8E-07
D51	24.7-27.7	siltstone/claystone	3.2E-06
	27.7-30.8	claystone/sandstone	2.8E-06
D60	21.6-23.1	sandstone	3.1E-07
	23.1-26.2	claystone/sandstone	1.8E-06
	26.2-29.2	claystone	1.4E-07
	29.2-32.3	claystone/sandstone	2.4E-06
	32.3-35.3	claystone/sandstone	8.6E-06
	35.3-38.4	claystone/sandstone	3.8E-07
	42.1-45.1	claystone/sandstone	3.5E-07

3.2.2 Groundwater Flow in the Unconsolidated Glacial Deposits

The interpreted water table surface of the unconsolidated deposits is presented in Figure 3-19. The methods used to interpret the water table elevation are presented in Section 2.6. Project-specific field characterization data indicates groundwater elevations within the surficial deposits generally follow the topography and range from 0 m BGL, where the water table intersects ground surface at springs and along stream and river banks, to approximately 8.0 m BGL as measured in May 2017. The corresponding groundwater elevations range from approximately 1,380 m ASL in the topographically elevated areas in the of the RAA southwest to 1,080 m ASL along the eastern boundary of the RAA.

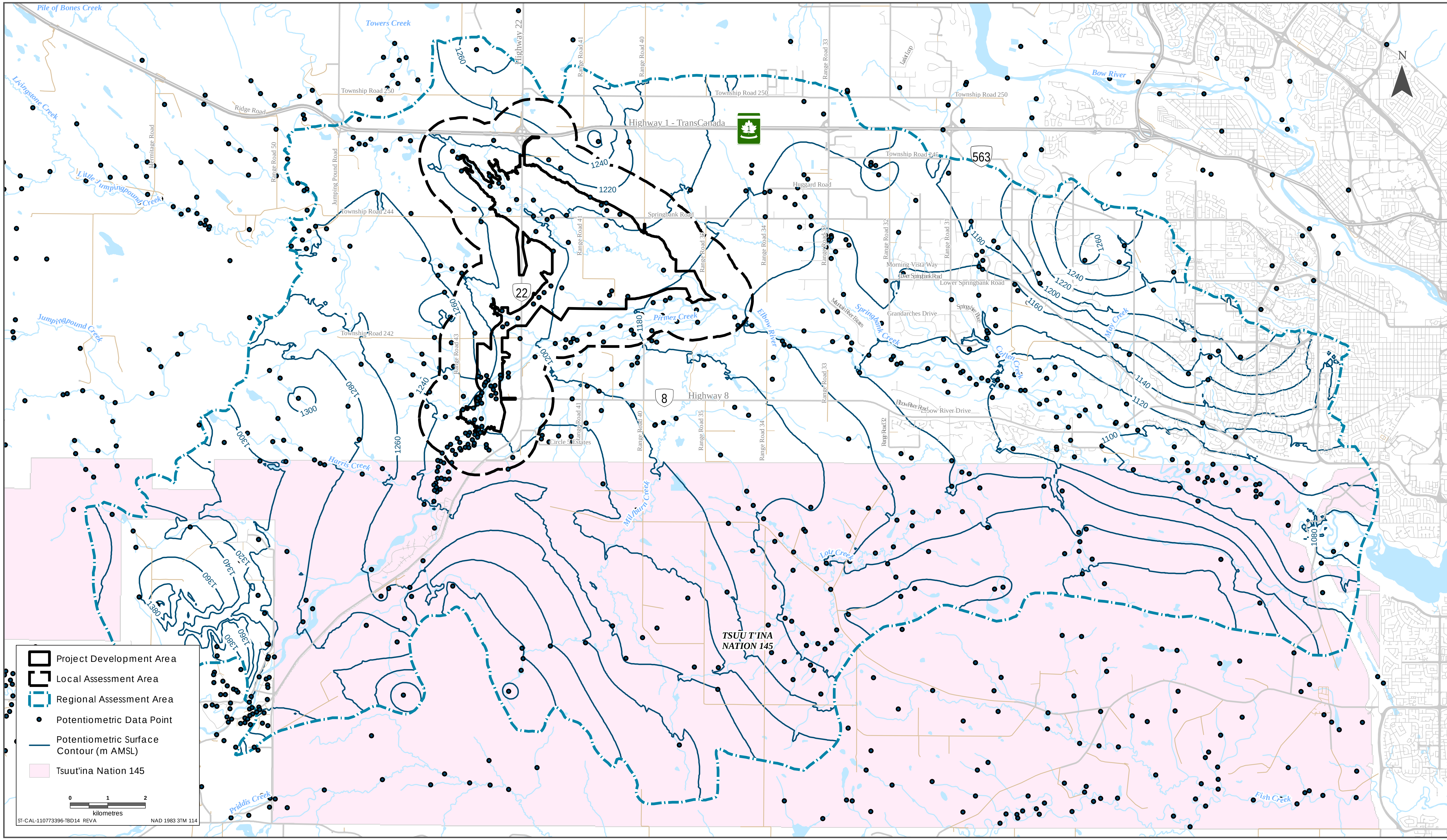
There is high potential for perched water table development within the RAA because of the following landscape and geological controls:

- permeability contrast created by an unconsolidated sediment veneer over the bedrock
- steep land surface gradients and erosional unconformities that truncate hydrostratigraphic units within the RAA
- mapped contact springs that indicate perched conditions in topographically elevated areas.

As such, the bedrock potentiometric surface is more representative of the reginal water table position, whereas the water table surface likely overestimates water table position in areas of elevated bedrock topography.

Groundwater flow direction is interpreted to be toward Elbow River across the majority of the RAA, except for areas 1) northwest where shallow groundwater flows west toward Jumpingpound Creek, 2) areas along the north side of the RAA across the flow divide, and 3) in the Bow River watershed where groundwater flows north. Horizontal gradients beneath the LAA range from 0.003 in the central portion of the reservoir to 0.1 in the southern portion of the LAA that is adjacent to the Elbow River near the diversion structure.

As noted above, the unconsolidated sediment above bedrock is also thought to host-perched water tables in which groundwater flow is typically dictated by local-scale topography where the permeability contrast exists to support development of perched groundwater.



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Water Table Elevation in the Unconsolidated Deposits

Figure 3-19

Average linear groundwater velocities for near-surface groundwater flow in the unconsolidated sediment above bedrock have been estimated as follows based on the hydraulic conductivities and apparent horizontal hydraulic gradients described above:

$$V = Ki/n$$

where: V is the average linear velocity (m/y)
K is the hydraulic conductivity (0.01 to 6.9 m/y in the unconsolidated glacial deposits)
i is the estimated hydraulic gradient (0.003 to 0.1)
n is the assumed effective porosity of 0.3.

The average linear groundwater velocity in the unconsolidated glaciolacustrine deposits and till is estimated to range from less than .01 m/year to approximately 2.3 m/year. However, it should be noted that flow velocities through sand lenses within, or at the base of, the till could be higher.

3.2.3 Groundwater Flow in the Upper Bedrock Aquifers

The potentiometric surface of the bedrock aquifer is presented in Figure 3-20. The locations of the hydraulic head data control points used in the interpretation are also shown. Given the scale of the RAA, all head data from screened intervals located between the upper bedrock surface and less than 80 m BGL were used to interpolate the potentiometric surface. Applying further restriction on the depth range to isolate a narrower depth interval resulted in an overly sparse data density to effectively interpolate across the RAA. Potentiometric surface elevations range from approximately 1,400 m ASL in the southwest to 1,080 m ASL at the base of the Elbow River valley along the eastern boundary of the RAA.

The potentiometric surface elevation in the mountainous southwest area of the RAA is predicted above land surface between topographically elevated areas. This suggests the presence of locally perched bedrock aquifers in this area that are poorly hydraulically connected to the underlying regional bedrock aquifer. Areas like this are difficult to resolve in a regional study, given the uncertainty from limited data density and the inability to resolve localized permeability contrasts due to interbedding in the bedrock.

Despite the challenges presented by the topography, the potentiometric data highlight that the head difference between the elevated areas upstream of the PDA and LAA (south and southwest of the diversion structure) creates independent, local scale topographically-driven groundwater flow-systems within the RAA. These independent flow-systems are upstream and up-gradient, relative to hydraulic head of the RAA.

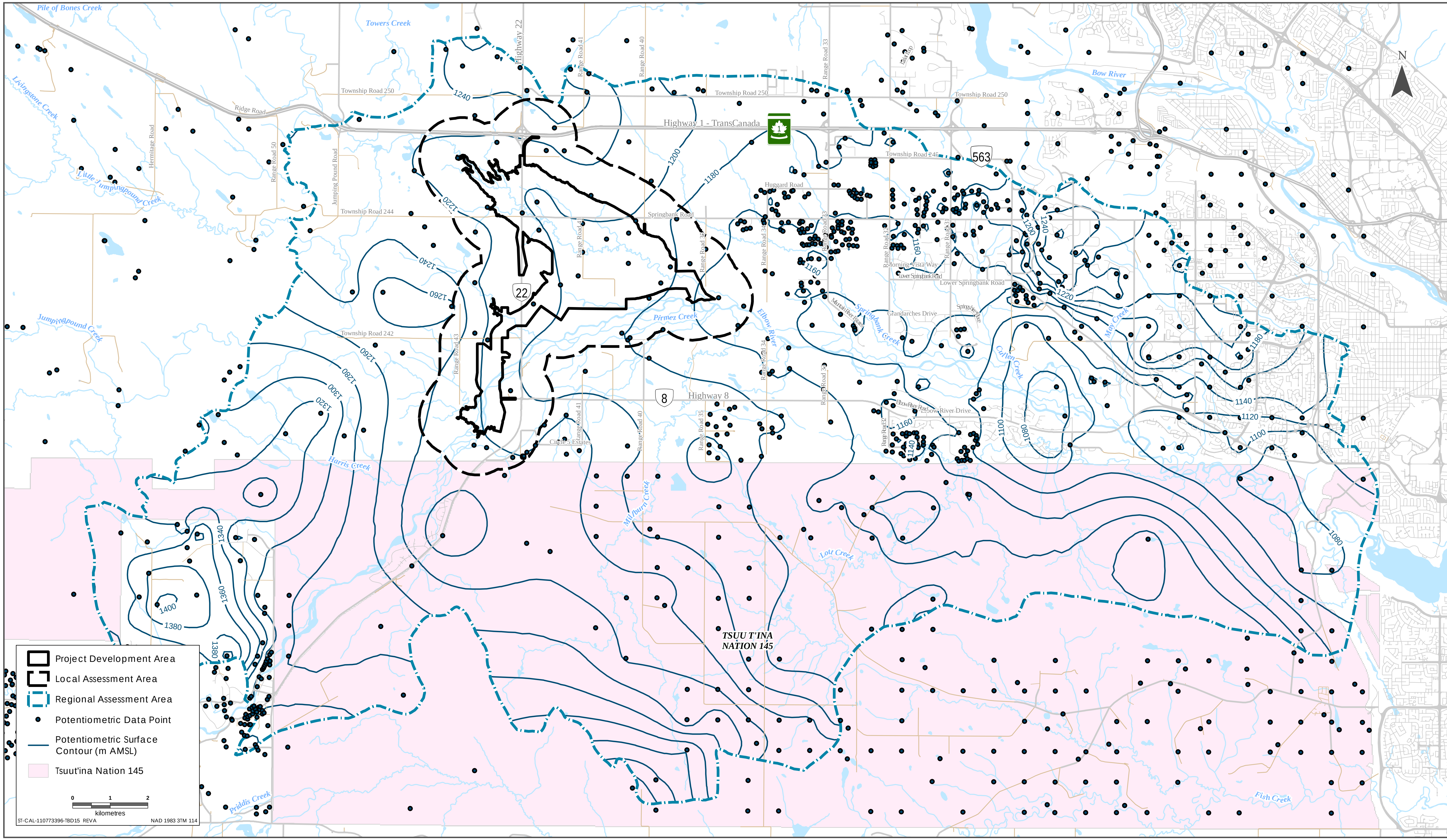
Groundwater flow direction in the bedrock is dominantly controlled by the bedrock surface-topography. On the north side of Elbow River, the bedrock generally slopes towards the river, while being influenced by variation in the bedrock surface topography. There are some topographic low areas in the bedrock on the north side of the river that focus groundwater flow in the bedrock beneath the PDA and LAA before trending towards Elbow River. The bedrock topography is significantly more complex on the south side of Elbow River and the flow patterns in the bedrock demonstrate radial flow away from elevated bedrock features. Correspondingly, the surface water drainage features to Elbow River on the south side appear to act as groundwater discharge features that focus flow between topographically-elevated bedrock features.

Groundwater elevations within the upper bedrock generally follow the topography although the relationship is not as strong as compared to the water table surface of the unconsolidated deposits. The potentiometric surface as shown in cross-section (Figures 3-14 to 3-18) and on Figure 3-20 demonstrate localized over-pressures and under-pressures likely related to heterogeneity and degree of hydraulic connection to Elbow River. However, there is regionally mappable areas in which confined conditions can be conclusively identified.

Horizontal gradients in the upper-bedrock aquifers beneath the LAA range from 0.005 in the central portion of the proposed reservoir to 0.02 in the southern portion of the LAA adjacent to Elbow River near the diversion structure.

The average linear groundwater velocity in the shallow bedrock is estimated to range from less than 0.01 cm/year in the unfractured portions of the claystone bedrock to approximately 30 m/year in the more permeable sandstone in the areas of higher hydraulic gradient near the Elbow River.

Yields calculated by HCL (2002) for wells completed in the bedrock aquifers in the disturbed belt in this area generally ranged from 10 m^3/day to 75 m^3/day.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Potentiometric Surface of the Upper Bedrock

Figure 3-20

3.2.4 Vertical Hydraulic Gradients, Groundwater Springs and Recharge/Discharge Mapping

Vertical hydraulic gradients between the unconsolidated and bedrock deposits indicate the potential for upward-directed groundwater flow (discharge) at each of the five nested monitoring well locations. The vertical gradients ranged from 0.1 at MW16-6-11/MW16-6-20 to 1.9 at MW16-8-8/MW16-8-19.

In addition to the contact springs discussed in Section 3.2.2, the high magnitude vertical gradients likely result in artesian springs along the valley walls and in low-lying areas where the confining layers are thin or in areas of more permeable material. Nested monitoring well pair MW16-8-8/MW16-8-19 is located 35 m hydraulically upgradient of a groundwater spring. The lower hydraulic head measurements in the nested monitoring wells indicate the potential for upward directed groundwater flow and discharge at this location.

A number of springs were noted along the northeast side of the off-stream reservoir area, as indicated by yellow dots in Figure 3-21. Springs outside the PDA were mapped based on public data sources (indicated by blue dots in Figure 3-21) including the Alberta Geological Survey Springs Inventory (Stewart, 2009), and the springs records within the AWWID are also presented in Figure 3-21.

Based on field mapping, springs within the PDA are interpreted to be contact springs with groundwater flow in the unconsolidated deposits discharging where the underlying low permeability bedrock material is near surface along the valley wall. As groundwater flows along this bedrock/unconsolidated contact, downward flow is limited and the water discharges along the open slope, forming the springs evident at ground surface. The elevation of these springs ranges from approximately 1,205 m ASL in the southeast of the PDA to 1,225 m ASL farther northwest along the valley wall.

At least one contact spring was also identified along the southwest ridge of the off-stream reservoir. This spring location is plotted in Figure 3-21 and is at an elevation of approximately 1,211 m ASL.

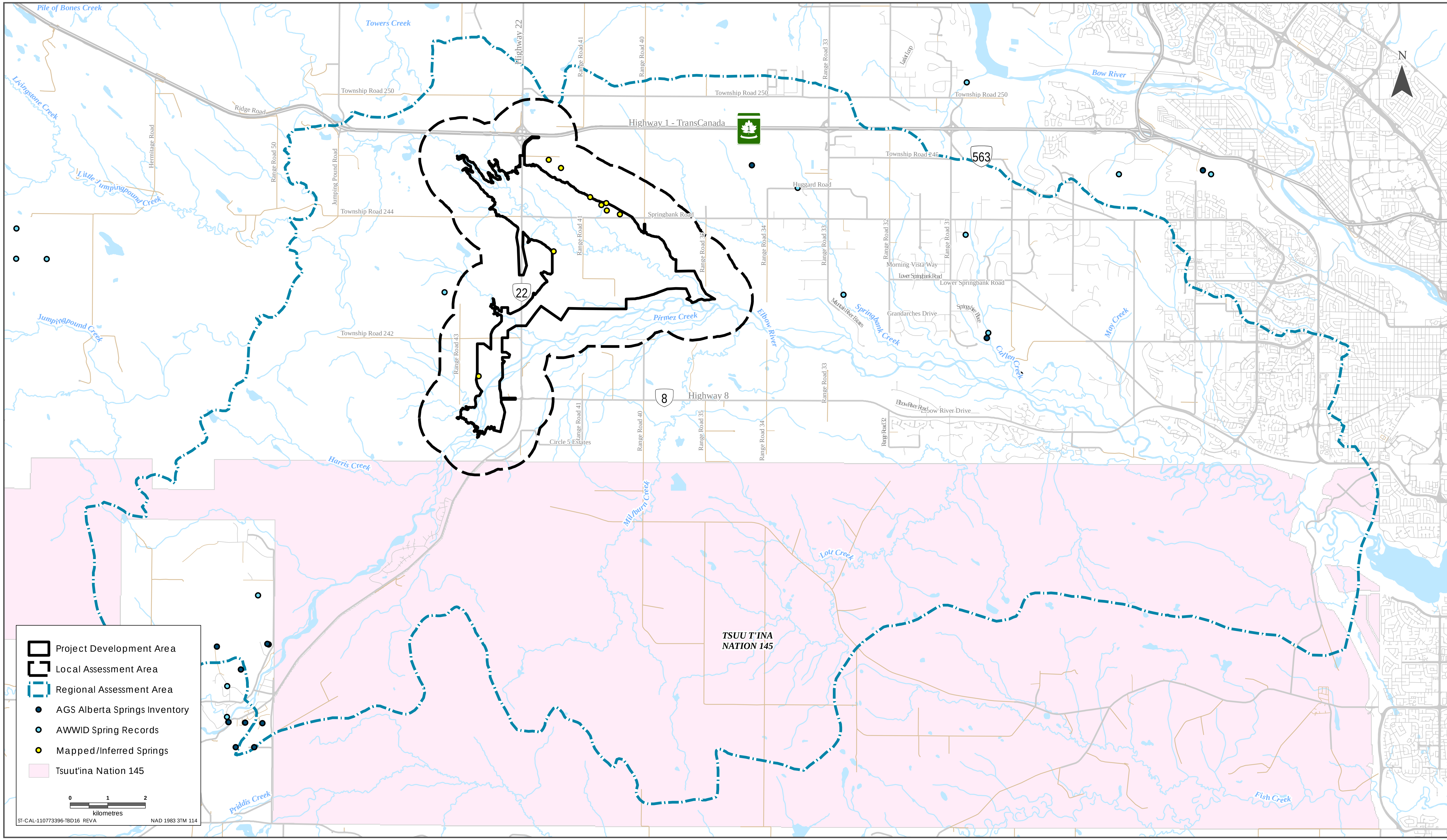
A number of groundwater springs are also noted in the topographically elevated areas in the southwest portion of the RAA where conditions are favorable for contact spring development. This is likely related to perched water table development in the veneer of unconsolidated sediment situated on bedrock highs.

Two methods were used to evaluate the areas of the RAA that constitute groundwater recharge areas and groundwater discharge areas. The first method used to determine the patterns of recharge and discharge was to subtract the gridded potentiometric surface from the gridded water table surface and examine the head difference distribution shown as contours on

Figure 3-22. This approach highlights areas where the phreatic surface is different from the potentiometric surface. Where the potentiometric surface exceeds the water table elevation, discharge conditions are present. Conversely, where the deeper potentiometric surface indicates lower head than that of the water table, recharge conditions are present. Due to the scale of the recharge and discharge mapping and variable data density available, the resulting interpretation is a general guide for where such conditions may prevail.

There are challenges associated with mapping regional recharge and discharge patterns in the RAA with a large land area, large topographic variability and areas of limited data within the RAA. To overcome these challenges, depth-to-water mapping was used as an indicator of recharge and discharge areas. A depth to groundwater map was developed by subtracting the water table surface, as described in Section 3.2.2, from the land surface topography. Depth to groundwater is used as a proxy for recharge and discharge areas, since discharge areas typically have near surface water tables and, conversely, recharge areas have deep water table positions relative to the land surface.

Figure 3-23 shows the depth to groundwater as a colour scale with symbology chosen to highlight the discharge areas in the RAA (dark blue), midline areas of flow systems where the vertical gradient is near neutral or varies seasonally (shown in light grey-blue), and the recharge areas with high modeled depths to groundwater shown in the yellow-orange-red tones showing weak (yellow) to strong (red) recharge areas. Given the incision of the river sediments into the upper bedrock surface, the discharge features are observed near watercourses at the base of the valley with broad recharge areas at high elevations. This configuration of a discharge area adjacent to groundwater sink features like Elbow River is typical of a groundwater catchment area with steep topography and fluvial incision, such as is the case in the RAA.



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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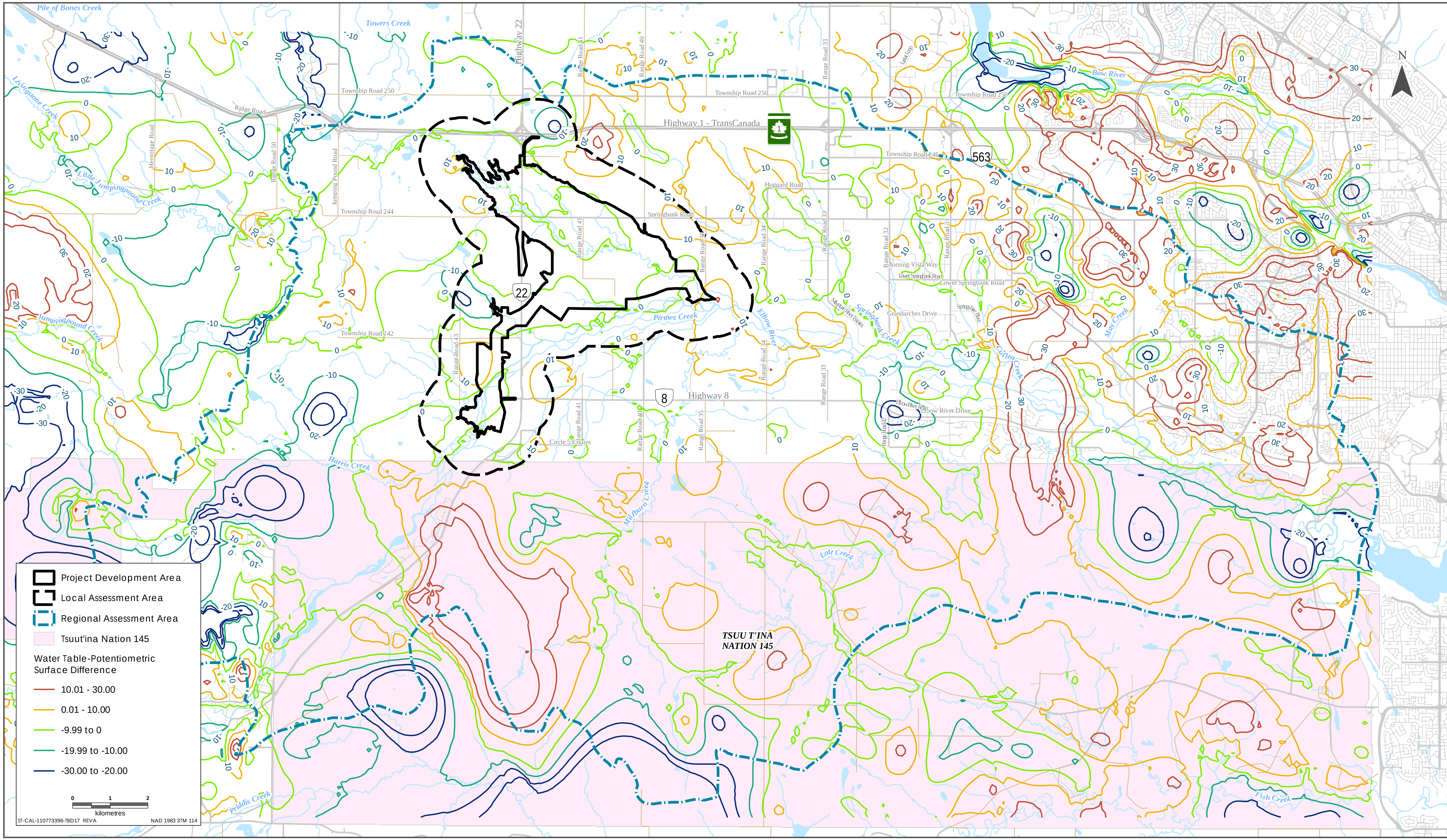
Mapped Groundwater Spring Locations

Figure 3-21



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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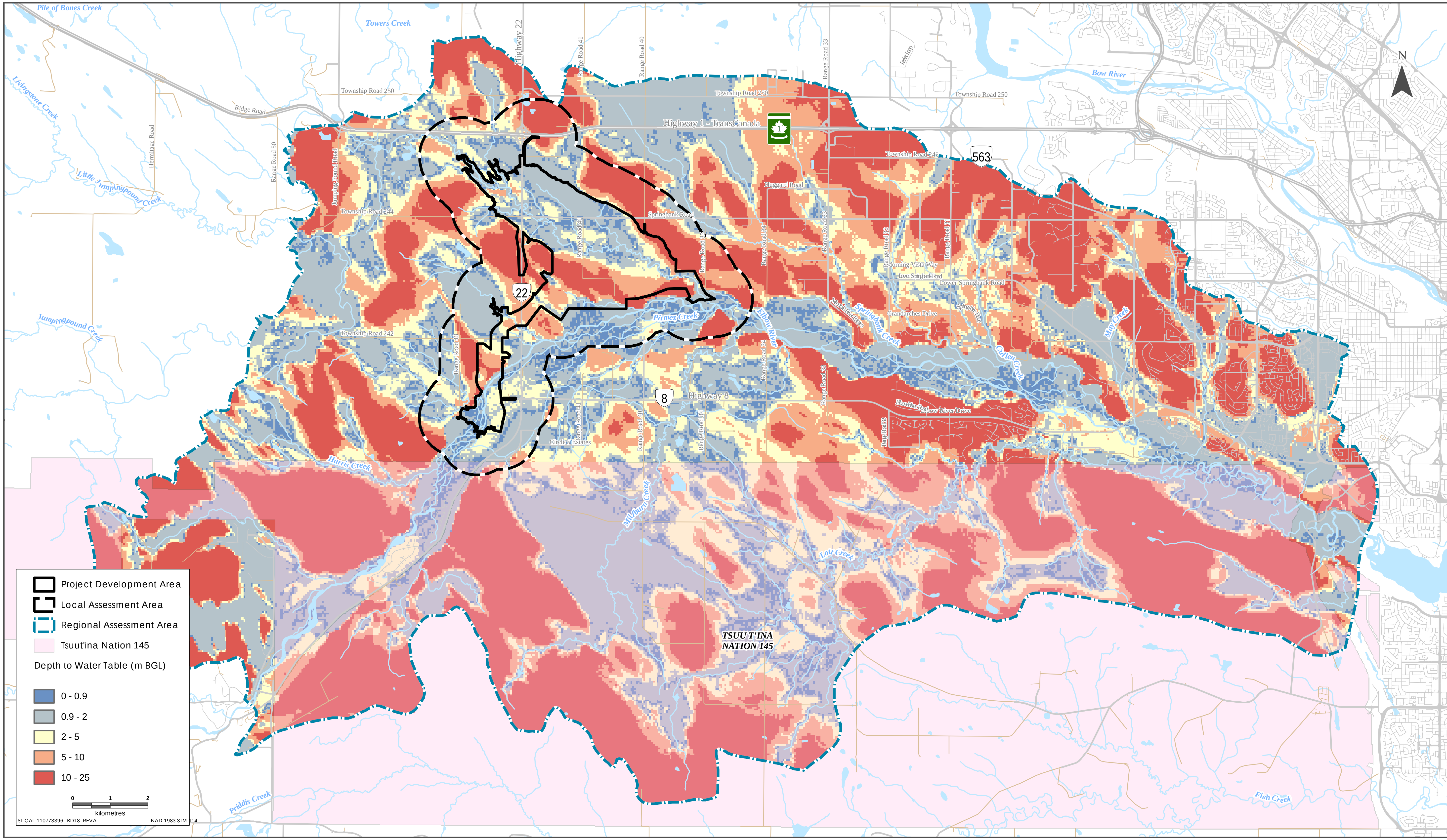
Water Table-Potentiometric Surface Difference Mapping

Figure 3-22



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Depth to Groundwater and Recharge-Discharge Mapping

Figure 3-23

3.2.5 Groundwater Level Fluctuation

Groundwater levels fluctuate in response to various climatic and anthropogenic influences. Short-term fluctuations result from precipitation, seasonal effects (e.g., spring runoff, dry periods, frozen surface water) or transient groundwater pumping. Longer-term fluctuations are generally caused by climatic trends (e.g., prolonged drought or successive years of above normal precipitation) or groundwater production.

Hydrographs depicting change in groundwater levels over time have been prepared for 10 monitoring wells within the RAA. The data for the hydrographs was recorded using data logging pressure transducers installed in each of the wells and covers the period between October 7, 2016 and May 24, 2017. Hydrographs for monitoring wells completed in the unconsolidated materials above bedrock are presented in Figure 3-24 and the hydrographs of wells completed in bedrock, generally to greater depths, are presented in Figure 3-25 and Figure 3-26. The location of these monitoring wells is presented in Figure 2-2.

Water levels in the wells completed in the unconsolidated deposits generally showed the same seasonal trends (Figure 3-24), except for monitoring well MW16-17-5. The very low hydraulic conductivity adjacent to the screened interval of MW16-17-5 masks the effects of the natural variation. Following purging during the September 2016 monitoring, the water level slowly recovered toward a static level and continued recovering until February 16, 2017. An increase of approximately 1 m was observed over a one-hour period on February 16. Given the warm temperature of 16°C, the increase is attributed to a loss of surface seal integrity (either the cap or well seal) and meltwater entering the well. Because the water level in the well was then artificially high, the level decreased toward static over the period of February to May 2017.

The water level elevations in the remaining three monitoring wells completed in unconsolidated deposits increased or remained stable between October 2016 and December 2016. Water levels then decreased over the winter months reaching seasonal lows in March 2017 to April 2017. Water level increases were then observed during April and May. Water level fluctuations were less than 0.5 m in the three monitoring wells.

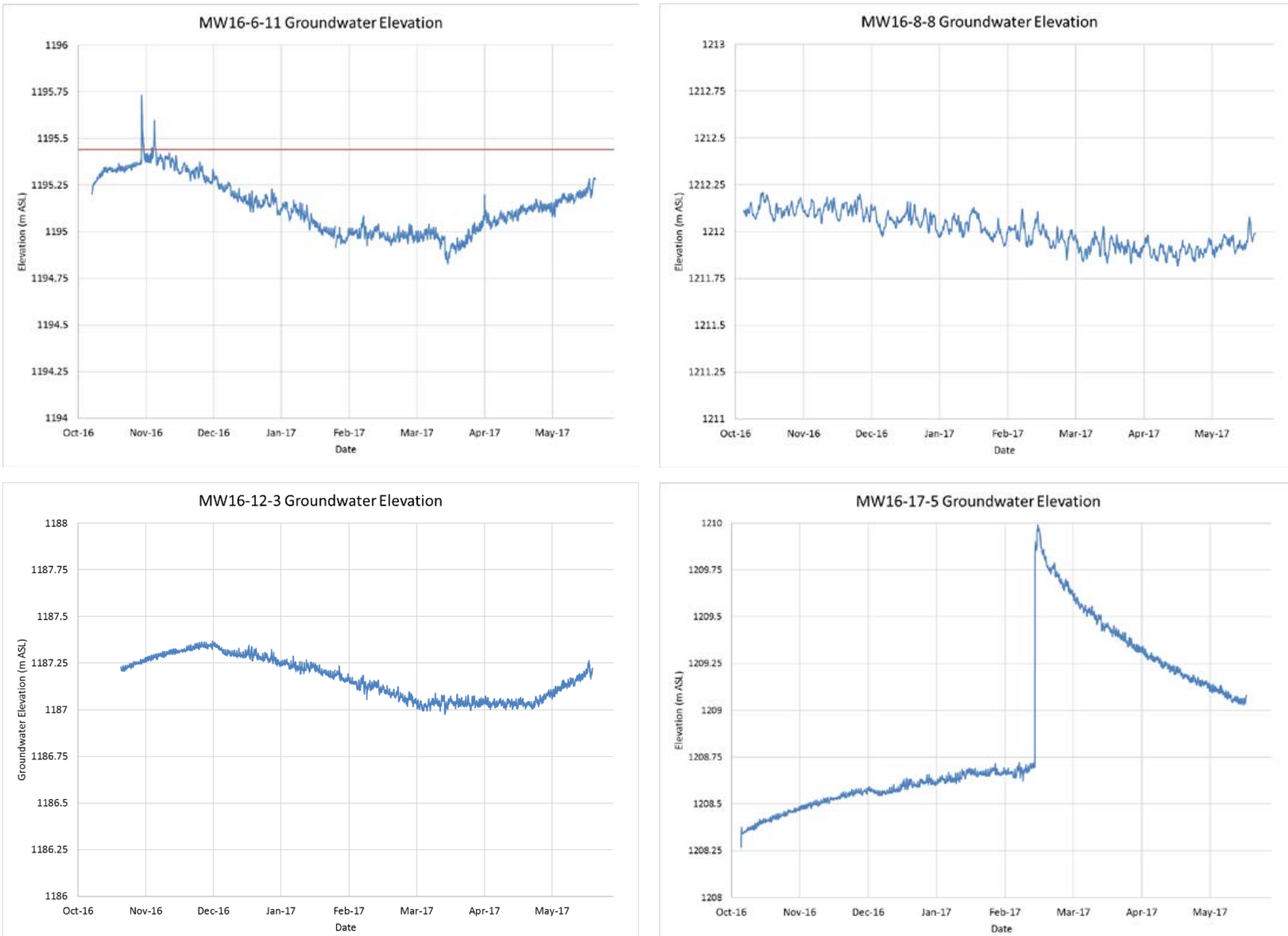


Figure 3-24 Hydrographs of Monitoring Wells Completed in Unconsolidated Deposits

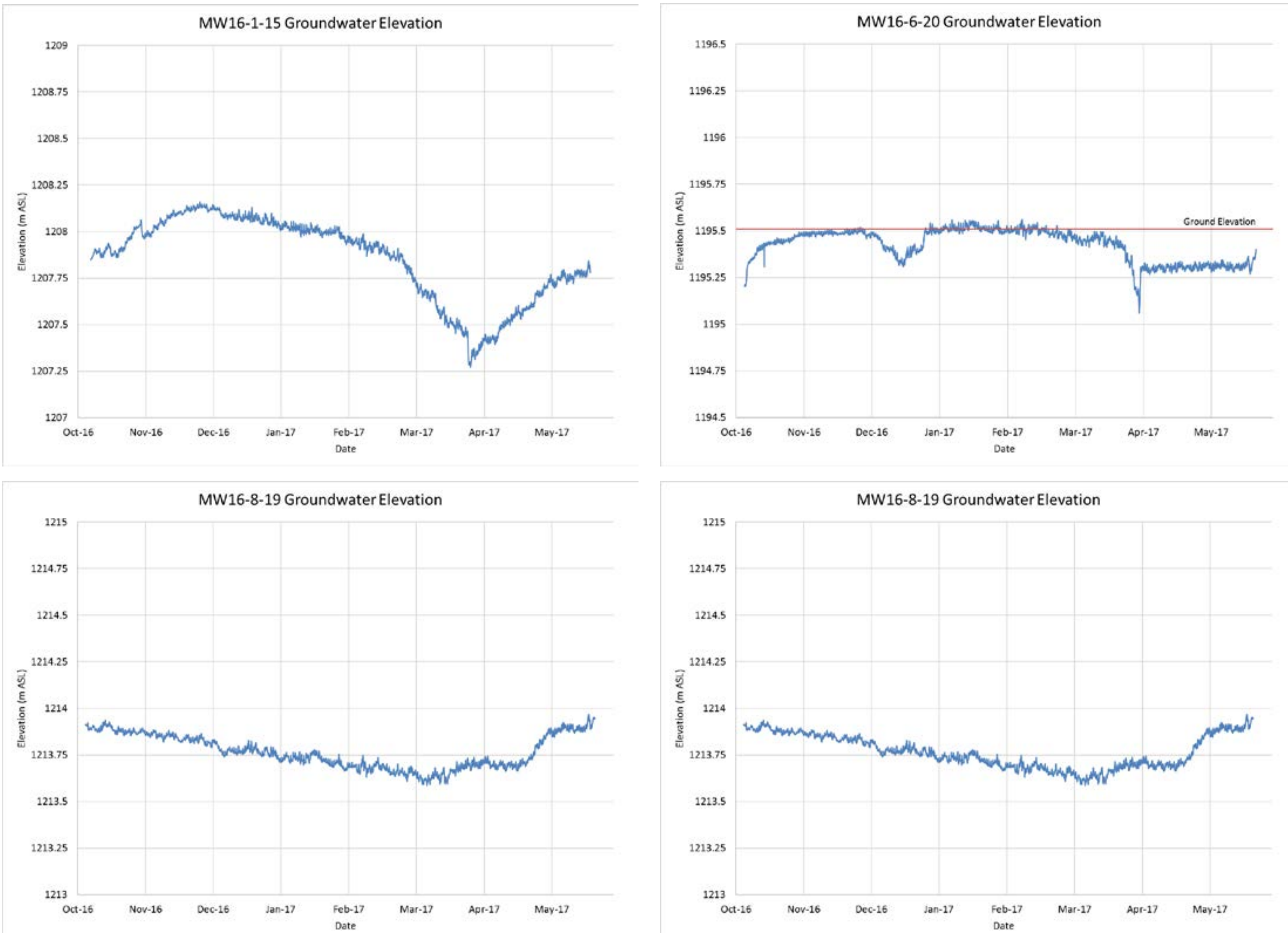


Figure 3-25 Hydrographs of Monitoring Wells Completed in Bedrock

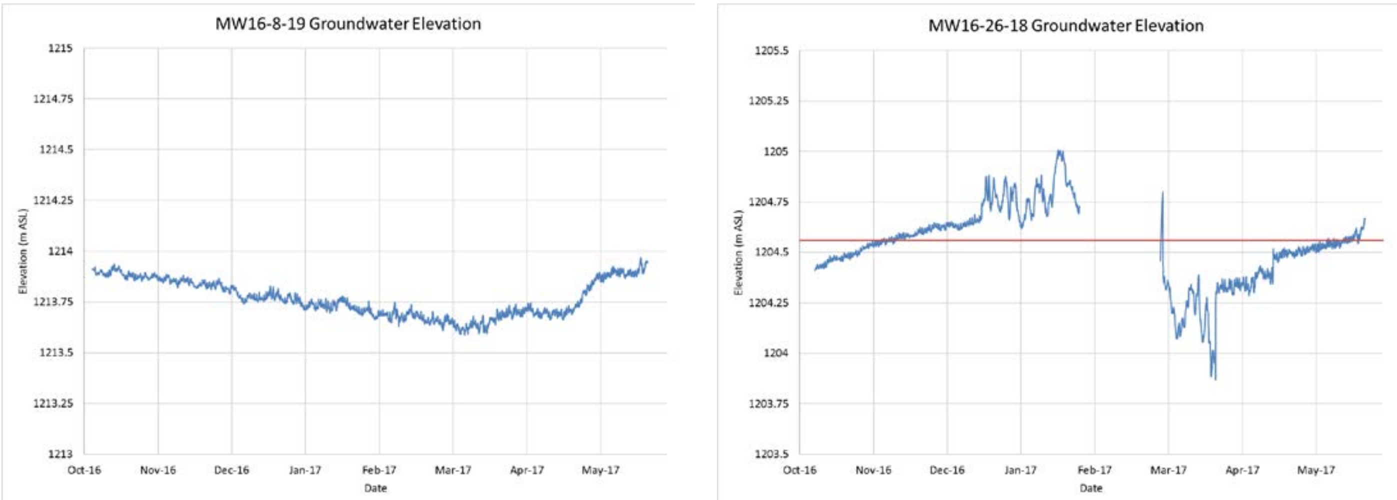


Figure 3-26 Hydrographs of Monitoring Wells Completed in Bedrock (continuation of Figure 3-25)

Water levels, or potentiometric elevations in the case of confined portions of the bedrock aquifers, exhibited seasonal trends similar to the unconsolidated deposits in a number of monitoring wells. In four of the six bedrock wells monitored, levels decreased between October 2016 and late March 2017 and then increased between late March 2017 to May 2017. However, MW16-6-20 had water levels that were at or near the ground surface throughout the year. In monitoring well MW16-26-18, the water level was also near or above the ground surface. As a result, freezing of the water within the casing and integrity issues caused some issues with the logger readings over the winter months. Water level fluctuations of up to 2 m were observed in the bedrock monitoring wells.

Over the long-term, regional scale groundwater levels at three Alberta Environment Groundwater Observation Well Network (GOWN) wells located in the Calgary area were evaluated. Hydrographs depicting historical water levels at the three GOWN wells are presented in Figure 3-27. The Canmore well (05BEG018) shows seasonal variability as a result of being installed in an unconfined fluvial aquifer. Water levels increased each spring, reaching a peak in June, and followed by a steady decrease over the remainder of the year and into the next spring. Water level fluctuations fluctuate by approximately 3 m over this annual cycle. The fluctuations are related to river levels because this well is in direct hydraulic connection with Bow River. Similar fluctuations would be expected in wells completed in the recent fluvial deposits near Elbow River.

The GOWN well at Crossfield ((05BHG006) shows considerably less variation than the Canmore well. The Crossfield well is completed to approximately 48 m BGL in interbedded shale and sandstone bedrock. Fluctuations of approximately 0.5 m are observed at this well over the 2009 to 2017 monitoring record with fluctuations independent of seasonal effects. No long-term trends are evident at this well.

At the Okotoks GOWN well (05BLG006), completed in sandstone to 38 m BGL, a relatively high degree of variation in water levels is noted along with an overall increasing trend. The water level in this well increased from a depth of approximately 31 m in 1986 to less than 27 m in 2016.

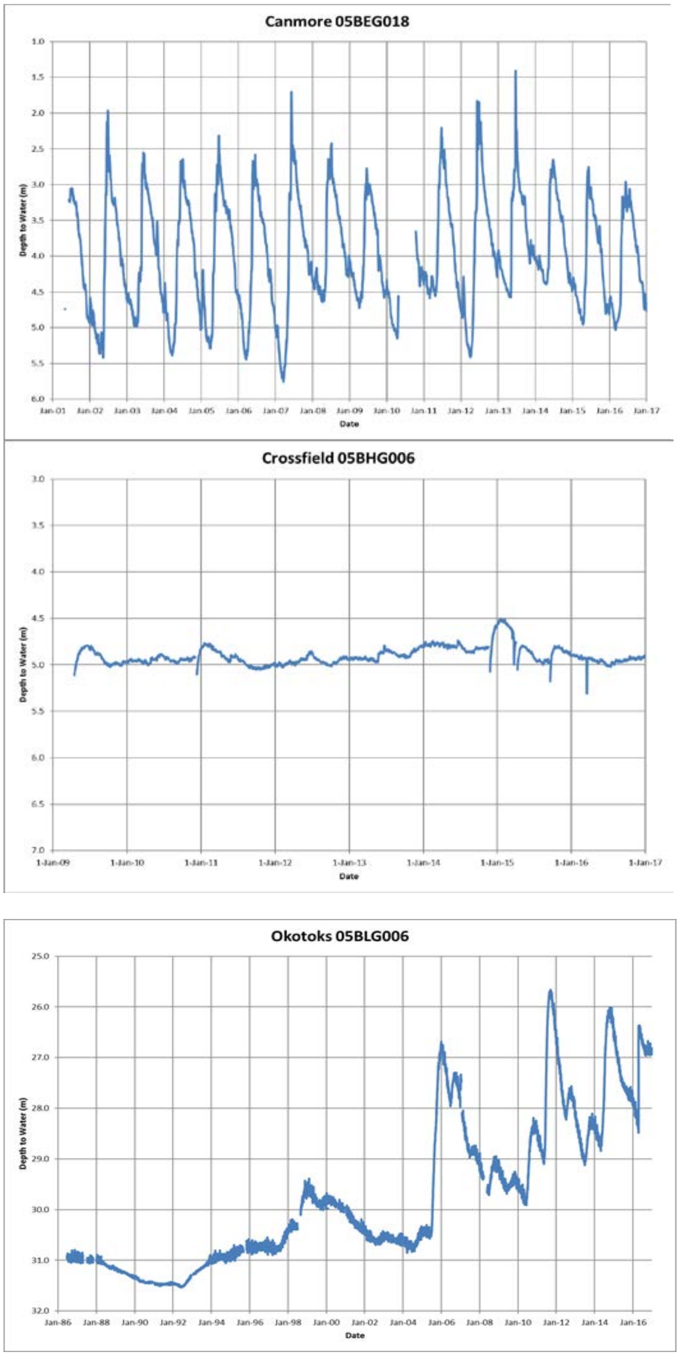


Figure 3-27 GOWN Well Hydrographs

3.3 GROUNDWATER USE

Groundwater use in the RAA is primarily from shallow bedrock aquifers with some wells also completed in the recent fluvial deposits along the Elbow River. Regional mapping by HCL (2002) indicated yields from the bedrock aquifers in the disturbed belt range from 10 m^3/day to 75 m^3/day. Yields from wells completed in the recent fluvial deposits along the Elbow River are expected to range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

The base of groundwater protection (BGP) is an estimate of the elevation of the base of the geological formation in which the groundwater is deemed useable with a total dissolved solids (TDS) concentration of less than 4,000 mg/L. West of the RAA, the BGP is defined as the base of the Paskapoo Formation; however, because the RAA lies within the disturbed belt of the Rocky Mountains, the AGS has set an arbitrary BGP of 600 m BGL.

Water well drillers records for groundwater wells completed in the expanded RAA were queried from the AWWID. A total of 2,140 unique well records were identified within the expanded RAA. A number of well record types were removed from the raw data such as abandoned test holes, dry holes, piezometers, and seismic test holes, which are not reflective of groundwater use.

A total of 1,708 water well drilling records remained after removing irrelevant data. A summary of water well records is presented as additional information in Attachment B. The locations of the water well records are presented in Figure 3-28. A domestic water well testing program was completed, as requested by landowners, within the LAA. To adhere to land access agreements and confidentiality requested by landowners, data from specific locations are not presented, however the data were used in development of the 3D CSM. Wells that were verified in the field and monitored as part of the domestic well testing program are also indicated in Attachment B and their locations are presented in Figure 3-28.

The proposed use of the wells associated with the AWWID drilling records within the expanded are as follows:

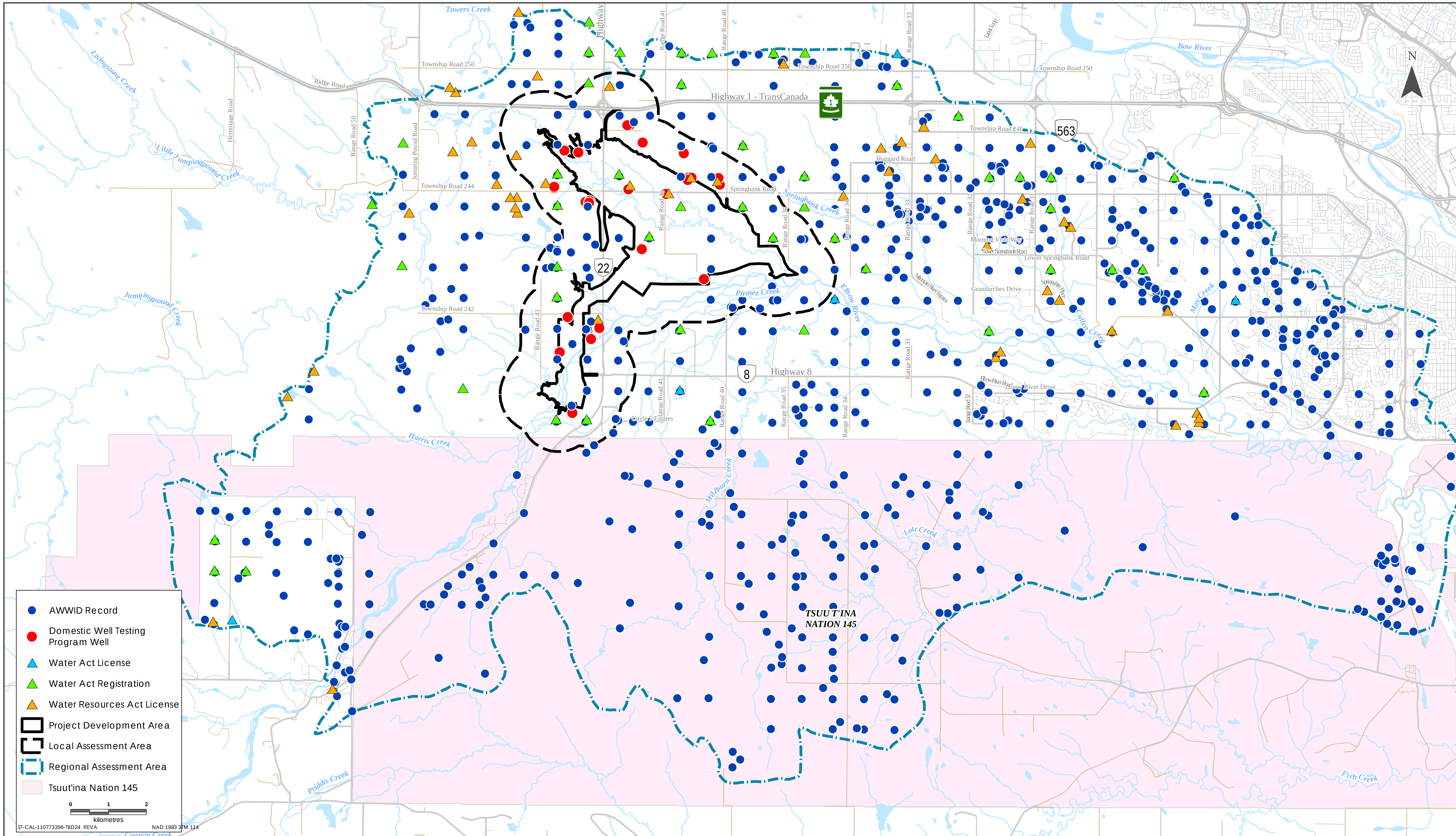
- 1,458 for domestic use
- 71 for stock use
- 75 for domestic and stock use
- 15 for commercial purposes
- 16 for industrial purposes
- 5 for irrigation purposes
- 9 for municipal use
- 59 for unknown use

Water well depths ranged from 1.5 m BGL to 246 m BGL. Figure 3-29 presents a histogram of the total depth recorded on the drilling records. The number of wells completed in bedrock and unconsolidated units are also summarized in the figure. A total of 83 well records were for wells installed in unconsolidated deposits with completion depths ranging from 0 m BGL to 50 m BGL.

Groundwater diversion licenses and registrations (termed Approvals herein for simplicity) associated with the water well records in the RAA provide additional information on the nature and magnitude of water allocations. A total of 100 unique licenses and registrations are located in the expanded RAA as follows:

- 47 *Water Resources Act* licenses (Issued prior to 1999 Water Act)
- 5 *Water Act* licenses
- 48 *Water Act* registrations

Table 3-3 summarizes the groundwater licenses and registrations and their locations are presented in Figure 3-24. No Approvals are noted within the Tsuut'ina Nation Reserve because such approvals are exempted within Tsuut'ina Nation Reserve lands. Additional details for each groundwater Approval are provided in Attachment B.



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

AWWID Records: Alberta Water Well Information Database

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Groundwater Use

Figure 3-28

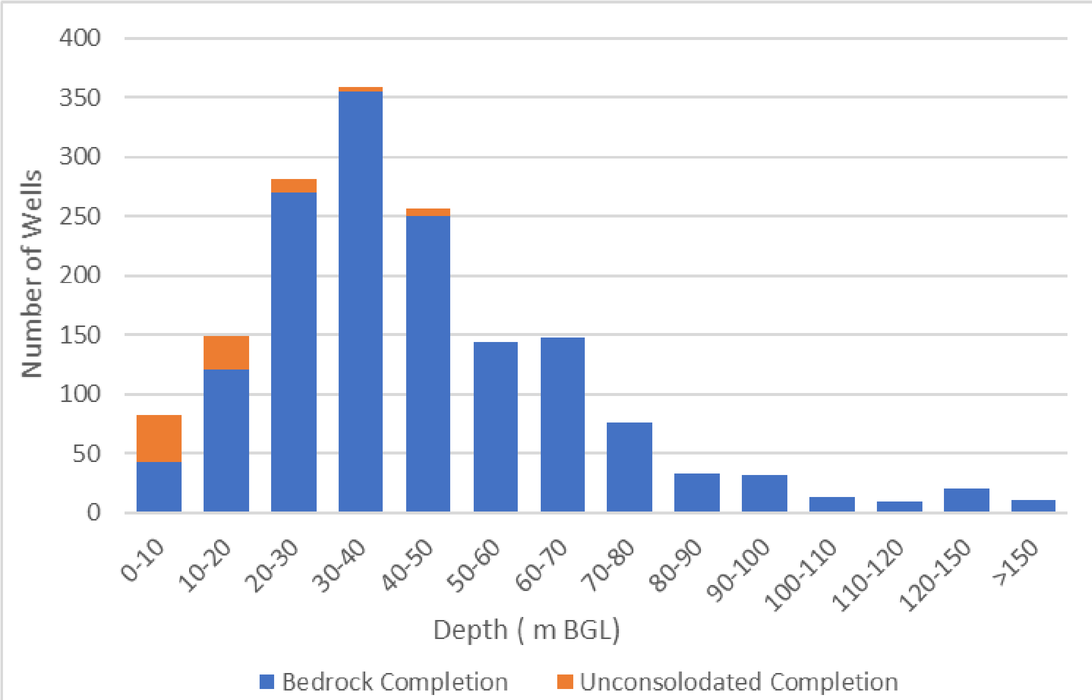


Figure 3-29 Histogram of Water Well Depth in the RAA

Table 3-3 Groundwater Licences and Registrations in the RAA

Approval No.	Type of Approval	LSD	Q	SEC	TWP	RNG	MER	Source	Quantity (m^3/year)
73672	Water Act License	0	NE	15	23	5	5	Unnamed Aquifer	12,775
82749	Water Act License	0	SW	16	24	2	5	Unnamed Aquifer	9,563
157105	Water Act License	0	SE	17	24	3	5	Unnamed Aquifer	311,643
204789	Water Act License	0	NW	1	24	4	5	Unnamed Aquifer	123
229656	Water Act License	0	SE	4	25	3	5	Unnamed Aquifer	1,250
75112	Water Act Registration	0	NW	16	24	3	5	Unnamed Aquifer	245
75322	Water Act Registration	0	NW	11	24	3	5	Unnamed Aquifer	365
78333	Water Act Registration	0	NW	36	24	4	5	Unnamed Aquifer	130
78548	Water Act Registration	0	SE	27	23	5	5	Unnamed Aquifer	130
82946	Water Act Registration	0	NE	33	24	3	5	Unnamed Aquifer	175
141013	Water Act Registration	0	SE	34	24	3	5	Unnamed Aquifer	868
142093	Water Act Registration	0	SW	25	24	3	5	Unnamed Aquifer	335

Table 3-3 Groundwater Licences and Registrations in the RAA

Approval No.	Type of Approval	LSD	Q	SEC	TWP	RNG	MER	Source	Quantity (m^3/year)
155886	Water Act Registration	0	SE	3	24	4	5	Unnamed Aquifer	3,155
159603	Water Act Registration	0	SW	26	24	3	5	Unnamed Aquifer	585
159911	Water Act Registration	0	NW	15	24	4	5	Unnamed Aquifer	235
160591	Water Act Registration	0	NW	8	24	3	5	Unnamed Aquifer	1,240
160646	Water Act Registration	0	NW	30	24	3	5	Unnamed Aquifer	1,090
161324	Water Act Registration	0	NW	19	24	4	5	Unnamed Aquifer	1,562
161384	Water Act Registration	0	NE	3	25	4	5	Unnamed Aquifer	1,085
161483	Water Act Registration	0	NE	18	24	4	5	Unnamed Aquifer	326
161570	Water Act Registration	0	SW	1	25	4	5	Unnamed Aquifer	1,295
161619	Water Act Registration	0	SE	23	24	4	5	Unnamed Aquifer	655
161634	Water Act Registration	0	SW	29	24	3	5	Unnamed Aquifer	1,310
161660	Water Act Registration	0	SE	20	24	3	5	Unnamed Aquifer	330
161875	Water Act Registration	0	SE	19	24	3	5	Unnamed Aquifer	3,300
162017	Water Act Registration	0	SW	15	24	4	5	Unnamed Aquifer	2,630
162213	Water Act Registration	0	NW	18	24	2	5	Unnamed Aquifer	25
162868	Water Act Registration	0	NW	13	24	3	5	Unnamed Aquifer	2,389
163116	Water Act Registration	0	NW	24	24	4	5	Unnamed Aquifer	4,910
163271	Water Act Registration	0	SW	26	24	4	5	Unnamed Aquifer	2,635
163401	Water Act Registration	0	NW	22	24	4	5	Unnamed Aquifer	1,293
163402	Water Act Registration	0	SE	1	25	4	5	Unnamed Aquifer	4,166
165012	Water Act Registration	0	NW	24	24	3	5	Unnamed Aquifer	59
167739	Water Act Registration	0	SW	2	25	4	5	Unnamed Aquifer	1,080
167951	Water Act Registration	0	SE	6	25	3	5	Unnamed Aquifer	3,605
168294	Water Act Registration	0	NE	5	24	2	5	Unnamed Aquifer	160
169793	Water Act Registration	0	NW	12	24	4	5	Unnamed Aquifer	1,710
170103	Water Act Registration	0	NE	34	24	4	5	Unnamed Aquifer	942
170135	Water Act Registration	0	SE	1	24	4	5	Unnamed Aquifer	492
170644	Water Act Registration	0	SW	29	24	2	5	Unnamed Aquifer	435
172175	Water Act Registration	0	NE	5	24	2	5	Unnamed Aquifer	303
172207	Water Act Registration	0	NE	30	24	4	5	Unnamed Aquifer	87
172660	Water Act Registration	0	SE	26	24	3	5	Unnamed Aquifer	1,265

Table 3-3 Groundwater Licences and Registrations in the RAA

Approval No.	Type of Approval	LSD	Q	SEC	TWP	RNG	MER	Source	Quantity (m^3/year)
172847	Water Act Registration	0	SW	3	24	4	5	Unnamed Aquifer	1,980
173095	Water Act Registration	0	NE	18	24	2	5	Unnamed Aquifer	83
174068	Water Act Registration	0	NE	5	24	4	5	Unnamed Aquifer	466
182509	Water Act Registration	0	SE	3	25	4	5	Unnamed Aquifer	1,085
183452	Water Act Registration	0	SW	27	24	4	5	Unnamed Aquifer	1,965
187243	Water Act Registration	0	NE	22	23	5	5	Unnamed Aquifer	1,212
194348	Water Act Registration	0	NW	23	23	5	5	Unnamed Aquifer	90
202163	Water Act Registration	0	SW	5	25	3	5	Unnamed Aquifer	3,808
333125	Water Act Registration	0	NW	20	24	3	5	Unnamed Aquifer	1,905
333126	Water Act Registration	0	NW	19	24	3	5	Unnamed Aquifer	835
27924	Water Resources Act License	16		23	24	3	5	Unnamed Aquifer	2,470
23882	Water Resources Act License	11		7	24	2	5	Unnamed Aquifer	740
23993	Water Resources Act License	16		28	24	3	5	Unnamed Aquifer	21,590
24023	Water Resources Act License	13		35	24	4	5	Unnamed Aquifer	13,560
24328	Water Resources Act License	0	SW	34	24	3	5	Unnamed Aquifer	2,470
24342	Water Resources Act License	16		26	24	3	5	Unnamed Aquifer	620
24545	Water Resources Act License	1		6	25	3	5	Unnamed Aquifer	2,470
25968	Water Resources Act License	16		10	24	4	5	Unnamed Aquifer	1,230
27046	Water Resources Act License	7		5	24	2	5	Unnamed Aquifer	12,950
27047	Water Resources Act License	7		5	24	2	5	Unnamed Aquifer	1,230
27048	Water Resources Act License	7		5	24	2	5	Unnamed Aquifer	9,870
27049	Water Resources Act License	7		5	24	2	5	Unnamed Aquifer	185,020
27527	Water Resources Act License	4		12	24	5	5	Unnamed Aquifer	2,470
27528	Water Resources Act License	10		2	24	5	5	Unnamed Aquifer	2,470
27529	Water Resources Act License	11		28	24	4	5	Unnamed Aquifer	2,470
27530	Water Resources Act License	14		21	24	4	5	Unnamed Aquifer	2,470
27531	Water Resources Act License	11		32	24	4	5	Unnamed Aquifer	1,230
27532	Water Resources Act License	10		21	24	4	5	Unnamed Aquifer	1,230
27533	Water Resources Act License	10		21	24	4	5	Unnamed Aquifer	1,230
27534	Water Resources Act License	10		19	24	4	5	Unnamed Aquifer	13,560
27535	Water Resources Act License	11		32	24	4	5	Unnamed Aquifer	1,230

Table 3-3 Groundwater Licences and Registrations in the RAA

Approval No.	Type of Approval	LSD	Q	SEC	TWP	RNG	MER	Source	Quantity (m^3/year)
27536	Water Resources Act License	4		28	24	4	5	Unnamed Aquifer	1,230
27537	Water Resources Act License	14		21	24	4	5	Unnamed Aquifer	2,470
27538	Water Resources Act License	16		33	24	4	5	Unnamed Aquifer	1,230
27539	Water Resources Act License	15		29	24	4	5	Unnamed Aquifer	1,230
27540	Water Resources Act License	11		29	24	4	5	Unnamed Aquifer	2,470
27546	Water Resources Act License	15		4	25	4	5	Unnamed Aquifer	1,230
27701	Water Resources Act License	4		27	24	4	5	Unnamed Aquifer	2,460
27702	Water Resources Act License	3		26	24	4	5	Unnamed Aquifer	2,460
27703	Water Resources Act License	13		24	24	4	5	Unnamed Aquifer	7,400
27704	Water Resources Act License	1		25	24	4	5	Unnamed Aquifer	4,940
27705	Water Resources Act License	3		25	24	4	5	Unnamed Aquifer	7,400
28591	Water Resources Act License	6		13	24	3	5	Unnamed Aquifer	11,100
31714	Water Resources Act License	4		17	24	2	5	Unnamed Aquifer	27,140
31829	Water Resources Act License	16		20	24	3	5	Unnamed Aquifer	4,930
31838	Water Resources Act License	7		24	24	3	5	Unnamed Aquifer	6,170
32318	Water Resources Act License	10		28	24	3	5	Unnamed Aquifer	12,330
32320	Water Resources Act License	7		32	24	3	5	Unnamed Aquifer	3,700
32862	Water Resources Act License	5		13	24	3	5	Unnamed Aquifer	8,630
32996	Water Resources Act License	0	SW	23	24	3	5	Unnamed Aquifer	3,700
33155	Water Resources Act License	11		24	24	3	5	Unnamed Aquifer	9,870
33307	Water Resources Act License	0	NE	15	23	5	5	Unnamed Aquifer	2,470
33514	Water Resources Act License	0	NW	27	24	3	5	Unnamed Aquifer	2,470
33554	Water Resources Act License	0	SE	28	24	3	5	Unnamed Aquifer	2,273
34574	Water Resources Act License	6		11	24	3	5	Unnamed Aquifer	20,970
34575	Water Resources Act License	6		11	24	3	5	Unnamed Aquifer	40,710
35448	Water Resources Act License	15		12	23	5	5	Unnamed Aquifer	1,230

3.4 GROUNDWATER CHEMISTRY

Groundwater chemistry was determined using data from the groundwater monitoring described in Section 2.5. All monitoring wells were sampled except for MW16-13-37, which could not be located and may have been destroyed. The full analytical suite of parameters described in Section 2.5 was analyzed for each monitoring well sampled except for MW16-12-3 and MW16-17-5 where, as a result of low yield, microbiological and hydrocarbon parameters were not analyzed. Additional analytical data from the domestic well testing program were also included for existing water chemistry. Table 3-4 presents the laboratory analytical results from Project-specific monitoring, and the analytical results from the domestic well testing program are listed in Table 3-5. Analytical data from the third party domestic well testing program are not included in this summary.

For comparison purposes, Table 3-4 includes the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Alberta Tier 1 Guidelines) (AEP 2016) for fine-grained soils in an agricultural land use setting and the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2014).

Figure 3-30 is a visual representation of TDS and major ion chemistry in the groundwater samples collected from monitoring wells in the LAA. The size of the symbols in the central portion of the piper diagram are scaled to represent the relative TDS concentration of the sample. TDS in all samples ranged from 440 mg/L to 6,900 mg/L. The water chemistry characteristics displayed in the diagram are described in the following subsections.

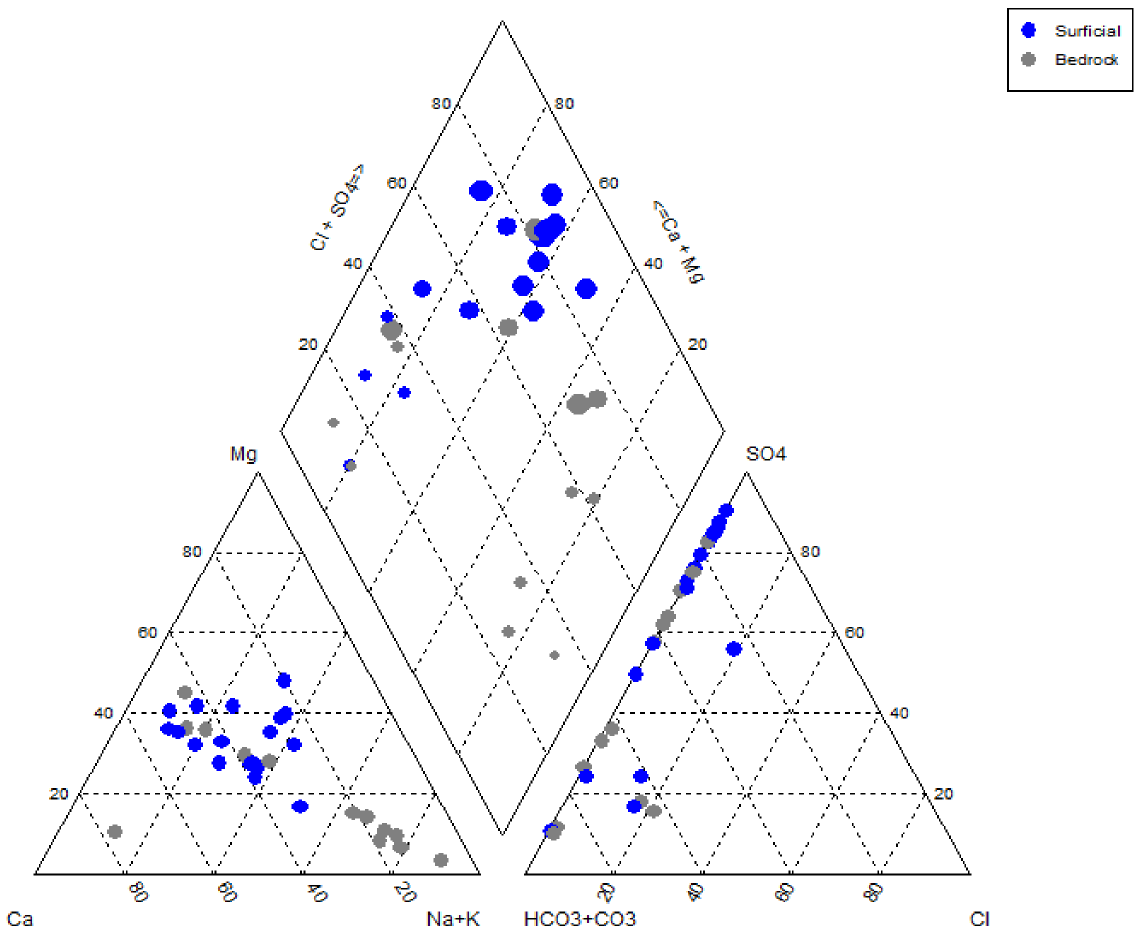


Figure 3-30 Diagram of Monitoring Well Chemistry

Table 3-4
Summary of Groundwater Analytical Laboratory Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters

Sample Location	Units	Health Canada	AEP	MW16-2-6	MW16-3-7	MW16-6-11	MW16-7-5	MW16-8-8	MW16-9-6	MW16-10-15	MW16-11-15
Sample Date				30-Sep-16	28-Sep-16	27-Sep-16	27-Sep-16	4-Oct-16	30-Sep-16	4-Oct-16	30-Sep-16
Aquifer				Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology				Sandstone	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glacial Till
Calculated Parameters											
Anion Sum	meq/L	n/v	n/v	83	32	43	55	12	21	45	39
Cation Sum	meq/L	n/v	n/v	83	33	41	49	12	22	42	38
Hardness (as CaCO3)	mg/L	n/v	n/v	2600	950	1300	1600	550	930	1400	1200
Ion Balance	none	n/v	n/v	1.0	1.0	0.95	0.90	1.0	1.1	0.94	0.98
Nitrate	mg/L	45[C]	13[D]	<0.22	1.3	<0.044	<0.044	6.9	0.065	0.12	<0.044
Nitrate + Nitrite (as N)	mg/L	n/v	100[D]	0.024	0.30	<0.020	<0.020	1.6	<0.020	0.027	<0.020
Nitrite	mg/L	3[C]	0.06[D]	**0.078**[D]	0.051	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	≤500[B]	500[D]	**5300**[BD]	**2000**[BD]	**2700**[BD]	**3400**[BD]	**640**[BD]	**1200**[BD]	**2800**[BD]	**2400**[BD]
BTEX and Petroleum Hydrocarbons											
Benzene	mg/L	0.005[C]	0.005[D]	0.00044	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024[B] 0.06[C]	0.024[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016[B] 0.14[C]	0.0016[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Xylene, m & p-	mg/L	n/v	n/v	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
Xylene, o-	mg/L	n/v	$_{s1}$[D]	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02[B] 0.09[C]	0.02[D]	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	n/v	2.2[D]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	n/v	1.1[D]	0.47	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics											
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	6.2	8.0	4.3	9.2	2.8	4.7	4.2	3.1
Electrical Conductivity, Lab	µS/cm	n/v	1000[D]	**5900**[D]	**2600**[D]	**3300**[D]	**3900**[D]	**1100**[D]	**1700**[D]	**3000**[D]	**3100**[D]
pH	S.U.	6.5-8.5[B]	6.5-8.5[D]	7.95	8.16	7.53	7.57	7.90	7.88	7.65	7.99
Anions											
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	520	450	330	380	370	510	380	410
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	630	550	410	470	450	630	470	500
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50
Sulfate	mg/L	≤500$_{j}$[B]	500[D]	**3500 CD**[BD]	**1100 CD**[BD]	**1800 CD**[BD]	**2200 CD**[BD]	140	490 CD	**1800 CD**[BD]	**1500 CD**[BD]
Chloride	mg/L	≤250[B]	100[D]	6.0	12	4.3	14	60	1.6	7.1	1.7
Nutrients											
Ammonia (as N)	mg/L	n/v	0.261-190$_{n1}$[D]	0.27	0.20	0.37	0.16	0.055	0.16	0.59	0.49
Nitrite (as N)	mg/L	1[C]	0.06[D]	0.024	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (as N)	mg/L	10[C]	3[D]	<0.050 MI	0.29	<0.010	<0.010	1.6	0.015	0.027	<0.010
Orthophosphate(as P)	mg/L	n/v	n/v	0.0041	0.0099 OG	<0.0030	0.012 OG	<0.0030	0.0036	<0.0030	<0.0030
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.0094	0.0067	<0.0030	0.0065	0.0045	0.0059	0.0035	0.0033
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	5.1 DB	1.7 DB	6.5 DB	0.62	0.95	0.20	5.4 CD	3.7 DB

Sample Location	MW16-12-3	MW16-16-11	MW16-17-5	MW16-18-6	MW16-19-8	MW16-22-26	MW16-23-14	MW16-25-9
Sample Date	6-Oct-16	3-Oct-16	6-Oct-16	4-Oct-16	27-Sep-16	28-Sep-16	29-Sep-16	30-Sep-16
Aquifer	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology	Glacial Till	Glacial Till	Glaciolacustrine Clay	Basal Silt and Sand	Basal Silt and Sand	Glacial Till	Glacial Till	Glacial Till
Calculated Parameters								
Anion Sum	33	78	110	13	32	26	13	13
Cation Sum	31	75	100	12	31	26	14	14
Hardness (as CaCO3)	1300	2400	3500	480	980	640	540	590
Ion Balance	0.94	0.95	0.93	0.98	0.96	1.0	1.0	1.1
Nitrate	1.5	0.14	5.0	5.3	1.8	0.054	<0.044	0.064
Nitrate + Nitrite (as N)	0.34	0.031	1.3	1.2	0.42	<0.020	<0.020	<0.020
Nitrite	<0.033	<0.033	**0.55**[D]	**0.10**[D]	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	**1900**[BD]	**4900**[BD]	**6900**[BD]	**650**[BD]	**2000**[BD]	**1700**[BD]	**680**[BD]	**680**[BD]
BTEX and Petroleum Hydrocarbons								
Benzene	-	**0.0056**[CD]	-	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	-	0.024	-	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	-	**0.0034**[BD]	-	0.00062	<0.00040	<0.00040	<0.00040	<0.00040
Xylene, m & p-	-	0.013	-	0.0020	<0.00080	<0.00080	<0.00080	<0.00080
Xylene, o-	-	0.0056	-	0.0010	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	-	0.019	-	0.0030	<0.00080	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	-	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics								
Dissolved Organic Carbon (DOC)	-	4.6	-	4.9	6.3	3.3	4.1	5.6
Electrical Conductivity, Lab	**2600**[D]	**5400**[D]	**6900**[D]	**1100**[D]	**2500**[D]	**2200**[D]	**1100**[D]	**1100**[D]
pH	7.97	7.57	7.81	8.01	7.56	8.04	7.94	8.11
Anions								
Alkalinity (P as CaCO3)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Total (as CaCO3)	410	630	520	420	420	180	600	470
Alkalinity, Bicarbonate (as CaCO3)	510	770	640	510	520	220	730	580
Alkalinity, Carbonate (as CaCO3)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Hydroxide (as CaCO3)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulfate	**900 CD**[BD]	**3100 CD**[BD]	**4800 CD**[BD]	100	**1100 CD**[BD]	**1100 CD**[BD]	70	150
Chloride	**230 CD**[D]	7.9	8.7	72	1.9	4.9	3.5	8.2
Nutrients								
Ammonia (as N)	-	0.60	-	<0.050	0.070	0.68	0.14	0.12
Nitrite (as N)	<0.010	<0.010	**0.17**[D]	0.031	<0.010	<0.010	<0.010	<0.010
Nitrate (as N)	0.34	0.031	1.1	1.2	0.42	0.012	<0.010	0.015
Orthophosphate(as P)	-	0.0045	-	<0.0030	<0.0030	0.0076 OG	<0.0030	0.0086
Phosphorus, Total (Dissolved)	-	0.011	-	0.0038	0.0037	<0.0030	<0.0030	0.016
Total Kjeldahl Nitrogen	-	14 DB	-	1.3	0.70 DB	0.97	2.8 CD	0.54 DB

See notes on last page.

Table 3-4
Summary of Groundwater Analytical Laboratory Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters

Sample Location				MW16-2-6	MW16-3-7	MW16-6-11	MW16-7-5	MW16-8-8	MW16-9-6	MW16-10-15	MW16-11-15
Sample Date				30-Sep-16	28-Sep-16	27-Sep-16	27-Sep-16	4-Oct-16	30-Sep-16	4-Oct-16	30-Sep-16
Aquifer				Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology	Units	Health Canada	AEP	Sandstone	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glaciolacustrine Clay and Silt	Glacial Till	Glacial Till
Metals, Dissolved											
Aluminum	mg/L	$0.1/0.2_{a}$[B]	$0.1/0.050_{n2}$[D]	0.016	0.0064	0.0041	0.0048	<0.0030	<0.0030	0.0042	<0.0030
Antimony	mg/L	0.006[C]	0.006[D]	0.00073	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	.	<0.00060
Arsenic	mg/L	0.010[C]	0.005[D]	0.0044	0.00078	0.00050	0.0010	<0.00020	0.00093	0.0012	0.0012
Barium	mg/L	1.0[C]	1[D]	0.018	0.035	0.021	0.032	0.039	0.039	0.022	0.016
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	5[C]	1.0[D]	0.11	0.10	0.13	0.12	0.043	0.14	0.12	0.10
Cadmium	mg/L	0.005[C]	$0.011/0.040_{n2}$[D]	0.000092	0.000036	0.000058	0.00013	0.000040	0.000073	0.00010	0.000043
Calcium	mg/L	n/v	n/v	390	170	310	250	120	220	320	290
Chromium	mg/L	0.05[C]	0.0049_{s2}[D]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0043	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0060	0.0023	0.0041	0.0051	0.00057	0.0037	0.0043	0.0016
Copper	mg/L	≤1.0[B]	0.007[D]	0.00084	0.00085	<0.00020	0.00097	0.00032	0.00064	<0.00020	0.00029
Iron	mg/L	≤0.3[B]	0.3[D]	<0.060	0.17	0.11	<0.060	<0.060	0.13	<0.060	**0.37[BD]**
Lead	mg/L	0.010[C]	0.068_{n2}[D]	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.11	0.057	0.049	0.077	<0.020	0.030	0.055	0.050
Magnesium	mg/L	n/v	n/v	400	130	140	230	60	94	140	110
Manganese	mg/L	≤0.05[B]	0.05[D]	**1.5[BD]**	**0.39[BD]**	**0.85[BD]**	**0.81[BD]**	**0.12[BD]**	**0.93[BD]**	**1.0[BD]**	**0.77[BD]**
Mercury	µg/L	1[C]	0.005[D]	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0036
Molybdenum	mg/L	n/v	n/v	0.0071	0.0020	0.0014	0.0026	0.0011	0.00082	0.0034	0.0015
Nickel	mg/L	n/v	$0.40/3.6_{n2}$[D]	0.016	0.0065	0.0064	0.011	0.0025	0.0071	0.013	0.0027
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	9.4	6.1	8.5	5.9	5.8	5.6	11	6.0
Selenium	mg/L	0.05[C]	0.001[D]	**0.0013[D]**	0.00026	0.00044	0.00046	**0.011[D]**	<0.00020	0.00038	<0.00020
Silicon	mg/L	n/v	n/v	5.9	5.1	5.0	5.6	4.2	5.5	4.5	4.8
Silver	mg/L	n/v	0.0001[D]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	≤200[B]	200[D]	**690 CD[BD]**	**320[BD]**	**330[BD]**	**400[BD]**	25	71	**330[BD]**	**320[BD]**
Strontium	mg/L	n/v	n/v	4.6	1.6	2.4	2.4	0.90	1.4	3.4	2.6
Sulfur	mg/L	n/v	n/v	1200 CD	370	580 CD	700 CD	45	180	650 CD	480
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.02[C]	0.01[D]	**0.040[CD]**	**0.014[D]**	0.0085	**0.020[D]**	**0.011[D]**	0.0086	**0.012[D]**	0.0071
Vanadium	mg/L	n/v	n/v	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	≤5.0[B]	0.03[D]	0.016	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0053
Metals, Total											
Mercury	µg/L	1[C]	0.005[D]	***<6.0 DB***	***<6.0 DB***	***<20 DB***	***<2.0 DB***	***<20 DB***	***<0.020 DB***	***<20 DB***	***<6.0 DB***
Microbiological Parameters											
Escherichia coli (E.Coli)	mpn/100mL	0[A]	n/v	***<100 DB***	***<10 DB***	***<100***	***<10***	***<100 DB***	***<1.0***	***<100 DB***	***<100 DB***
Fecal Coliform	mpn/100mL	n/v	n/v	<100 DB	<10 DB	<100 DB	<10 DB	<100 DB	<1.0	100 DB	<100 DB
Heterotrophic Plate Count	cfu/mL	n/v	n/v	49000 DB	6000 >	56000 DB	920	34000 DB	1100	6000 DB>	23000 DB
Total Coliforms	mpn/100mL	0[A]	n/v	***<100 DB***	**450 DB[A]**	**9300[A]**	**1700[A]**	***<100 DB***	**390[A]**	**9100 DB[A]**	**100 DB[A]**

Sample Location				MW16-12-3	MW16-16-11	MW16-17-5	MW16-18-6	MW16-19-8	MW16-22-26	MW16-23-14	MW16-25-9
Sample Date				6-Oct-16	3-Oct-16	6-Oct-16	4-Oct-16	27-Sep-16	28-Sep-16	29-Sep-16	30-Sep-16
Aquifer				Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
Lithology	Units	Health Canada	AEP	Glacial Till	Glacial Till	Glaciolacustrine Clay	Basal Silt and Sand	Basal Silt and Sand	Glacial Till	Glacial Till	Glacial Till
Metals, Dissolved											
Aluminum	mg/L	$0.1/0.2_{a}$[B]	$0.1/0.050_{n2}$[D]	0.0070	0.0056	0.0039	<0.0030	0.0039	0.0036	<0.0030	0.028
Antimony	mg/L	0.006[C]	0.006[D]	<0.00060	<0.00060	0.00062	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.010[C]	0.005[D]	0.00092	0.00085	0.00053	0.00022	0.00030	0.00073	**0.0056[D]**	0.00078
Barium	mg/L	1.0[C]	1[D]	0.12	0.026	0.041	0.075	0.013	0.034	0.12	0.053
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	5[C]	1.0[D]	0.051	0.20	0.12	0.088	0.092	0.098	0.13	0.099
Cadmium	mg/L	0.005[C]	$0.011/0.040_{n2}$[D]	0.000036	0.00014 NF	0.00028	<0.000020	0.000057	<0.000020	0.000033	0.000065
Calcium	mg/L	n/v	n/v	270	440	410	86	230	170	130	140
Chromium	mg/L	0.05[C]	0.0049_{s2}[D]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.00030	0.0037	0.00083	<0.00030	<0.00030	0.00087	0.0020	0.0020
Copper	mg/L	≤1.0[B]	0.007[D]	0.0018	**0.0097[D]**	0.0017	0.00067	0.00059	<0.00020	<0.00020	0.0011
Iron	mg/L	≤0.3[B]	0.3[D]	<0.060	<0.060	<0.060	<0.060	<0.060	0.11	**0.50[BD]**	0.16
Lead	mg/L	0.010[C]	0.068_{n2}[D]	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.030	0.15	0.15	0.026	0.029	0.064	0.032	0.034
Magnesium	mg/L	n/v	n/v	160	320	600 CD	63	99	54	53	59
Manganese	mg/L	≤0.05[B]	0.05[D]	0.025	**2.3[BD]**	**0.39[BD]**	**0.058[BD]**	**0.071[BD]**	**0.51[BD]**	**0.75[BD]**	**0.23[BD]**
Mercury	µg/L	1[C]	0.005[D]	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0035
Molybdenum	mg/L	n/v	n/v	0.0021	0.0011	0.0015	0.0019	0.00060	0.0039	0.0053	0.0036
Nickel	mg/L	n/v	$0.40/3.6_{n2}$[D]	0.0041	0.0066	0.0054	0.00099	<0.00050	0.0018	0.0053	0.0067
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	6.4	15	11	2.4	5.9	7.1	6.5	6.6
Selenium	mg/L	0.05[C]	0.001[D]	**0.0016[D]**	0.00038	**0.034[D]**	**0.0012[D]**	**0.056[CD]**	0.00023	<0.00020	**0.0014[D]**
Silicon	mg/L	n/v	n/v	6.1	6.3	5.2	4.1	3.6	4.8	6.5	7.0
Silver	mg/L	n/v	0.0001[D]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	≤200[B]	200[D]	110	**600 CD[BD]**	**750 CD[BD]**	66	**260[BD]**	**310[BD]**	59	34
Strontium	mg/L	n/v	n/v	1.1	4.9	4.7	0.75	1.4	2.4	1.1	0.74
Sulfur	mg/L	n/v	n/v	270	1000 CD	1500 CD	29	370	350	25	49
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.02[C]	0.01[D]	0.010	**0.033[CD]**	**0.031[CD]**	**0.011[D]**	**0.013[D]**	0.0044	0.0052	**0.014[D]**
Vanadium	mg/L	n/v	n/v	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011
Zinc	mg/L	≤5.0[B]	0.03[D]	<0.0030	<0.0030	0.0062	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Metals, Total											
Mercury	µg/L	1[C]	0.005[D]	**0.30 DB[D]**	***<6.0 DB***	***<0.20 DB***	***<6.0 DB***	***<2.0 DB***	***<6.0 DB***	***<20 DB***	***<2.0 DB***
Microbiological Parameters											
Escherichia coli (E.Coli)	mpn/100mL	0[A]	n/v	-	***<100 DB***	-	***<10 DB***	**63[A]**	***<10 DB***	***<10 DB***	***<10 DB***
Fecal Coliform	mpn/100mL	n/v	n/v	-	<100 DB	-	<10 DB	<10 DB	<10 DB	<10 DB	<10 DB
Heterotrophic Plate Count	cfu/mL	n/v	n/v	-	50000 DB	-	4400 DB	6000 >	6000 >	20000 DB	7900 DB
Total Coliforms	mpn/100mL	0[A]	n/v	-	**200 DB[A]**	-	**140 DB[A]**	**280[A]**	**2000 DB[A]**	**2400 DB>[A]**	**2400 DB>[A]**

See notes on last page.

Table 3-4
Summary of Groundwater Analytical Laboratory Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters

Sample Location				**MW16-27-12**	**MW16-1-15**	**MW16-4-22**	**MW16-5-11**	**MW16-6-20**	**MW16-8-19**	**MW16-14-33**	**MW16-15-34**	**MW16-18-10**	**MW16-19-19**	**MW16-20-21**	**MW16-21-11**	**MW16-23-36**	**MW16-24-30**	**MW16-26-18**
Sample Date				**28-Sep-16**	**3-Oct-16**	**4-Oct-16**	**4-Oct-16**	**27-Sep-16**	**4-Oct-16**	**27-Sep-16**	**26-Sep-16**	**4-Oct-16**	**27-Sep-16**	**27-Sep-16**	**29-Sep-16**	**29-Sep-16**	**28-Sep-16**	**28-Sep-16**
Aquifer				Surficial	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock
Lithology	**Units**	**Health Canada**	**AEP**	Glacial Till	Sandstone	Sandstone	Sandstone	Claystone/ Siltstone	Sandstone	Siltstone/ Claystone	Siltstone	Claystone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Claystone
Calculated Parameters																		
Anion Sum	meq/L	n/v	n/v	25	25	54	8.8	21	15	45	11	13	36	25	9.2	14	13	14
Cation Sum	meq/L	n/v	n/v	22	28	50	8.7	21	14	160	10	12	34	24	9.9	14	14	14
Hardness (as CaCO3)	mg/L	n/v	n/v	800	1000	1700	340	340	580	6700	52	160	600	740	440	180	160	140
Ion Balance	none	n/v	n/v	0.90	1.1	0.94	0.99	0.98	0.93	3.4	0.95	0.93	0.95	0.97	1.1	0.99	1.1	1.0
Nitrate	mg/L	45^{C}	13^{D}	<0.044	<0.044	<0.044	3.3	0.086	3.1	0.072	<0.044	0.51	<0.044	0.085	**21^{D}**	<0.044	<0.044	<0.044
Nitrate + Nitrite (as N)	mg/L	n/v	100^{D}	<0.020	<0.020	<0.020	0.76	<0.020	0.70	<0.020	<0.020	0.13	<0.020	<0.020	4.8	<0.020	<0.020	<0.020
Nitrite	mg/L	3^{C}	0.06^{D}	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	0.054	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	$\leq 500^{B}$	500^{D}	**1400^{BD}**	**1600^{BD}**	**3400^{BD}**	440	**1400^{BD}**	**750^{BD}**	**4700^{BD}**	**610^{BD}**	**680^{BD}**	**2200^{BD}**	**1500^{BD}**	480	**850^{BD}**	**730^{BD}**	**870^{BD}**
BTEX and Petroleum Hydrocarbons																		
Benzene	mg/L	0.005^{C}	0.005^{D}	<0.00040	<0.00040	<0.00040	0.00055	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0010	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{B} 0.06^{C}	0.024^{D}	<0.00040	<0.00040	<0.00040	0.0013	<0.00040	<0.00040	<0.00040	<0.00040	0.0013	<0.00040	0.00050	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{B} 0.14^{C}	0.0016^{D}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00068	<0.00040	<0.00040	0.00059	<0.00040	<0.00040	<0.00040
Xylene, m & p-	mg/L	n/v	n/v	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.0029	<0.00080	<0.00080	0.00090	<0.00080	<0.00080	<0.00080
Xylene, o-	mg/L	n/v	$_{s1}^{D}$	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0012	<0.00040	<0.00040	0.0010	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{B} 0.09^{C}	0.02^{D}	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.0041	<0.00080	<0.00080	0.0019	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	n/v	2.2^{D}	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	n/v	1.1^{D}	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																		
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	1.8	2.6	5.1	2.8	4.1	1.3	3.9	1.7	2.6	3.9	3.8	4.8	2.9	1.2	2.1
Electrical Conductivity, Lab	µS/cm	n/v	1000^{D}	**2000^{D}**	**2100^{D}**	**4000^{D}**	780	**2000^{D}**	**1300^{D}**	**2000^{D}**	1000	**1200^{D}**	**3000^{D}**	**2100^{D}**	800	**1300^{D}**	**1100^{D}**	**1300^{D}**
pH	S.U.	$6.5\text{-}8.5^{B}$	$6.5\text{-}8.5^{D}$	7.77	7.88	7.52	7.96	7.99	7.74	7.80	8.31	8.10	7.54	7.59	7.96	8.22	8.19	8.29
Anions																		
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	81	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	530	300	460	380	260	460	1500	350	410	520	450	390	290	460	260
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	650	360	570	470	320	560	1600	430	500	640	540	470	350	560	310
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	97	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulfate	mg/L	$\leq 500_{j}^{B}$	500^{D}	**690 CD^{BD}**	**910 CD^{BD}**	**2100 CD^{BD}**	43	**770 CD^{BD}**	110	**730 CD^{BD}**	170	110	**1200 CD^{BD}**	**760 CD^{BD}**	50	380 CD	160	400 CD
Chloride	mg/L	$\leq 250^{B}$	100^{D}	2.1	3.8	3.0	4.8	4.0	**110^{D}**	25	3.4	78	1.7	3.3	4.6	3.2	<1.0	2.0
Nutrients																		
Ammonia (as N)	mg/L	n/v	$0.261\text{-}190_{n1}^{D}$	0.38	<0.050	0.96	0.062	0.49	<0.050	1.5	0.99 A*	<0.050	1.1	0.57	<0.050	0.83	0.86	0.64
Nitrite (as N)	mg/L	1^{C}	0.06^{D}	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (as N)	mg/L	10^{C}	3^{D}	<0.010	<0.010	<0.010	0.76	0.020	0.70	0.016	<0.010	0.12	<0.010	0.019	**4.8^{D}**	<0.010	<0.010	<0.010
Orthophosphate(as P)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0039	0.0038	<0.0030	<0.0030	<0.0030	0.0041 OG	0.0040 OG	<0.0030	<0.0030
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030 XN	0.0034	<0.0030	<0.0030	0.0073	0.0057	<0.0030	<0.0030	<0.0030	0.013	0.013	<0.0030	0.0062
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.1	1.5 DB	1.1	7.5 DB	1.3	1.3	38 CD	0.90 A*	18 CD	1.5 DB	11 DB	3.3 DB	1.3	0.88	4.5 DB

See notes on last page.

Table 3-4
Summary of Groundwater Analytical Laboratory Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters

Sample Location				**MW16-27-12**	**MW16-1-15**	**MW16-4-22**	**MW16-5-11**	**MW16-6-20**	**MW16-8-19**	**MW16-14-33**	**MW16-15-34**	**MW16-18-10**	**MW16-19-19**	**MW16-20-21**	**MW16-21-11**	**MW16-23-36**	**MW16-24-30**	**MW16-26-18**
Sample Date				**28-Sep-16**	**3-Oct-16**	**4-Oct-16**	**4-Oct-16**	**27-Sep-16**	**4-Oct-16**	**27-Sep-16**	**26-Sep-16**	**4-Oct-16**	**27-Sep-16**	**27-Sep-16**	**29-Sep-16**	**29-Sep-16**	**28-Sep-16**	**28-Sep-16**
Aquifer				Surficial	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock	Bedrock
Lithology	**Units**	**Health Canada**	**AEP**	Glacial Till	Sandstone	Sandstone	Sandstone	Claystone/ Siltstone	Sandstone	Siltstone/ Claystone	Siltstone	Claystone	Sandstone	Sandstone	Sandstone	Siltstone	Sandstone	Claystone
Metals, Dissolved																		
Aluminum	mg/L	0.1/0.2$_{a}$[B]	0.1/0.050$_{n2}$[D]	<0.0030	<0.0030	<0.0030	0.011	0.0067	<0.0030	0.016 NF XN	0.0040	<0.0030	0.0033	0.0040	0.0033	0.0074	<0.0030	0.0037
Antimony	mg/L	0.006[C]	0.006[D]	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.0021	0.0013	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.010[C]	0.005[D]	0.00036	<0.00020	0.0017	0.0010	0.00043	<0.00020	0.0017	0.0010	0.00039	0.00033	0.00043	0.00045	0.00035	0.0023	<0.00020
Barium	mg/L	1.0[C]	1[D]	<0.010	0.018	<0.010	0.068	0.031	0.054	**3.8**[CD]	0.013	0.030	<0.010	0.018	0.087	0.030	0.019	<0.010
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	5[C]	1.0[D]	0.13	0.078	0.11	0.036	0.093	0.043	***<2.0***	0.040	0.14	0.13	0.076	0.061	0.086	0.089	0.13
Cadmium	mg/L	0.005[C]	0.011/0.040$_{n2}$[D]	0.000026	<0.000020	<0.000020	<0.000020	<0.000020	0.000029	0.000024	<0.000020	<0.000020	<0.000020	<0.000020	0.000073	<0.000020	<0.000020	<0.000020
Calcium	mg/L	n/v	n/v	200	230	380	76	76	130	2300	14	38	140	160	86	50	38	40
Chromium	mg/L	0.05[C]	0.0049$_{s2}$[D]	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0014	0.0012	0.00034	0.0010	0.00056	<0.00030	0.00065	<0.00030	0.00034	<0.00030	0.00085	0.00062	<0.00030	<0.00030	<0.00030
Copper	mg/L	≤1.0[B]	0.007[D]	<0.00020	<0.00020	<0.00020	<0.00020	0.00056	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0013	<0.00020	<0.00020	0.00021
Iron	mg/L	≤0.3[B]	0.3[D]	**0.42**[BD]	<0.060	**2.2**[BD]	0.061	<0.060	<0.060	**68**[BD]	<0.060	<0.060	**2.6**[BD]	**0.69**[BD]	0.078	<0.060	0.14	0.15
Lead	mg/L	0.010[C]	0.068$_{n2}$[D]	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.041	0.022	0.070	<0.020	0.044	<0.020	<2.0	0.074	0.031	0.056	0.053	0.028	0.066	0.054	0.035
Magnesium	mg/L	n/v	n/v	75	110	180	38	36	60	190	4.2	16	62	82	54	14	16	11
Manganese	mg/L	≤0.05[B]	0.05[D]	**0.41**[BD]	**0.88**[BD]	**0.60**[BD]	**0.15**[BD]	**0.16**[BD]	0.0062	**14**[BD]	0.028	**0.20**[BD]	**0.37**[BD]	**0.34**[BD]	**0.17**[BD]	**0.083**[BD]	**0.067**[BD]	**0.083**[BD]
Mercury	µg/L	1[C]	0.005[D]	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Molybdenum	mg/L	n/v	n/v	0.00058	0.0028	0.0016	0.012	0.0060	0.00085	0.028	0.018	0.0037	0.0012	0.0052	0.0010	0.0023	0.0014	0.0048
Nickel	mg/L	n/v	0.40/3.6$_{n2}$[D]	0.00062	0.0010	<0.00050	0.0020	<0.00050	<0.00050	0.0036	<0.00050	<0.00050	<0.00050	<0.00050	0.0016	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	49	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	4.9	4.8	8.2	3.7	4.9	5.7	53	2.4	1.3	5.9	8.9	7.6	4.2	4.0	2.8
Selenium	mg/L	0.05[C]	0.001[D]	<0.00020	<0.00020	<0.00020	**0.0031**[D]	<0.00020	**0.0080**[D]	**0.0011**[D]	0.00065	0.00066	<0.00020	0.00090	**0.0019**[D]	<0.00020	<0.00020	<0.00020
Silicon	mg/L	n/v	n/v	5.7	4.7	4.3	4.2	3.4	3.7	25	2.6	3.4	3.4	4.0	4.7	3.8	3.6	4.5
Silver	mg/L	n/v	0.0001[D]	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	≤200[B]	200[D]	140	160	**370**[BD]	39	**320**[BD]	47	**410**[BD]	**210**[BD]	**200**[B]	**490**[BD]	**210**[BD]	21	**230**[BD]	**240**[BD]	**250**[BD]
Strontium	mg/L	n/v	n/v	1.6	1.6	6.0 CD	0.82	0.78	1.3	9.7	0.25	0.27	2.1	2.0	1.1	0.77	0.66	0.61
Sulfur	mg/L	n/v	n/v	180	340	730 CD	13	250	29	220	51	33	370	240	19	120	51	130
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.02[C]	0.01[D]	0.0049	0.0054	0.0023	0.0053	0.0021	0.0053	**0.012**[D]	0.00024	0.0064	0.00092	0.0032	0.0067	0.00010	0.00022	0.00013
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	≤5.0[B]	0.03[D]	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Metals, Total																		
Mercury	µg/L	1[C]	0.005[D]	***<20 DB***	***<2.0 DB***	***<2.0 DB***	***<20 DB***	***<0.20 DB***	***<0.10 DB***	***<20 DB***	***<0.10 DB***	***<6.0 DB***	***<0.20 DB***	***<6.0 DB***	***<20 DB***	***<0.20 DB***	<0.0020	***<6.0 DB***
Microbiological Parameters																		
Escherichia coli (E.Coli)	mpn/100mL	0[A]	n/v	***<10 DB***	***<10 DB***	***<2.0 DB***	***<100 DB***	***<1.0***	***<1.0***	***<20***	***<1.0***	***<100 DB***	***<10***	***<100***	***<10 DB***	**11**[A]	***<1.0***	***<10 DB***
Fecal Coliform	mpn/100mL	n/v	n/v	<10 DB	<10 DB	<2.0 DB	<100 DB	<1.0	<1.0	<20 DB	<1.0	<100 DB	<10 DB	<100 DB	<10 DB	5.1	<1.0	<10 DB
Heterotrophic Plate Count	cfu/mL	n/v	n/v	980	4900 DB	550 DB	44000 DB	6000 >	620	6000 >	39	17000 DB	1700	17000 DB	3200 DB	400	48	6000 >
Total Coliforms	mpn/100mL	0[A]	n/v	**850 DB**[A]	**230 DB**[A]	***<2.0 DB***	***<100 DB***	**2400 >**[A]	**27**[A]	**2300**[A]	***<1.0***	**310 DB**[A]	**10**[A]	**750**[A]	**20 DB**[A]	**520**[A]	**2.0**[A]	**580 DB**[A]

See notes on last page.

Table 3-4
Summary of Groundwater Analytical Laboratory Results
Indicator Parameters, Dissolved and Total Metals, Bacteriological Parameters

Notes:

Health Canada	Health Canada (2014). Guidelines for Canadian Drinking Water Quality - Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
A	Guidelines for Canadian Drinking Water Quality - Microbial Parameters
B	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
C	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
AEP	Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division 197 pp.
D	Table 2. Alberta Tier 1 Groundwater Remediation Guidelines - Agricultural - Fine
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occuring aluminum found in groundwater.
	The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
j	High levels (above 500 mg/L) can cause physiological effects such as diarrhoea or dehyrdration.
n1	See Environmental Quality Guidelines for Alberta Surface Waters (ESRD, 2014) for further guidance on aquatic life pathway. (Equation, varies with pH and temperature)
n2	Tier 1 guideline = lowest of aquatic life guideline and all other guidelines (See Appendix B of Alberta Environment and Parks (AEP). 2016. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy B
	See Environmental Quality Guidelines for Alberta Surface Waters (ESRD, 2014) for further guidance on aquatic life pathway. Aluminum, Cadmium and Nickel both have short and long term values which are repr
s1	Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
s2	There is no applicable total Chromium guideline, therefore the value from Chromium (trivalent) is applied.
>	Greater than.
A*	Ammonia greater than TKN. Results are within acceptable limits of precision.
CD	Detection limits raised due to dilution to bring analyte within the calibrated range.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
MI	Detection limit was raised due to matrix interferences.
NF	Duplicate exceeds acceptance criteria due to sample non homogeneity.
OG	Orthophopshate greater than phosphate. Results within acceptable limits of precision.
XN	Matrix Spike exceeds acceptance limits, due to matrix interference. Reanalysis yields similar results.

Table 3-5
Summary of Laboratory Analytical Results from the Domestic Well Testing Program

Calculated Parameters	Units	Minimum	Maximum	Average	Standard Deviation
Hardness (as CaCO3)	mg/L	56	780	348	213
Nitrate	mg/L	<0.044	11	NC	NC
Nitrate + Nitrite (as N)	mg/L	<0.020	2.5	NC	NC
Nitrite	mg/L	<0.033	0.089	NC	NC
Total Dissolved Solids	mg/L	260	2800	761	680
Electrical Conductivity, Lab	µS/cm	470	3800	1253	911
pH	S.U.	7.56	8.13	7.88	0.21
Anions					
Alkalinity (P as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Alkalinity, Total (as CaCO3)	mg/L	150	1100	431	250
Alkalinity, Bicarbonate (as CaCO3)	mg/L	180	1300	523	295
Alkalinity, Carbonate (as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Alkalinity, Hydroxide (as CaCO3)	mg/L	<0.50	<0.50	NC	NC
Sulfate	mg/L	36	1200	176	324
Chloride	mg/L	1.6	350	59	106
Fluoride	mg/L	0.1	0.62	0.24	0.15
Nutrients					
Nitrite (as N)	mg/L	<0.010	0.027	NC	NC
Nitrate (as N)	mg/L	<0.010	2.5	NC	NC
Metals, dissolved					
Aluminum	mg/L	<0.0030	0.012	NC	NC
Antimony	mg/L	<0.00060	0	NC	NC
Arsenic	mg/L	<0.00020	0.00085	NC	NC
Barium	mg/L	<0.05	0.082	NC	NC
Beryllium	mg/L	<0.0010	0	NC	NC
Boron	mg/L	<0.020	0.14	NC	NC
Cadmium	mg/L	<0.000020	0.000077	NC	NC
Calcium	mg/L	14	180	79	45
Chromium	mg/L	<0.0010	0	NC	NC
Cobalt	mg/L	<0.00030	0.00046	NC	NC
Copper	mg/L	<0.00020	0.013	NC	NC
Iron	mg/L	<0.060	0.4	NC	NC
Lead	mg/L	<0.00020	0.00099	NC	NC
Lithium	mg/L	<0.020	0.14	NC	NC
Magnesium	mg/L	4.8	82	37	26
Manganese	mg/L	<0.0040	0.18	NC	NC
Mercury	mg/L	<0.00000200	0.0000025	NC	NC
Molybdenum	mg/L	0.00045	0.013	0.0024	0
Nickel	mg/L	<0.00050	0.0024	NC	NC
Phosphorus	mg/L	<0.10	0	NC	NC
Potassium	mg/L	<0.6	7.1	NC	NC
Selenium	mg/L	<0.0005	0.0059	NC	NC
Silicon	mg/L	1.6	4.3	2.7	1
Silver	mg/L	<0.00010	<0.00010	NC	NC
Sodium	mg/L	4.3	750	142	206
Strontium	mg/L	0.27	2.1	0.97	0.70
Sulfur	mg/L	10	270	47	72
Thallium	mg/L	<0.00020	<0.00020	NC	NC
Tin	mg/L	<0.0010	<0.0010	NC	NC
Titanium	mg/L	<0.0010	0.007	NC	NC
Uranium	mg/L	0.00032	0.0061	NC	NC
Vanadium	mg/L	<0.0010	0.0011	NC	NC
Zinc	mg/L	<0.0030	4	NC	NC
Bacteriological					
Escherichia coli (E.Coli)	mpn/100mL	<1.0	<1.0	NC	NC
Total Coliforms	mpn/100mL	<1.0	2400	NC	NC

3.4.1 Groundwater Chemistry of the Unconsolidated Deposits

A total of 17 groundwater samples were collected from wells completed in the unconsolidated deposits in the LAA. The TDS concentrations in the unconsolidated deposits ranged from 640 mg/L to 6,900 mg/L, with an average concentration of 2,381 mg/L. These TDS concentrations exceeded both the Alberta Tier 1 Guidelines and the GCDWQ and are considered slightly to moderately saline. At three locations (MW16-2-6, MW16-16-11, MW16-17-5), the TDS concentrations exceeded the definition of "fresh water" (TDS less than 4,000 mg/L) under the Alberta's Water (Ministerial) Regulation.

Figure 3-30 indicates that there is no dominant cation characteristic of the unconsolidated deposits; samples are near the center of the lower left portion of the plot. Sodium concentrations are relatively high with 10 of 17 samples exceeding the 200 mg/L guidelines. Sulphate is the dominant anion in 12 samples with bicarbonate dominating the remaining five. The average sulphate concentration was 1,444 mg/L with the majority of samples exceeding both guidelines (500 mg/L). Chloride concentrations were low in the majority of samples ranging from 1.6 mg/L to 17 mg/L, except for MW16-12-3 (230 mg/L) and MW16-17-5 (72 mg/L).

Nutrient concentrations—ammonia, nitrate, nitrite, phosphate and total Kjeldahl nitrogen—were analyzed because they are contaminants of potential concern in agricultural settings. Nutrient concentrations were low in all samples except for MW16-17-5, which had nitrite-nitrogen above the Alberta Tier 1 Guideline. The nitrite concentration was 0.17 mg/L-N compared to a guideline value of 0.06 mg/L-N.

Dissolved metals concentrations were generally within the range of expected concentrations for monitoring wells completed in glacial deposits in southern Alberta. Iron concentrations exceeded the 0.3 mg/L guideline at three locations with a maximum concentration 0.5 mg/L. Manganese concentrations exceeded the guidelines (0.05 mg/L) in all samples except MW16-11-15 (with values ranging from 0.025 to 2.3 mg/L). Selenium concentrations exceeded the 0.001 mg/L Alberta Tier 1 Guideline in seven samples and exceeded the 0.05 mg/L GCDWQ in one sample from MW16-19-8. Uranium concentrations exceeded the 0.01 mg/L guidelines in 10 of 17 samples with values ranging from 0.0044 to 0.04 mg/L. Single exceedances of arsenic at MW16-23-14 and copper at MW16-16-11 were also noted with concentrations marginally exceeding guidelines.

Dissolved mercury was below the 0.002 µg/L laboratory detection limit in 14 of 17 samples. Concentrations in the remaining three samples were marginally above the detection limit with values ranging from 0.002 to 0.0036 µg/L. Total mercury was also analyzed in all samples; however, given the amount of sediment entrained in many of the samples as a result of the fine-grained aquifer material, the laboratory detection limits had to be raised for many samples. Detection limits ranged from 0.02 µg/L to 20 µg/L.

Hydrocarbon concentrations were below their respective guideline concentrations at all monitoring wells except for MW16-16-11. Benzene and ethylbenzene marginally exceeded guidelines with concentrations of 0.0055 and 0.0034 mg/L, respectively. The source of the hydrocarbon impacts is not known. Dissolved organic carbon concentrations ranged from 1.8 mg/L to 9.2 mg/L.

Bacteriological parameters including *Escherichia* coli (E. Coli), fecal coliform, total coliforms and heterotrophic plate counts (HPC) were enumerated for all samples. As with the mercury analyses described, sediment in the samples also affected the detection limits for the bacteriological parameters. While the detection limits were not low enough to determine if the water is safe for human consumption in most samples, it does provide general information on the bacteriological levels and potential for pre-existing impacts in the shallow groundwater.

HPCs were included in the analytical suite to provide information on the level of bacteriological activity across the LAA. HPC concentrations varied significantly from 920 cfu/100 mL at MW16-7-5 to 56,000 cfu/100 mL at MW16-6-11. No spatial or depth correlation was evident in the HPC data. E. coli concentrations were below the detection limits in all samples except MW16-19-8, which had an E. coli concentration of 63 mpn/100 mL, compared to the GCDWQ of 0 mpn/100 mL. Total coliform bacteria ranged from less than 100 mpn/100 mL to 9,300 mpn/100 mL. Fecal coliform bacteria were below the detection limit in all samples except MW16-10-5, which had a concentration of 100 mpn/100 mL.

3.4.2 Groundwater Chemistry of the Upper Bedrock Aquifers

A total of 14 groundwater samples were collected from Project-related monitoring wells completed in bedrock within the LAA. Samples collected from domestic water wells were also available from the domestic well testing program completed in April 2016.

The TDS concentrations in the bedrock deposits ranged from 440 mg/L to 4,700 mg/L, with an average concentration of 1,444 mg/L. The bedrock TDS concentrations are significantly lower than in the surficial deposits but still exceed both guidelines in 12 of the 14 samples and are considered slightly saline. The TDS exceeded the 4,000 mg/L Water (Ministerial) Regulation criteria for fresh water at MW16-14-33. TDS concentrations were lower in the 12 domestic wells sampled, with an average concentration of 761 mg/L.

Figure 3-30 indicates that sodium is the dominant cation in 8 of the 14 bedrock samples with the remaining samples plotting near the center of the lower left portion of the plot having no dominant cation. Sodium concentrations exceed the 200 mg/L guideline in 12 of the 15 samples, with an average concentration of 222 mg/L. Bicarbonate is the dominant anion in 7 of the 14 samples, with sulphate dominating the remaining. The average sulphate concentration was 564 mg/L, which is lower than in the surficial deposits. Chloride concentrations were low in the majority of samples, ranging from less than 1 mg/L to 78 mg/L, except for MW16-8-9, which had a concentration of 110 mg/L. Similar chloride concentrations were noted in the domestic water wells, with an average concentration of 59 mg/L.

Nutrient concentrations were low in all bedrock groundwater samples except for one nitrate-nitrogen Alberta Tier 1 Guideline exceedance at MW16-21-5. The nitrite concentration at this monitoring well was 4.8 mg/L-N compared to a guideline value of 3 mg/L-N. Nitrate and nitrite concentrations were low and below guidelines in all domestic wells sampled.

Dissolved metals concentrations in the bedrock aquifers were relatively consistent across the LAA and similar to the surficial deposits with the exception of MW16-14-33, which had elevated barium (3.8 mg/L), iron (68 mg/L) and manganese (14 mg/L) concentrations. Iron concentrations exceeded the 0.3 mg/L guideline at three other locations, with a maximum concentration 2.6 mg/L. Manganese concentrations exceeded the guidelines (0.05 mg/L) in 12 of 14 samples. Selenium concentrations exceeded the 0.001 mg/L Alberta Tier 1 Guideline in four samples. Manganese and selenium exceedances were also noted in a number of domestic water wells sampled. Uranium concentrations were lower than in the surficial deposits with only one exceedance of the 0.01 mg/L guidelines at MW16-14-33, with a concentration of 0.012 mg/L.

Dissolved mercury was below the 0.002 µg/L laboratory detection limit in 13 of 14 samples. Concentrations in the remaining monitoring well (MW16-1-15) was marginally above the detection limit, with a value of 0.0029 µg/L. Total mercury concentrations were below the detection limits (0.1 µg/L to 20 µg/L) in all samples. Samples from the domestic wells also had mercury concentrations that were below the laboratory detection limits in 11 of 12 samples and marginally above the detection limit with a concentration of 0.0000025 mg/L in the remaining sample.

No hydrocarbon concentration exceedances were noted in any of the bedrock groundwater samples. Dissolved organic carbon concentrations ranged from 1.2 mg/L to 5.1 mg/L.

HPC concentrations were generally lower than in the surficial deposits, as expected, and ranged from 39 cfu/100 mL at MW16-15-34 to 44,000 cfu/100 mL at MW16-5-11. Lower HPC concentrations were generally found in deeper bedrock wells. E. coli concentrations were below the detection limits in all samples except MW16-23-36, which had an E. coli concentration of 11 mpn/100 mL, compared to the GCDWQ of 0 mpn/100 mL. Total coliform bacteria ranged from less than 1 mpn/100 mL to 2,400 mpn/100 mL. Fecal coliform bacteria were below the detection limit in all samples except MW16-23-36, which had a concentration of 5.1 mpn/100 mL. Total coliform bacteria in the domestic wells were low, ranging from less than 1 mpn/100 mL to 24 mpn/100 mL in all samples, except one which had a concentration of 2,400 mpn/100 mL. E. coli concentrations were below the detection limit in all domestic well samples.

3.5 GROUNDWATER QA/QC RESULTS

Two duplicate samples were collected as part of the QA/QC program to evaluate the precision or reproducibility of the analytical data between samples. A summary of the QA/QC data and analysis is included along with the laboratory reports in Attachment C.

The relative percent difference (RPD) between the sample and duplicate results was calculated for each sample or, when the parameter result was within five times the detection limit, the absolute difference (AD) between the sample and duplicate was calculated. An RPD of 40% or less, or an AD of less than two times the detection limit, is considered acceptable for duplicate groundwater samples (CCME 2016).

A comparison of the duplicate sample results indicated that 99.3% (139 of 140 results) meet the criteria. The one parameter result that did not meet the criteria was the heterotrophic plate count for the duplicate sample from MW16-24-30. Overall the reproducibility of the data is good and the analytical results are considered valid.

Laboratory QA/QC procedures and analysis are included with the analytical results in Attachment D. The quality assurance reports include analysis of matrix spikes, QC standards, blanks and calibration checks.

4.0 NUMERICAL MODEL CONSTRUCTION AND CALIBRATION

This section describes the numerical groundwater flow model that has been geographically expanded in accordance with the expansion of the RAA described in Section 2.

4.1 NUMERICAL MODELLING APPROACH

Numerical flow modelling using the finite element method (FEM) was selected over other potential analytical and numerical methods (e.g., finite difference method) due to the large size of the hydrogeology RAA, complex geologic framework, time-variable boundary conditions, and irregular geometry of the physiographic setting, and nature of the Project components. A numerical solution technique minimizes the number of simplifying assumptions that would be required using other analytical methods, thus yielding a more detailed depiction of the hydrogeologic setting and system response to the Project within the hydrogeology RAA.

The finite element subsurface flow and transport system (FEFLOW) is a numerical groundwater modelling system that is capable of modelling 3D groundwater flow and mass transport. FEFLOW was selected to simulate the groundwater flow because it is a well documented, well-tested numerical code capable of advanced simulation of regional and local groundwater systems due to its ability to simulate time-varying boundary conditions with variable mesh resolution within an irregular model domain.

A detailed description of the code is provided by WASY (2009). All parts of the FEFLOW code have passed an extensive benchmarking process, where simulated results are compared to those of other well-known simulation systems, analytical solutions or to observations from lab experiments whenever possible. The results of numerous benchmark tests are published in the Diersch (2014) and WASY (2009) documentation, along with a detailed description of the corresponding model setups and an extensive discussion of the results.

A FEFLOW model represents the groundwater flow through a saturated porous media (in this case, unconsolidated and bedrock materials), considering the hydraulic properties, subsurface geologic materials and associated physical parameters that govern the flow within the porous media. FEFLOW explicitly models flow through the primary porosity of a geologic material.

Flow through secondary porosity such as fractures in a porous media generally increases the permeability or hydraulic conductivity relative to the primary (matrix) permeability of a given porous media. Fracturing of porous media can occur for a variety of reasons, but the two applicable in the RAA are 1) weathering (areal exposure) of the lacustrine and till units and 2) fracturing of the bedrock units in highly deformed and topographically elevated bedrock features.

For fractures related to weathering of the unconsolidated deposits, it is well documented (Hendry 1988; Ameli et al. 2015) that the fractures in a till generally decrease with depth and the permeability trends back towards matrix permeability. Approximately the upper 5 m of the porous media exposed to weathering have higher permeability and may contribute to interflow and or contact springs at the weathered/un-weathered interface due to the permeability contrast.

Bedrock fractures have a similar permeability enhancement effect as weathered tills. However, bedrock fractures are very difficult to map, particularly in highly deformed areas with veneers of unconsolidated material. Bedrock fractures generally date back to the mountain building period millions of years ago and remineralization can occur in fractures precluding the effects of secondary porosity.

Despite the acknowledgement that fracturing and secondary porosity exists, the scale of the model, coupled with the data type and data density used to characterize the model domain, precludes explicit implementation of secondary porosity in the numerical flow model. However, the effects of secondary porosity have been accounted for through parameterization of additional model layers incorporated into the model as is further discussed below.

4.2 NUMERICAL MODEL DOMAIN AND DISCRETIZATION

The domain of the numerical flow model encompasses the same region as the RAA. A 3D overview of the expanded numerical model domain is presented in Figure 4-1 for context. The numerical model domain was based on the geographic extent of the RAA and hydrogeologic interpretations described within the 3D CSM. The geologic units represented in the 3D CSM were ported into the FEFLOW model domain through export of 3D surfaces representing the various geologic contact surfaces between units. In this manner, the overall hydrogeologic framework of the 3D CSM is maintained within the FEFLOW model.

Figure 4-1 3D Overview of the RAA and Numerical Model Domain

The model's uppermost boundary is defined by the surface topography, which will change as a result of construction of the Project infrastructure. Two separate domains are required to model groundwater conditions, one prior to and the other after Project construction. The lateral extents of the two domains are identical, as is the 2D mesh that was generated (described below). However, the surface topography of the two domains differs slightly, but only in areas where the surface topography changes as a result of construction of the Project. The changes to surface topography are caused by construction of the diversion channel (which incises into the current land surface) and construction of the off-stream dam (which adds fill on top of the current land surface). These changes in surface topography elevations are based on the engineering design of these features.

4.2.1 Discretization of the Model Domain

The numerical flow model domain was discretized into reasonably small elements to provide sufficient resolution within the model results such that potential effects of the Project on the groundwater system in the RAA could be characterized. The number of nodes within the domain determines both the computational efficiency and accuracy of the model. According to Istok (1989), a fine mesh is generally more accurate than a coarse mesh, but requires more detailed computations and effort. The selection of the appropriate mesh for the modelling was based on the need for required output resolution and numerical stability in areas of high topographic relief.

The 3D mesh generation process involved the following steps:

1. creating a FEFLOW supermesh from a defined model domain incorporating all the geometrical information required for the 3D groundwater flow model
2. generating a 2D surface mesh of the topographic extent of the area modelled
3. generating a 3D element mesh by projecting the 2D mesh into a multi-layer mesh so as to provide an accurate representation of the hydrostratigraphic units within the model domain

4.2.1.1 FEFLOW Supermesh

A FEFLOW supermesh defines the overall framework for internal 2D and 3D mesh generation. The supermesh comprises polygons, lines, and points which are based on geographic features of the model domain. The following spatial information was used as inputs for defining the FEFLOW supermesh:

- the off-stream dam, diversion channel, and floodplain berm design
- topography from the regional DEM and LiDAR data
- surface water features including creeks, rivers and waterbodies

4.2.1.2 2D Surface Mesh

The 2D surface mesh was refined with a higher density of nodes near Project infrastructure as well as waterbodies (e.g., Elbow River and its tributaries), as shown on Figure 4-2, Figure 4-3, and Figure 4-4. Nodal spacing varies from approximately 150 m where the mesh is coarse, to approximately 1 m where the mesh is fine.

The aspect ratio (the ratio of maximum to minimum element dimensions) was assigned to be small so that computed flow directions are not subject to large errors. Anderson and Woessner (1992) and Istok (1989) advocate the use of such modelling protocols.

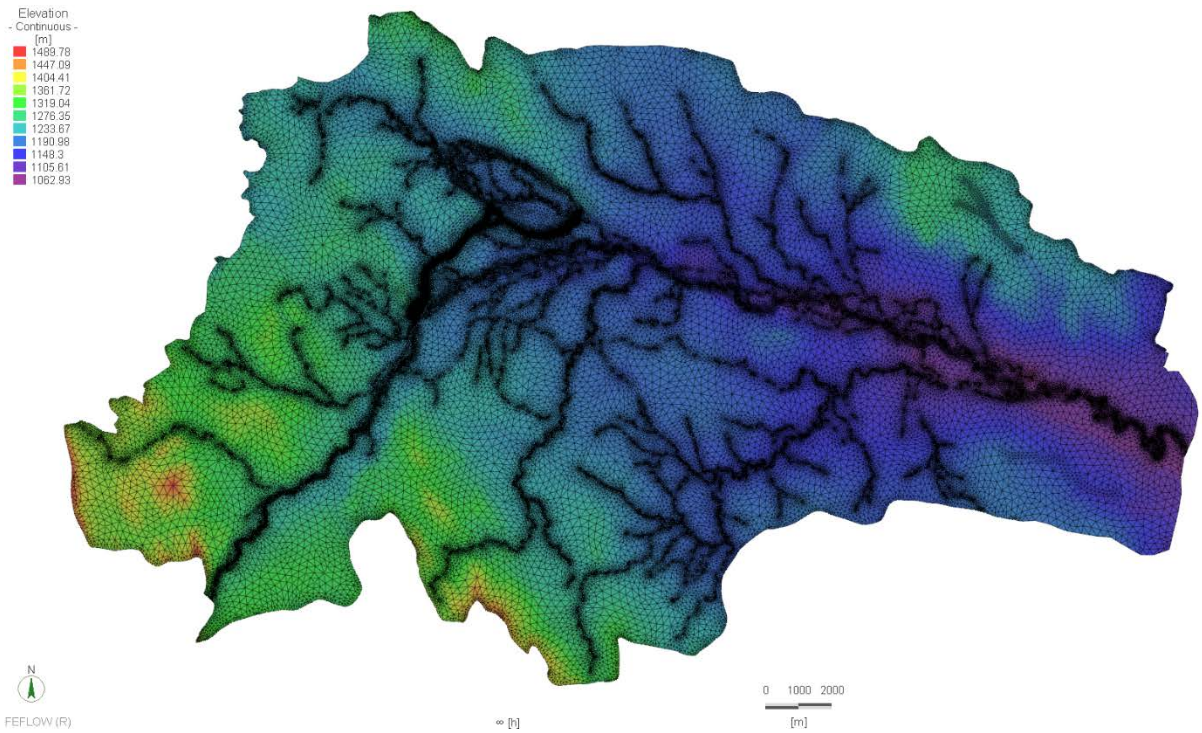


Figure 4-2 Overview of 2D Surface Mesh within the Numerical Model Domain

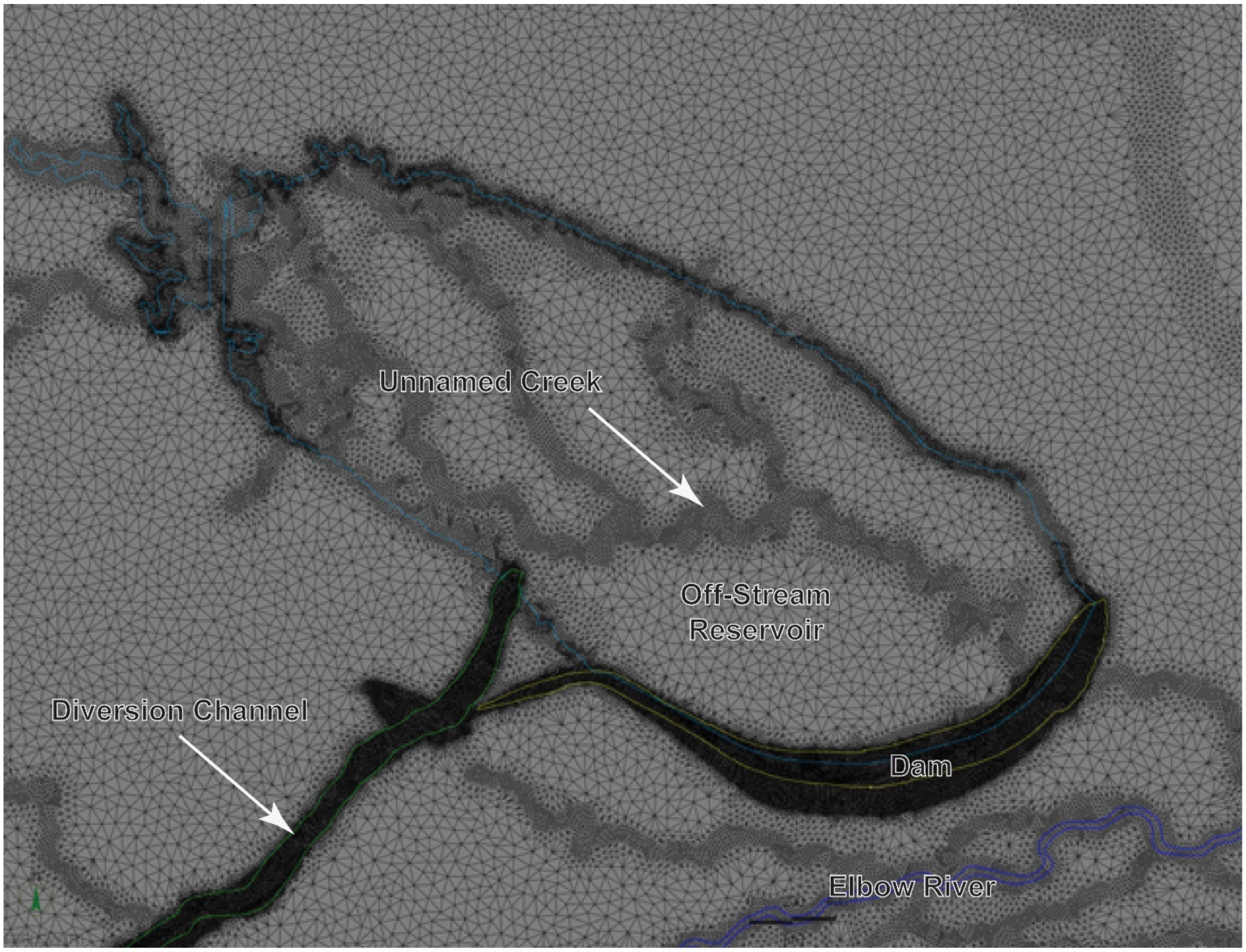


Figure 4-3 Refined 2D Mesh in the Vicinity of the Off-Stream Reservoir and Dam

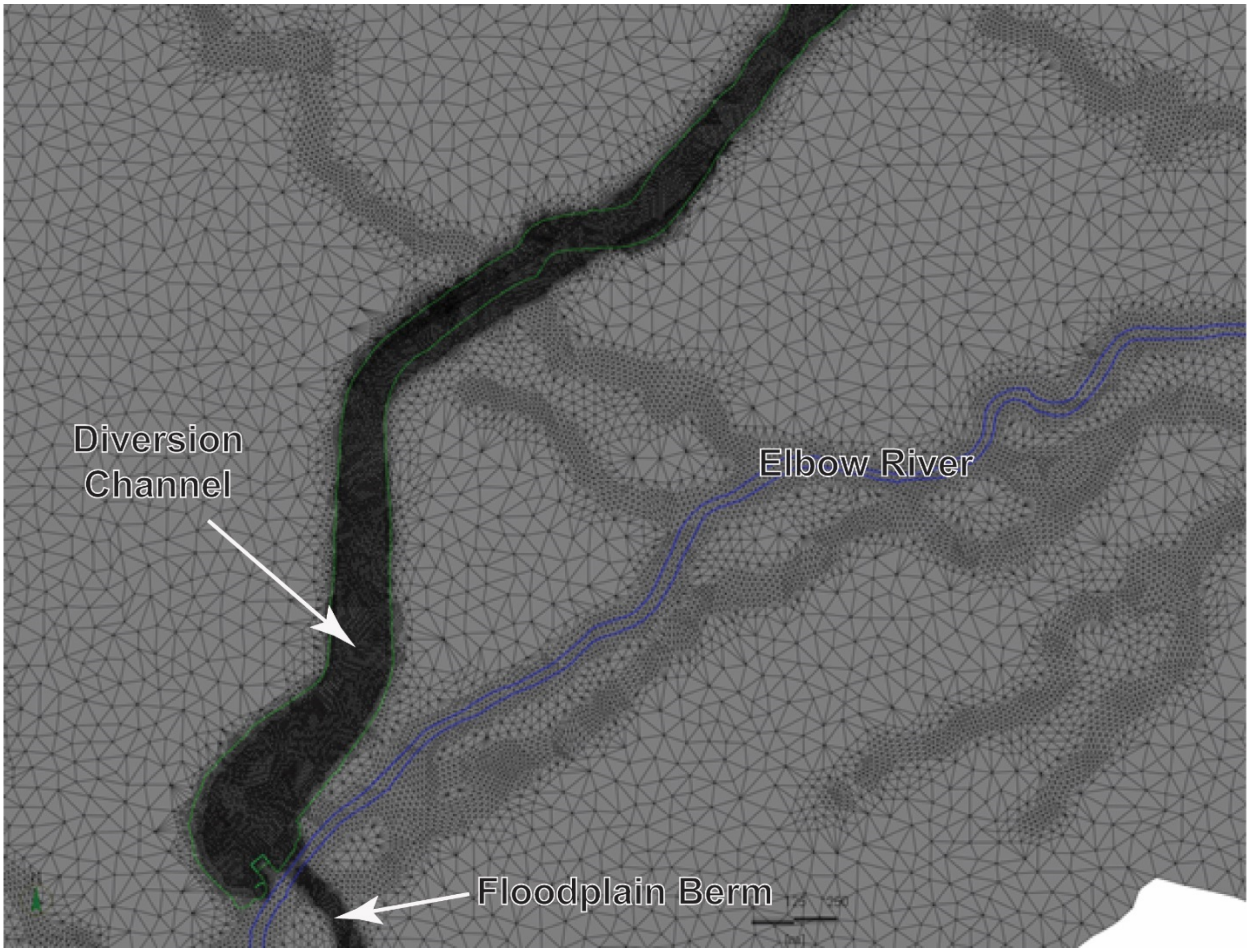


Figure 4-4 Refined 2D Mesh along the Diversion Channel and Elbow River

4.2.1.3 3D Element Mesh

The 3D mesh was constructed by projecting the 2D mesh into 3D using the hydrostratigraphic structural surfaces derived from the 3D CSM to define the layers. The hydrostratigraphic surfaces are defined by identifying the contacts between the hydrostratigraphic units as interpreted within the 3D CSM.

The 3D mesh constructed for numerical simulation of groundwater flow has 2,110,800 nodes and 3,680,551triangular elements. The number of elements was minimized, to the extent possible, to balance the numerical accuracy with the computational effort required

4.3 HYDROSTRATIGRAPHIC FRAMEWORK OF THE NUMERICAL MODEL

The hydrostratigraphic framework of the FEFLOW model domain is consistent with the framework that was interpreted within the 3D CSM.

4.3.1 Model Layers

A total of seven model layers were used to define the hydrostratigraphic units within the model. The model layers were developed based on the 3D CSM and are consistent with the interpreted geologic contacts. However, some hydrogeologic units were represented in the model by more than one layer, to allow for separate parameterization of the upper regions of a unit as compared to the lower regions. For example, the undifferentiated bedrock unit was represented in the model with two layers, and the upper layer of the bedrock (Layer 6) was assigned higher hydraulic conductivity values to reflect the potential for this unconformable surface to be fractured and of higher permeability than the underlying bedrock (Layer 7).

In areas of the model domain where a hydrostratigraphic unit is absent, the hydraulic properties of the model layer are assigned based on those of the underlying model layer. A minimum thickness of 0.1 m is assigned to the model elements where the hydrostratigraphic unit is absent. Layer 1 of the model was set in FEFLOW to “phreatic” mode. All other model layers were set as “unspecified” mode.

4.3.2 Parameterization of Model Layers

Hydraulic conductivity values for each of the model layers were parameterized based upon the hydrogeologic framework developed within the 3D CSM and on results of the steady-state calibration runs. Spatially variable hydraulic conductivities were assigned in most model layers, depending upon the geologic materials being represented by that layer. In many areas where a given layer's thickness was at the minimum value (representing the absence of the hydrostratigraphic unit at that location), the hydraulic conductivity value was set to the value of the underlying layer (or layers in cases where multiple overlying units were absent as is the case where bedrock is outcropping).

Figure 4-5 through Figure 4-11 present the hydraulic conductivity distributions established in each of the seven model layers.

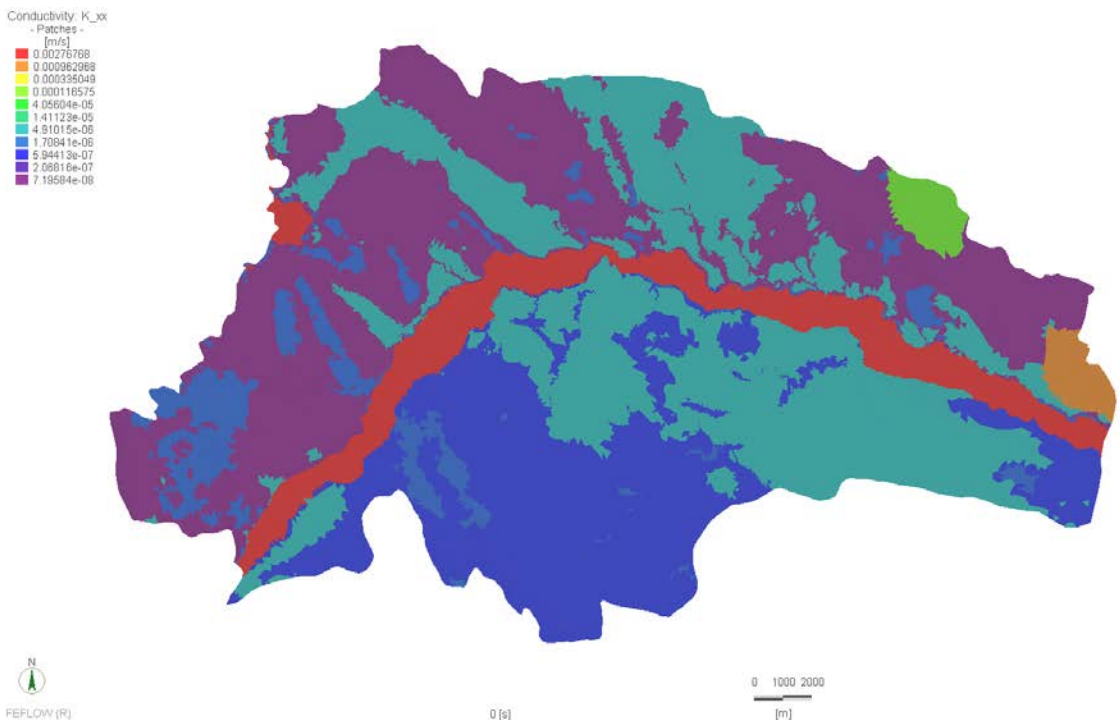


Figure 4-5 Hydraulic Conductivity Distribution in Layer 1

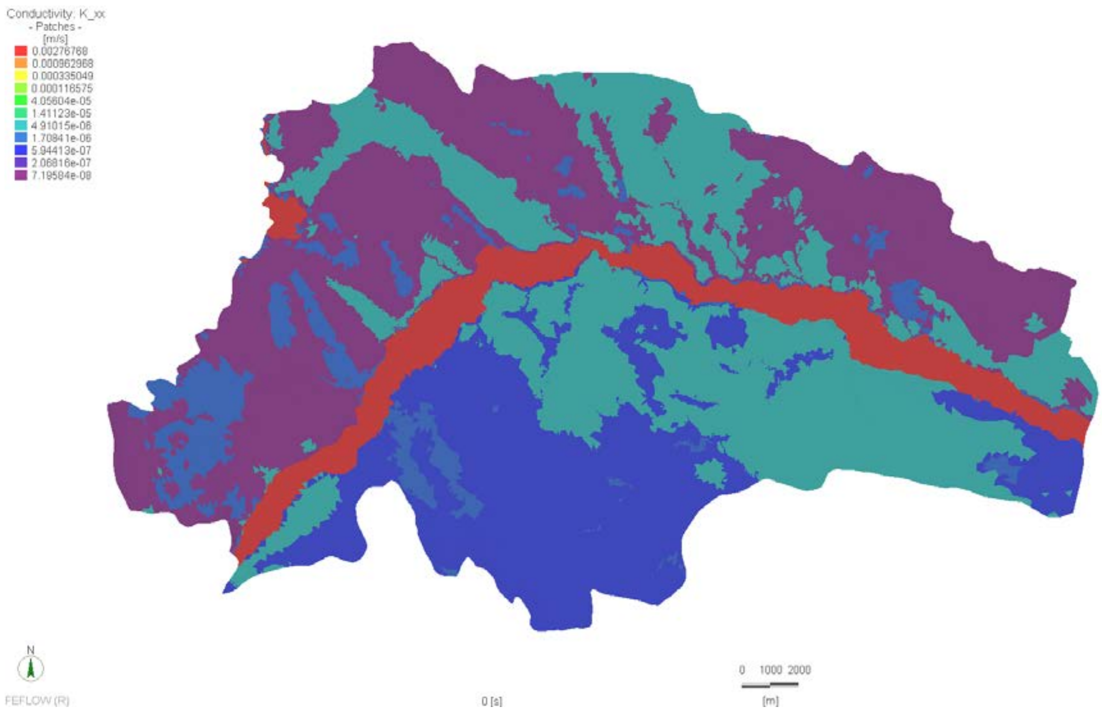


Figure 4-6 Hydraulic Conductivity Distribution in Layer 2

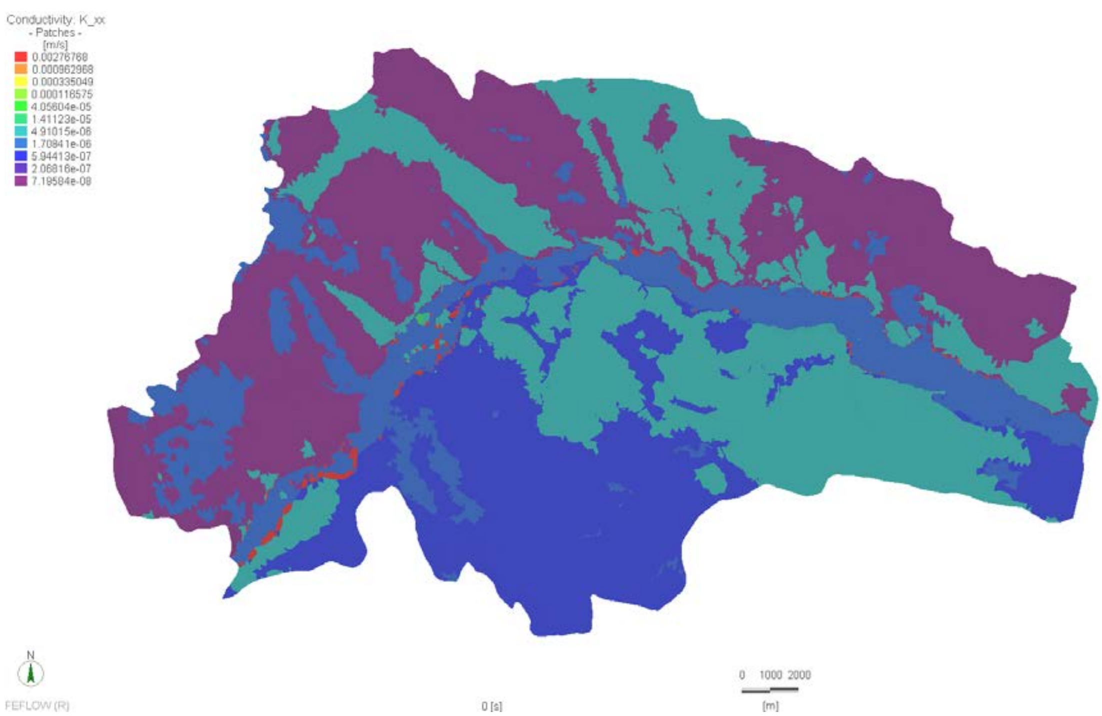


Figure 4-7 Hydraulic Conductivity Distribution in Layer 3

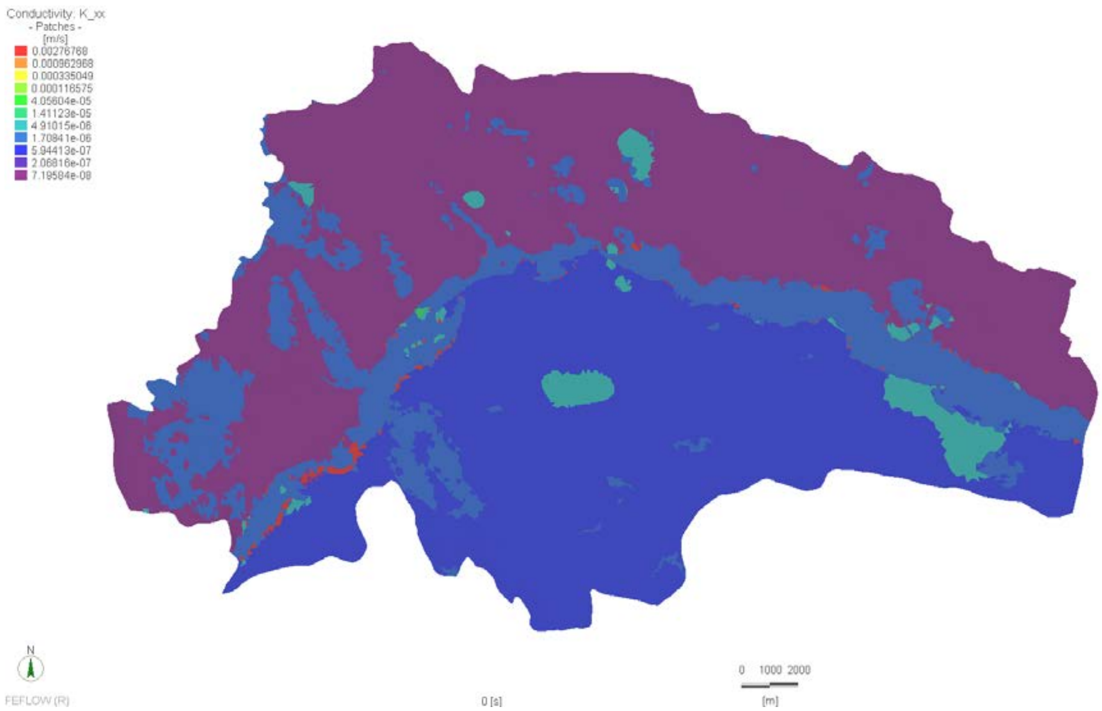


Figure 4-8 Hydraulic Conductivity Distribution in Layer 4

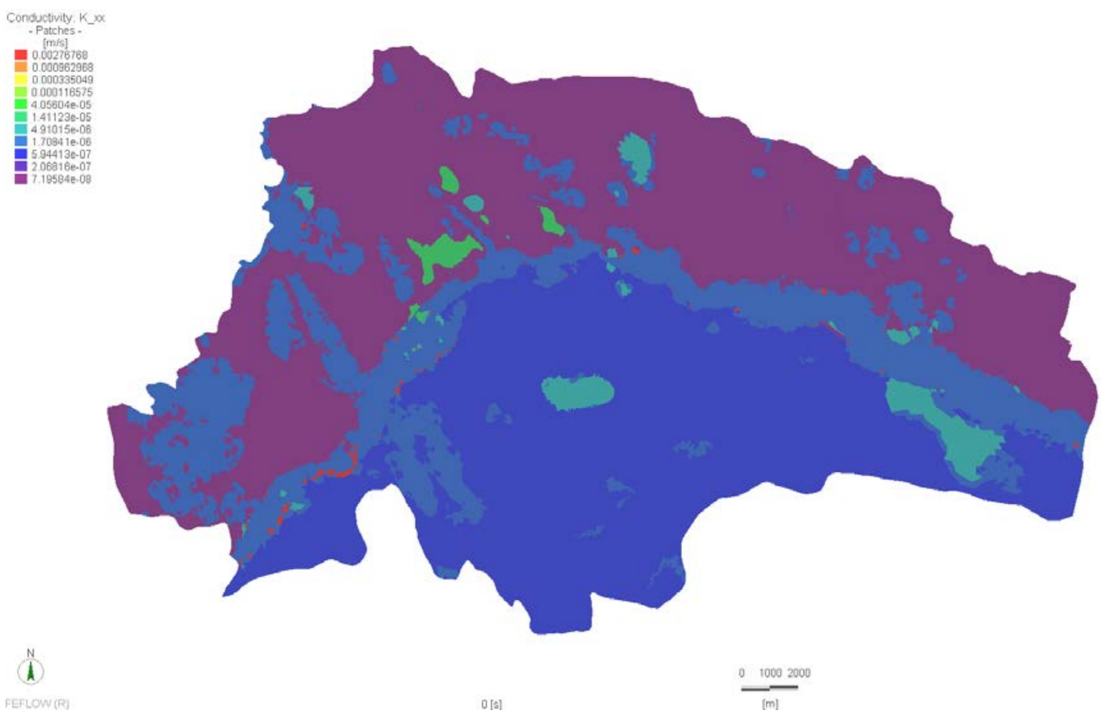


Figure 4-9 Hydraulic Conductivity Distribution in Layer 5

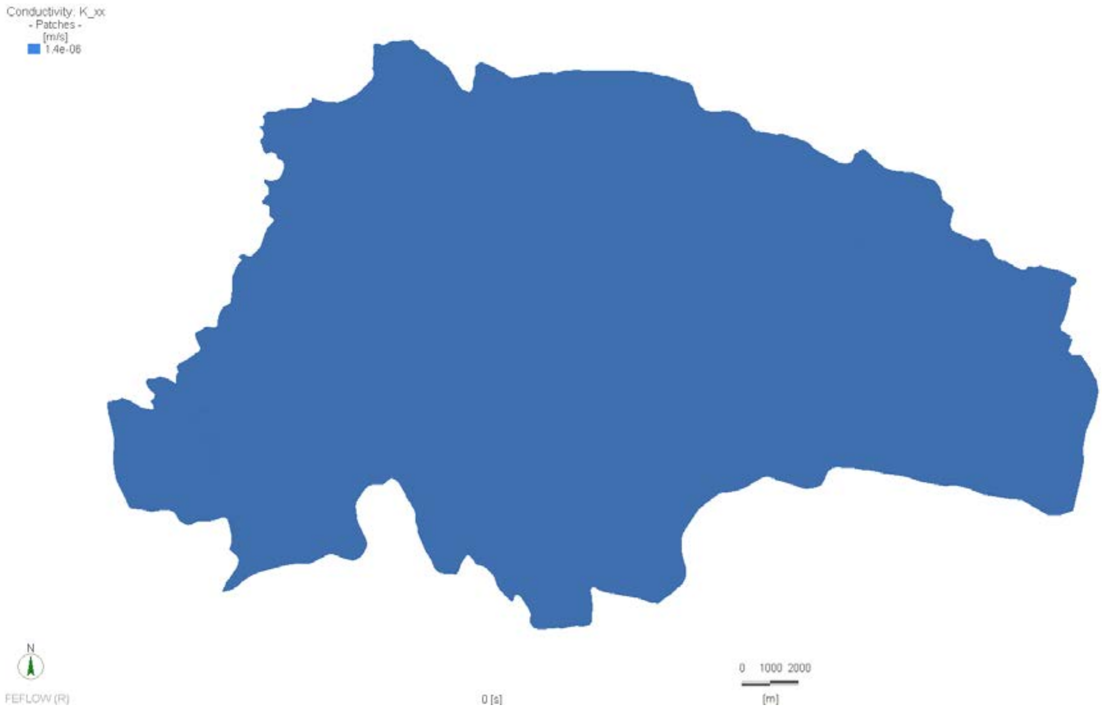


Figure 4-10 Hydraulic Conductivity Distribution in Layer 6

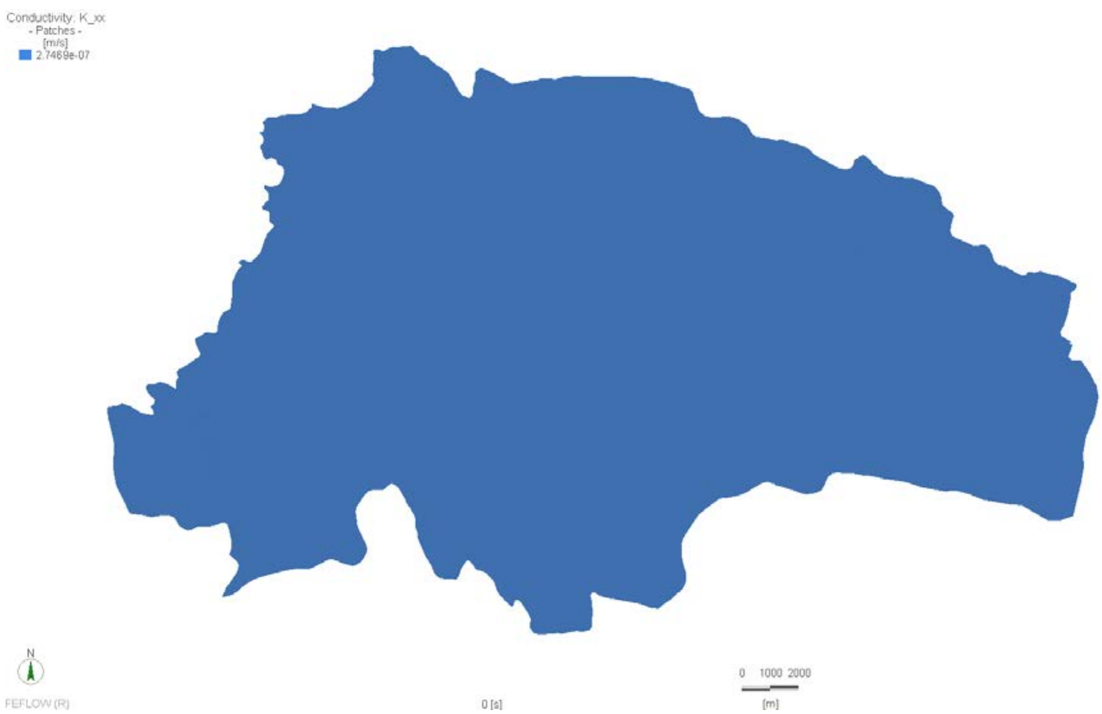


Figure 4-11 Hydraulic Conductivity Distribution in Layer 7

4.4 NUMERICAL FLOW MODEL BOUNDARY CONDITIONS

Boundary conditions are mathematical descriptions of physical and hydraulic features that need to be defined to formulate the governing flow equations and allow them to be solved by the numerical flow model. Definition of appropriate model boundary conditions is an essential part of any groundwater modelling. Boundary conditions, which describe how flow enters or leaves the model across the outer edges of the model domain, are required around the model boundaries. The choice of boundary condition depends on the physical situation being simulated and the availability of data. Boundary conditions can be used to represent head or flux constraints on the hydrogeologic system being modeled. Boundary conditions were applied to the model domain based on the interpretations yielded from the 3D CSM developed for the Project as well as other supporting hydrologic information for the Elbow River basin.

4.4.1 Specified Head Boundaries

Specified head boundaries, also known as Dirchilet boundary conditions, were specified to the top layer of the model domain at some locations to represent surface water features. Specified head boundaries were also set within all model layers around the perimeter of the model domain. As shown on Figure 4-12, the specified heads in the top layer were assigned to surface water features in the domain, based on the elevation of the features determined from the DEM. Specified head values at these nodes were set to constant values for the steady-state simulation runs. Constant specified head values were also specified around the perimeter of the model domain to represent static conditions or groundwater flow divides related to the topographic driving forces at the edges of the domain.

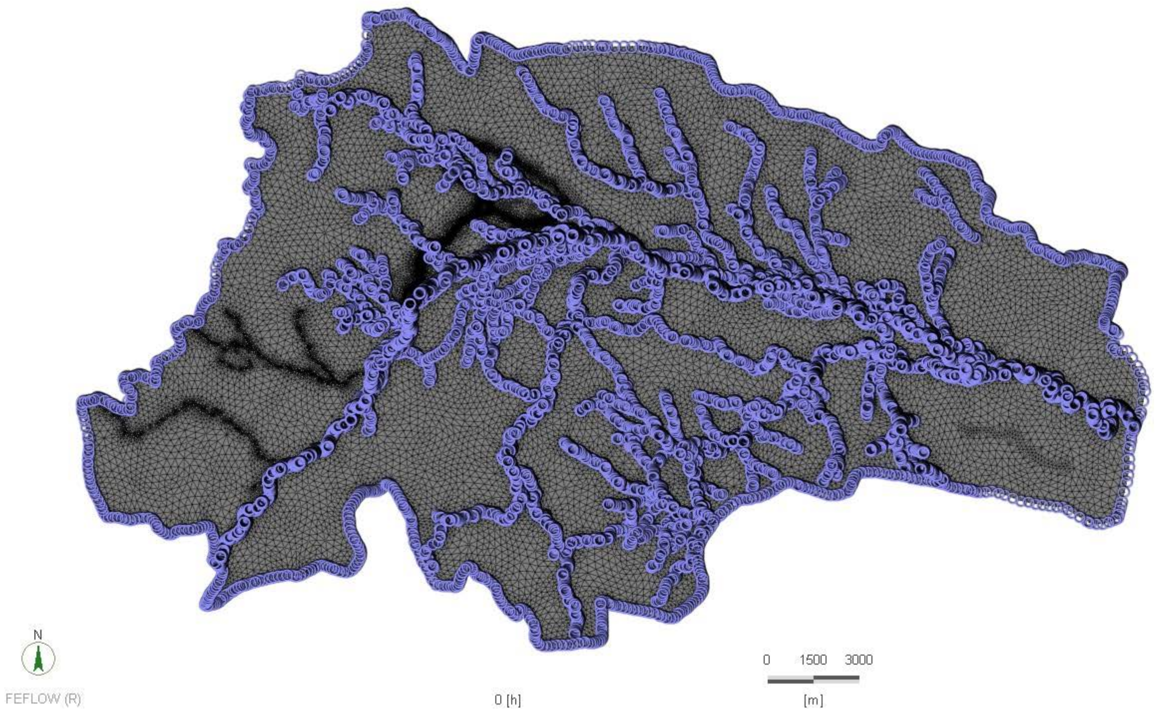


Figure 4-12 Locations of Specified Head Boundary Conditions in the Model Domain

4.4.2 Specified Flux Boundaries

Specified flux boundaries, also known as Neumann boundaries, were used within the numerical model where the flux rate at a given node is specified. Specified fluxes can be set to a numerical value based on hydrogeologic interpretations derived from hydrologic or climatological sources of information.

A net recharge flux was added within the updated model to the top of the model domain. The land surface elevation gradient, type of soil and vegetation present at surface is an important factor in determining whether precipitation will run off, based on surface water flow processes, or enter the subsurface as groundwater recharge. Literature values for recharge appropriate for the region were used (Klassen et al., 2018). The recharge estimates produced in the First-Order Groundwater Availability Assessment for Southern Alberta were rigourously developed specifically to account for terrain characteristics such as depression focused recharge following the methods developed by the University of Calgary Farrow et al. (2014), Pavlovskii et al. (2017). The terrain analysis was used as in input parameter for a 1-D, multi-layer recharge simulation model referred to as the Versatile Soil Moisture Budget (VSMB) with a depression upland storage

(DUS) module. In addition to the terrain analysis, the VSMB-DUS model is driven by meteorological data (e.g., hourly precipitation, air temperature, relative humidity), evapotranspiration parameters (e.g., growth curves), and soil properties (e.g., wilting point, field capacity; Klassen et al., 2018).

Groundwater recharge rates ranging from 12 mm/year to 25 mm/year were established by the regional groundwater study (Klassen et al. 2018). Given the regional nature of the study cited, and the large topographic variability of the RAA with many areas without significant depressions (i.e., well drained slopes without prairie-like depressions), the minimum recharge value of 12 mm/year was used. Relatively good model calibration resulted from application of 12 mm/year recharge, as assigned to the hydrostratigraphic units exposed at the top of the model domain.

4.5 NUMERICAL MODEL CALIBRATION

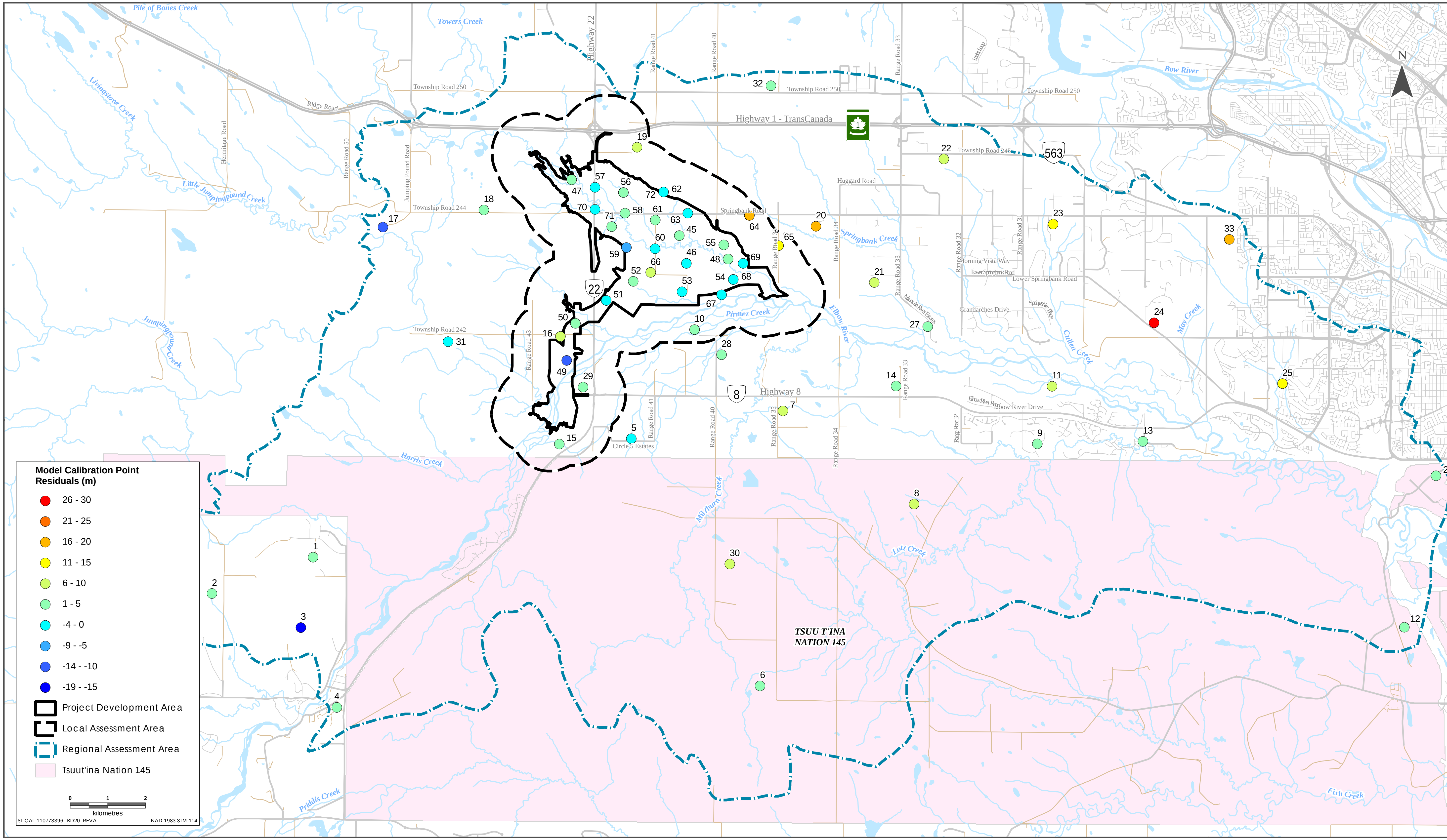
Model calibration is a process wherein certain model parameter(s) are altered in a systematic fashion and the model is run repeatedly until the modeled solution matches the field observed values within a range that is considered acceptable. Once the groundwater model is calibrated, the model is used to simulate and predict groundwater conditions for proposed scenarios. In this instance, the numerical model was calibrated to represent steady-state groundwater conditions.

A hybrid calibration approach was used that combined automated parameter estimation, facilitated by using the parameter estimation code (PEST) module, together with professional judgement and interpretation of the calibration results. This involved a process where a flow simulation was carried out, the resulting groundwater heads were compared to observed heads, and the model input parameters were re-adjusted to achieve better agreement with observed (field-measured groundwater head) conditions. Prior to numerical model calibration, the range of uncertainty in the parameters contained within the conceptual hydrogeologic model was evaluated and considered during the calibration process.

Calibration of the model considered both observed head measurements at specific calibration points (described below) as well as 3D surfaces of both the water table and potentiometric surfaces, as they were interpreted within the 3D CSM. In this manner, the calibration of the model was optimized at calibration points and in between calibration points based on an interpretation of the water table or potentiometric surface.

4.5.1 Calibration Points

Model calibration was assessed by comparing simulated water levels to groundwater water measurements obtained from Project fieldwork in the fall of 2016, as well as from select AWWID records. Data were also used from Project-specific monitoring wells installed for use as calibration points within the LAA. A subset of AWWID wells were chosen as calibration points in the RAA. The AWWID points were chosen based on their spatial relevance to the Project, using well records with appropriate well completion details and representative water levels.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Location of Calibration Targets within RAA

Figure 4-13

4.5.2 Steady-State Residual Analysis

At each of the calibration points, residuals were calculated by subtracting the observed head value from the simulated head value. Positive residuals indicate that the model simulated a head value higher than the observed value, while negative residuals indicate that the model simulated a head value lower than the observed value. Table 4-1 presents the final residuals calculated at the end of the calibration process.

Table 4-1 Observed versus Simulated Heads and Calculated Residuals

Calibration Point ID	Observed Head (m ASL)	Simulated Steady-State Head (m ASL)	Residual (m)
1	1330.26	1333.62	3.36
2	1361.43	1362.07	0.64
3	1382.24	1363.26	-18.98
4	1300.95	1301.15	0.20
5	1227.29	1226.79	-0.50
6	1246.93	1249.18	2.25
7	1182.86	1189.43	6.57
8	1164.91	1174.90	9.99
9	1132.71	1135.30	2.59
10	1181.95	1184.85	2.90
11	1117.00	1123.27	6.27
12	1110.85	1113.59	2.74
13	1105.19	1108.74	3.55
14	1160.81	1161.13	0.32
15	1220.93	1225.19	4.26
16	1215.26	1222.13	6.87
17	1243.81	1232.29	-11.52
18	1236.33	1239.54	3.21
19	1228.81	1234.04	5.23
20	1161.71	1178.06	16.35
21	1150.76	1158.89	8.13
22	1182.11	1191.49	9.38
23	1173.73	1188.60	14.87
24	1131.53	1159.67	28.14
25	1141.89	1155.46	13.57

Table 4-1 Observed versus Simulated Heads and Calculated Residuals

Calibration Point ID	Observed Head (m ASL)	Simulated Steady-State Head (m ASL)	Residual (m)
26	1104.37	1108.82	4.45
27	1143.79	1146.66	2.87
28	1183.33	1184.49	1.16
29	1207.29	1211.04	3.75
30	1215.48	1221.06	5.58
31	1255.60	1255.14	-0.46
32	1199.20	1202.10	2.90
33	1219.80	1235.08	15.28
45	1192.75	1193.94	1.19
46	1193.06	1192.29	-0.77
47	1207.83	1208.99	1.16
48	1187.23	1189.17	1.94
49	1226.12	1212.15	-13.97
50	1208.97	1213.41	4.44
51	1212.69	1208.99	-3.70
52	1198.88	1202.18	3.30
53	1193.00	1188.78	-4.22
54	1186.74	1183.86	-2.88
55	1190.50	1190.87	0.37
56	1203.52	1203.95	0.43
57	1209.22	1207.72	-1.50
58	1199.89	1200.13	0.24
59	1208.32	1201.61	-6.71
60	1195.28	1194.83	-0.45
61	1198.14	1198.79	0.65
62	1212.02	1211.46	-0.56
63	1204.29	1201.04	-3.25
64	1175.75	1194.28	18.53
65	1172.94	1183.97	11.03
66	1191.40	1196.59	5.19
67	1182.94	1182.30	-0.64

Table 4-1 Observed versus Simulated Heads and Calculated Residuals

Calibration Point ID	Observed Head (m ASL)	Simulated Steady-State Head (m ASL)	Residual (m)
68	1187.18	1183.84	-3.34
69	1186.37	1185.57	-0.80
70	1204.66	1203.09	-1.57
71	1200.97	1203.06	2.09
72	1213.88	1211.45	-2.43

Four statistical parameters were used to evaluate the degree of fit, including the mean residual, mean absolute residual, the normalized root mean squared residual (NRMS) and the correlation coefficient. A groundwater model is considered to be calibrated adequately if the:

- mean error is close to zero
- absolute mean error is as small as possible in consideration of the scale of the model
- NRMS residual is less than 10% (Spitz and Moreno 1996)
- correlation coefficient is close to the perfect correlation value of one

The statistical measures of the calibration to the water level data are reported in Table 4-2. In evaluating the fit between the observed and the simulated water levels, the RMS error is usually regarded as the best measure (Anderson and Woessner 1991). The RMS error is calculated as the average of the squared differences between the measured and the simulated water levels. If the ratio of the RMS error to the total water level differential over the model area is small (e.g., less than 10%), then the errors are only a small part of the overall hydraulic response of the model. In this simulation, the ratio of the RMS error to the total water level differential (2.8%) is markedly less than the recommended 10% threshold.

Table 4-2 Residual Statistics from Steady-State Calibration

Parameter	Value
Number of Observations	61
Mean Residual	2.62 m
Absolute Mean Residual	5.18 m
Normalized Root Mean Squared Residual	2.8%
Correlation Coefficient	0.99

Based on the residual statistics presented in Table 4-2, the statistical calibration targets were achieved, indicating good calibration of the model.

In addition to the residual statistics presented above, graphical examination of residuals was also completed to compare observed versus simulated heads at each of the calibration points. A cross plot of observed versus simulated heads can be used to assess the "goodness of fit" of the simulated heads relative the observed heads at calibration points through visual examination of the points relative to a line of perfect fit. Figure 4-14 presents a cross plot of the observed versus simulated heads at the end of model calibration and a line of perfect fit (red dotted line).

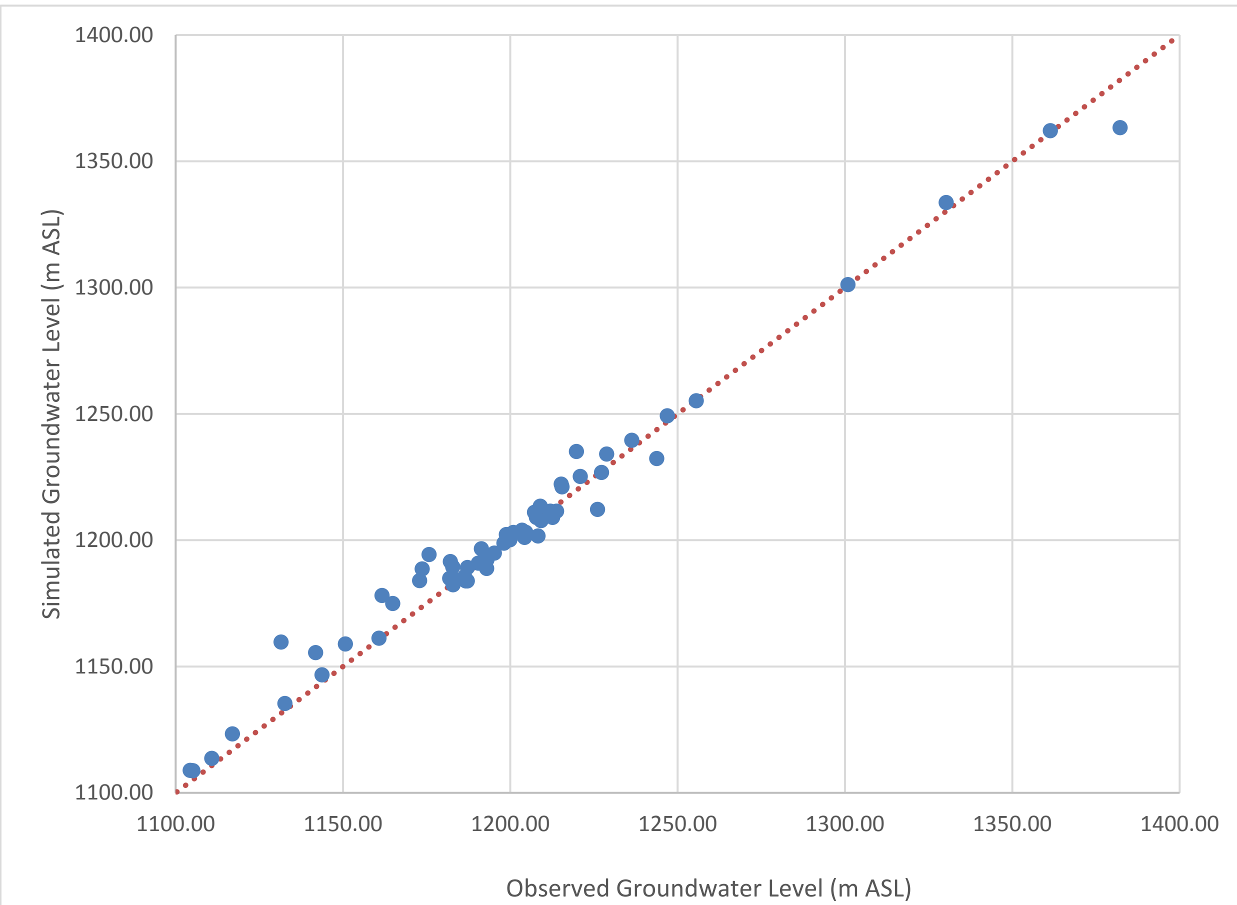


Figure 4-14 Comparison of Observed versus Simulated Groundwater Levels

From Figure 4-14, the simulated head values for all calibration points are situated close to the line of perfect fit. The distribution of points in the cross plot also indicate that the residuals are reasonable in all areas of the model. No systemic clustering of data off the line of perfect fit is observed, nor are any trends in the residuals noted, both of which indicate no systemic bias in the calibration.

Systemic bias in the simulations can be also evaluated by comparing the residuals to the simulated water levels. Figure 4-15 presents a plot of the residual values at each of the calibration points versus its simulated head. The plot indicates that residuals are distributed both above and below the zero line, again indicating no systemic bias in the calibration.

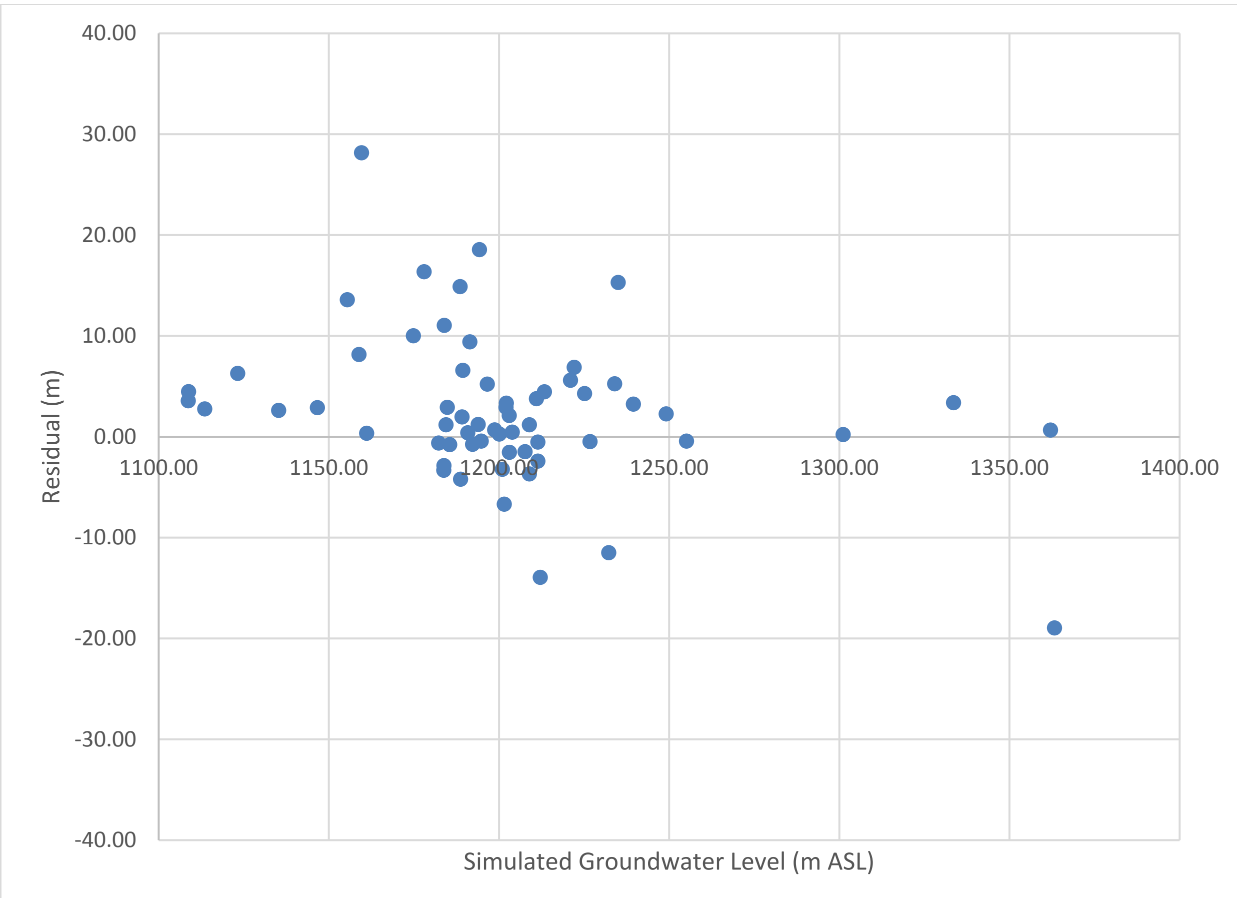


Figure 4-15 Comparison of Residuals to Simulated Water Levels

4.5.3 Calibrated Model Parameters

The values of the hydrogeologic parameters that were determined from the calibration process are presented in Table 4-3. The hydraulic conductivity and specific storage values for the various hydrostratigraphic units generated by the model during calibration are within the ranges expected for the geologic materials based on measured and literature values.

Table 4-3 Calibrated Parameters

Hydrostratigraphic Unit	Hydraulic Conductivity (m/s)	Specific Storage (1/m)	Specific Yield (Dimensionless)
Clay	5.1E-06	3.5E-03	0.07
Fluvial sand and gravel	2.8E-03	2.3E-05	0.25
Grouped Bedrock layer 6	1.4E-06	1.1E-05	0.17
Grouped Bedrock layer 7	2.7E-07	1.1E-05	0.17
Lower silt, sand and gravel	8.3E-05	2.3E-05	0.2
Till North	7.2E-08	4.0E-03	0.04
Till South	7.2E-07	4.0E-03	0.04
Till-high conductivity North	8.3E-05	3.8E-03	0.04
Till-high conductivity East	1.0E-04	3.8E-03	0.04

5.0 MODEL SIMULATIONS OF POTENTIAL EFFECTS ON GROUNDWATER

5.1 OVERVIEW OF MODELLED SCENARIOS

The calibrated FEFLOW model was used to simulate hydrogeologic conditions in the RAA under four different flow scenarios within the Elbow River, representing the following:

- flow conditions during non-flood periods of average flow in Elbow River
- flow conditions during the design flood, based on the 2013 flood

The hydrographs depicting flow rates within the Elbow River during the design flood are shown in Figure 5-1. Hydrographs for the 1:00 year and 1:10 year floods are also provided for reference. The time frame starts at an arbitrary point such that the hydrographs can be compared to each other to understand the relative dynamics of the flow scenarios that were modelled.

Numerical groundwater modelling of each of the floods is based on the Project diversion operational rules and modelled surface water elevations derived from the hydrodynamic model used for the surface water effects assessment in Volume 3B, Section 7 in the EIA (i.e., Elbow River water levels used in the model were derived from the surface water modelling). Partial diversion of water from the river starts when river flows exceed 160 m^3/s and the diversion rates increase until flows in the diversion channel reach a maximum of 600 m^3/s. Flow remaining in the river above 760 m^3/s (160 m^3/s plus 600 m^3/s) is allowed to pass downstream, while 600 m^3/s is continuously diverted into the diversion channel until the reservoir is full.

For both the dry operations and design floods, two FEFLOW simulation runs were completed to represent hydrogeologic conditions without the Project and with the Project, yielding a total of four simulation runs; these are listed in Table 5-1. The EEX-series of simulations (baseline conditions) represent the hydrogeologic system in the RAA under non-flood and flood scenarios. The PPX-series of simulations (Project operation) represent the hydrogeologic system in the RAA under flows with the operating major Project features (diversion channel, off-stream reservoir and dam) represented in the model.

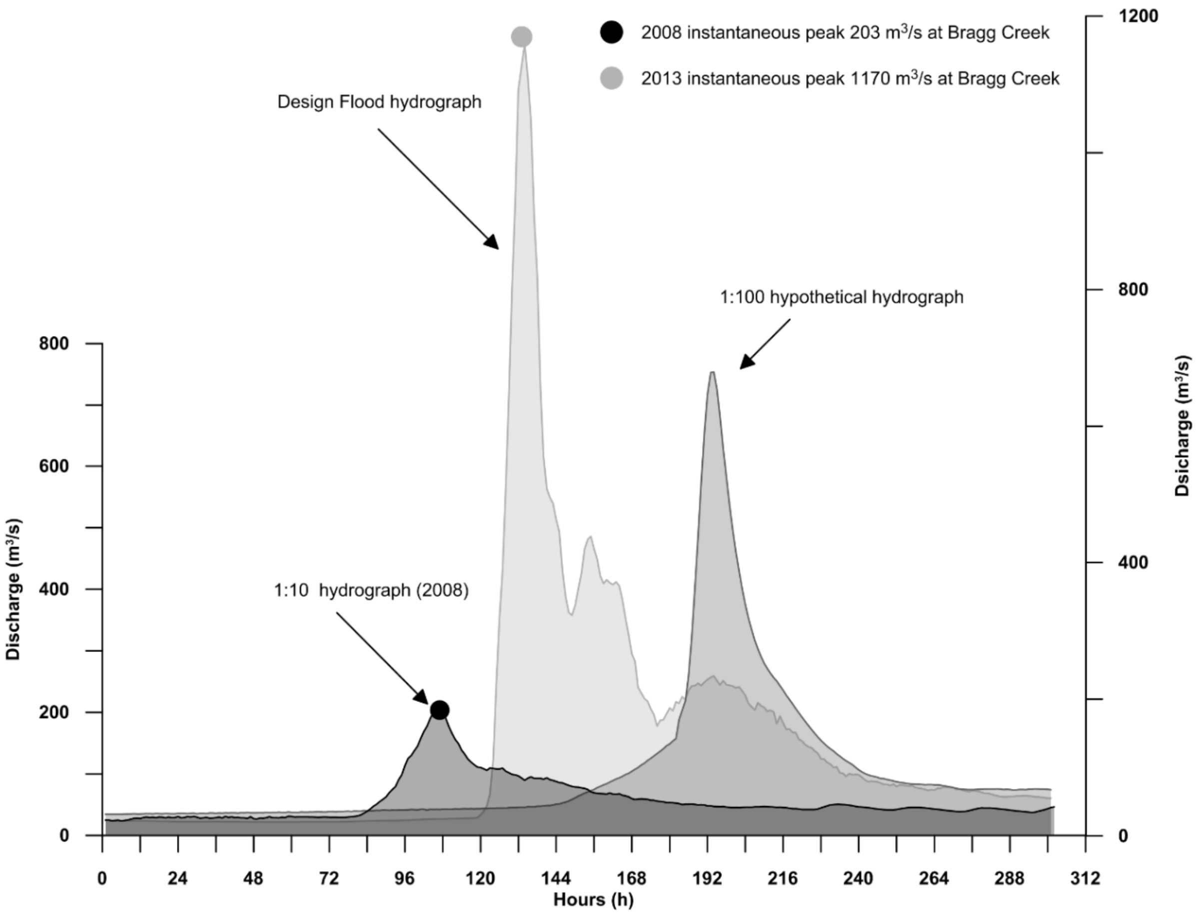


Figure 5-1 Design Flood, 1:100 Year Flood and 1:10 Year Flood Hydrographs (from Volume 4, Appendix J, Section 2, Figure 2-4)

Table 5-1 Summary of Numerical Groundwater Model Simulation Runs

Flow Condition in Elbow River	Numerical Model Simulation Run		Simulation Mode	Effects Evaluated
	Without Project (Baseline Conditions)	With Project		
Average Flow Conditions (No Flood)	EEX0	PPX0	Steady-State	Dry Operations
Design Flood	EEX1	PPX1	Transient	Flood Operations

5.2 TRANSIENT SIMULATION PERIODS AND TIMESTEPS

The transient simulations were run within the FEFLOW model using a constant time step over the entire simulation period. The simulation period was set to provide adequate time prior to the arrival of the flood and then incorporating the entire flood, water retention time in the off-stream reservoir, and associated water release times from the reservoir. Additional simulation time was added to represent the post-flood period following complete release of water from the off-stream reservoir such that recovery of groundwater levels could be simulated. Table 5-2 presents the transient simulation timesteps used.

Table 5-2 Summary of Transient Simulation Timesteps

Simulation Name	Timestep Used	Number of Timesteps in Simulation	Timestep at Onset of Flood Condition	Timestep at Peak Level in the Off-Stream Reservoir	Timestep at Off-Stream Reservoir Empty
EEX1/PPX1	0.5 hour simulation stepping with 2 hour outputs	1,476	603	649	1,349

5.3 TIME VARYING SPECIFIED HEAD BOUNDARY CONDITIONS

In each of the transient simulations, the specified head boundary conditions representing water in Elbow River, the diversion channel and off-stream reservoir were varied over each timestep in the simulation. Water level hydrographs at key points within these features were generated from the hydrodynamic model. These hydrographs were used to define the time variability of the specified heads used in the transient simulations.

By way of example, Figure 5-2 presents example hydrographs used to define the time varying boundary conditions in the Elbow River for the PPX1 and EEX1 simulations. The hydrographs in this example represent water levels at a point just downstream of the diversion inlet structure. Comparison of the PPX1 and EEX1 hydrographs highlights a reduction (approximately 2 m at peak flow) in water levels within Elbow River during the peak of a design flood (when the Project is in flood operations). Soon after peak flows within Elbow River begin to subside, the two hydrographs re-converge, coinciding with the cessation of diversion into the off-stream reservoir.

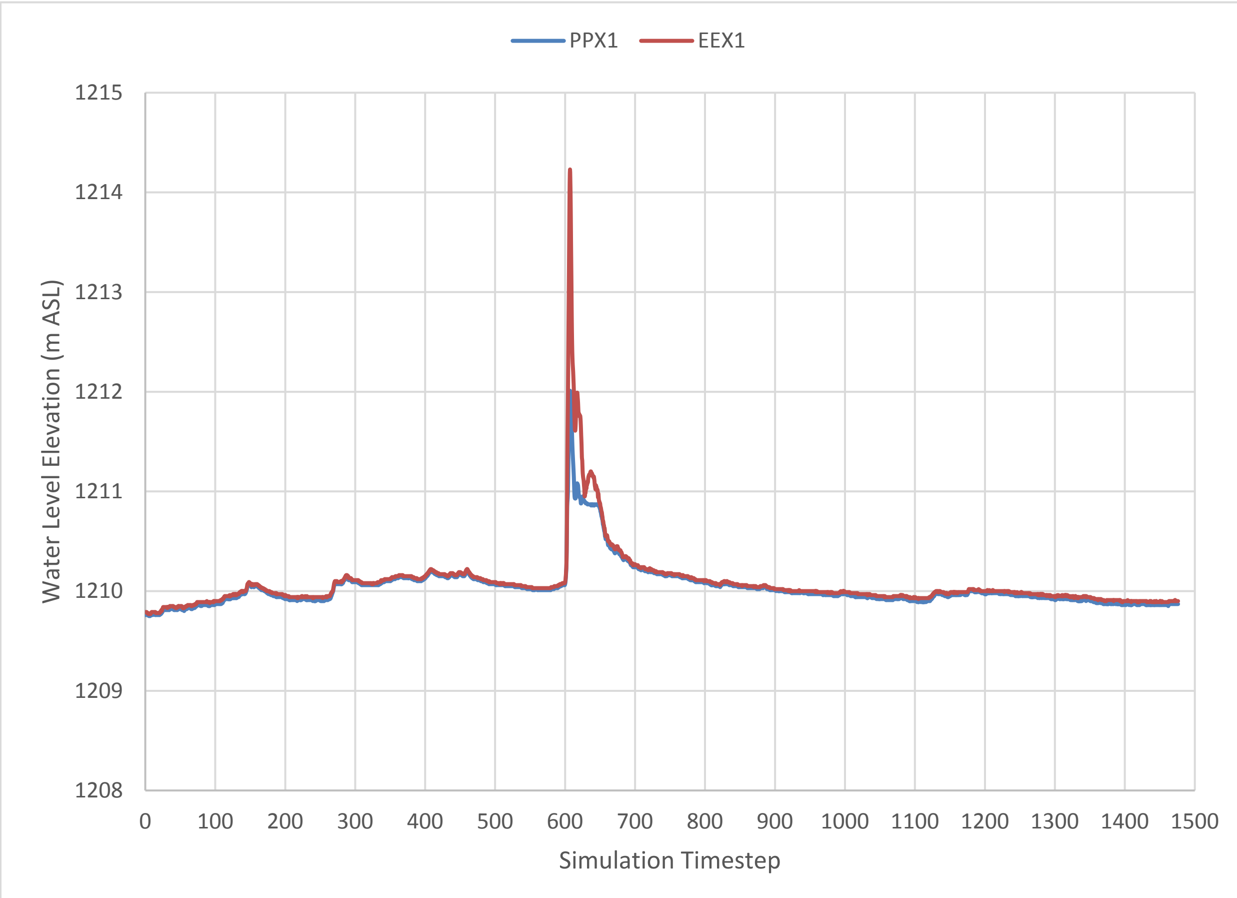


Figure 5-2 Example of Hydrographs Used for Time Varying Specified Head Boundary Conditions in Elbow River

Time varying specified head levels were also assigned to nodes within the diversion channel and off-stream reservoir based on simulated results from the hydrodynamic model. In these areas, time varying specified heads were only assigned for the PPX-series of simulations because the water level influence they represent are only relevant for the simulation runs where the Project infrastructure is present (i.e. they do not need to be represented in the EEX-series of simulations because infrastructure does not exist in those scenarios; that is without the Project in place). Further, the time varying specified head values were only applied for timesteps within the simulation while the Project was in operation.

Figure 5-3 presents an example hydrograph used to define the time-varying specified head boundary conditions in the diversion channel near its outlet into the off-stream reservoir. This hydrograph represents water levels variations within both the diversion channel and in the reservoir (once it has filled). This hydrograph illustrates:

- onset of water diversion into the off-stream reservoir
- followed by a plateau representing maximum flows in the diversion channel
- declining water levels as the diversion rates decline
- followed by an increase in water levels in the reservoir until the reservoir is full
- holding water within the reservoir
- final decline of water levels as the low-level outlet gate is opened and the reservoir drains

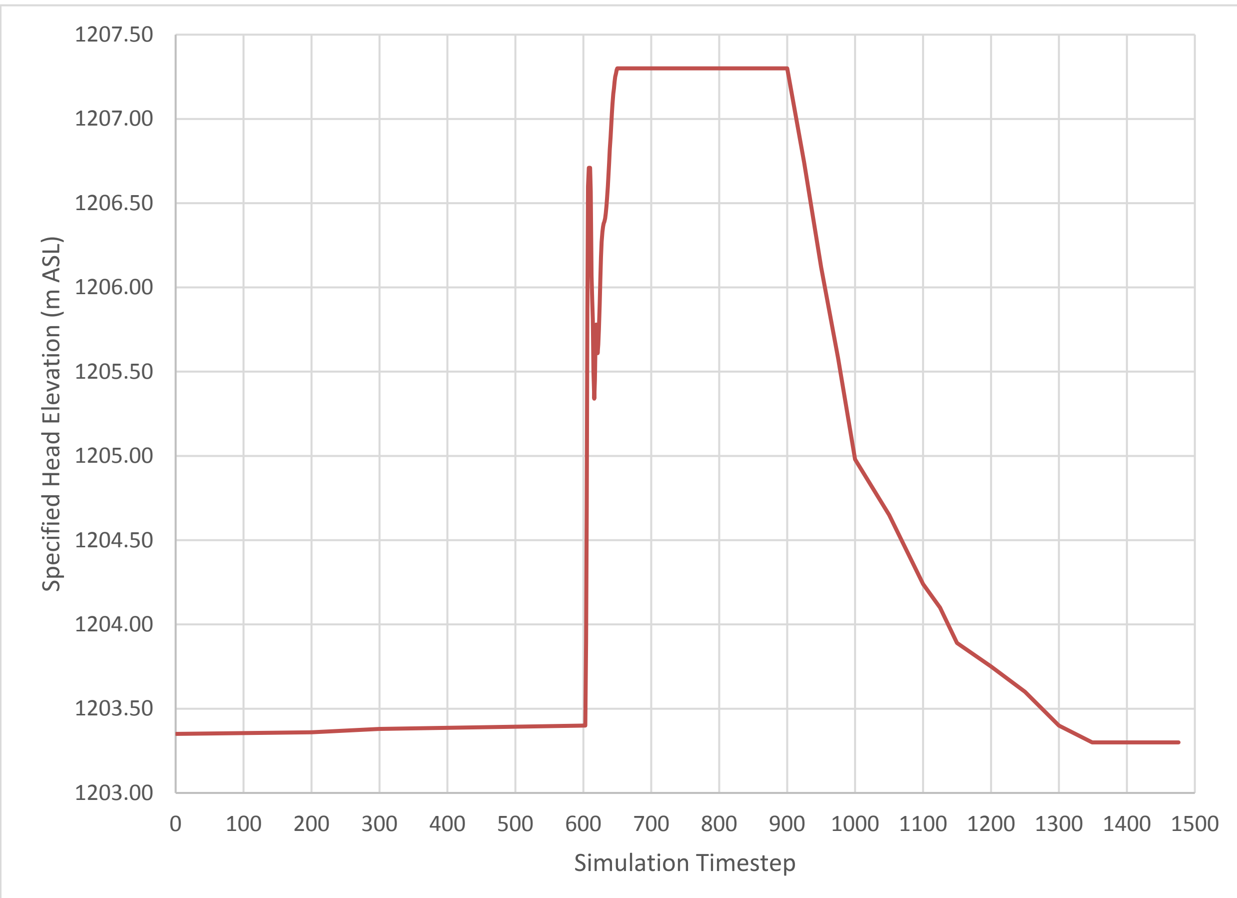


Figure 5-3 Example Hydrograph Used for Time Varying Specified Head Boundary Conditions in Diversion Channel

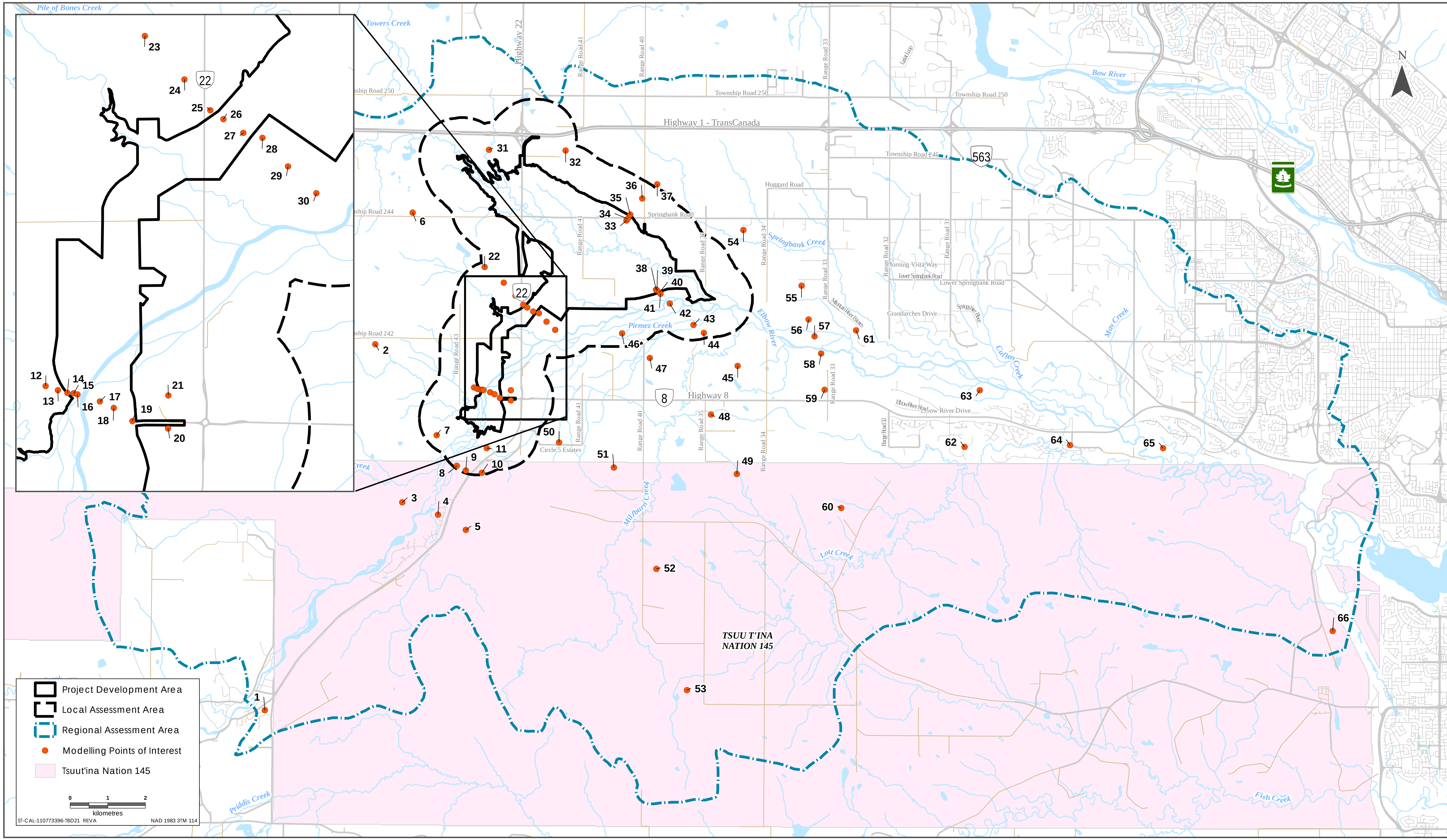
5.4 POINTS OF INTEREST USED FOR TIME SERIES EVALUATION

A total of 67 points of interest were chosen across the LAA and RAA to evaluate potential effects on groundwater levels from the construction and operation of the Project. The points are presented in Figure 5-4 and were chosen as follows:

- A line of 9 points located perpendicular and across the diversion structure were used to evaluate potential water levels changes in the fluvial deposits in the Elbow River valley and farther out into the adjacent clay, till and bedrock units.
- A line of 9 points located perpendicular and across the diversion channel were used to evaluate the effects of construction (excavation) and operation of the channel (flood and non-flood conditions).
- A line of 8 points located perpendicular and across the dam were used to evaluate the propagation of water level changes through the dam structure and downgradient to Elbow River as well as points south of the river to confirm that the effects do not propagate beyond the fluvial deposits.
- A line of 5 points located perpendicular and across the bedrock ridge on the northeast side of the dam area were used to evaluate potential propagation of effects through the ridge in that area.
- 12 points located on the Tsuut'ina Nation Reserve were used to address concerns raised by that Nation.

The remaining 24 points were distributed across the LAA and RAA to include both upland and lowland areas of the domain as well as to include points within the various geological units. The points do not correlate with monitoring well locations.

Following each of the transient simulations, the calculated heads at each of the points of interest were extracted from the model output files, such that simulated hydrographs could be developed for interpretation. Selected simulated hydrographs are presented in the following subsection for the time variation of water levels at a given location.



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Points of Interest Used for Interpretation of Time-Series Evaluation

Figure 5-4

5.5 INTERPRETATION OF MODEL SIMULATIONS

Following each of the simulation runs, output files from FEFLOW were exported for post processing and interpretation. Each of the output files detail simulated potentiometric heads at each of the model nodes either at steady-state conditions (EEX0/PPX0 runs) or at each time step of the simulation for transient simulations (EEX1/PPX1). These output files were examined using spatial analysis tools to generate interpolated 3D potentiometric surfaces (at steady-state or at various timesteps of interest in the simulation) that were then imported into the 3D CSM. Through examination of the 3D potentiometric surfaces over time, the dynamics of the hydrogeologic system in the RAA could be understood for the eight simulation runs.

To understand the potential changes in the groundwater system that could be attributable to the Project, the EEX run was compared to the corresponding PPX run to derive maps of the net change in head. For example, to examine potential changes in the groundwater system attributable to the Project during the design flood, the EEX1 simulated heads were subtracted from the PPX1 simulated heads to derive the net change in head for each timestep under examination. In this manner, changes in groundwater levels due to the Project alone could be isolated from changes due to a flood alone.

5.5.1 Average Flow Conditions Scenarios (EEX0/PPX0)

The EEX0 model output simulates groundwater conditions under average non-flood flow conditions in Elbow River, based on the baseline, pre-Project topography. Steady-state head distributions for the EEX0 simulation are presented in Figure 5-5.

Examination of the steady-state head distribution for the EEX0 simulation reveals general agreement with the groundwater flow interpretations derived from the 3D CSM. The EEX0 simulation results confirm that the predominant flow divide in the RAA is Elbow River and its associated fluvial deposits. At the scale of the RAA, groundwater movement is from upland areas toward Elbow River. Smaller scale local flow systems are also observed near tributary systems.

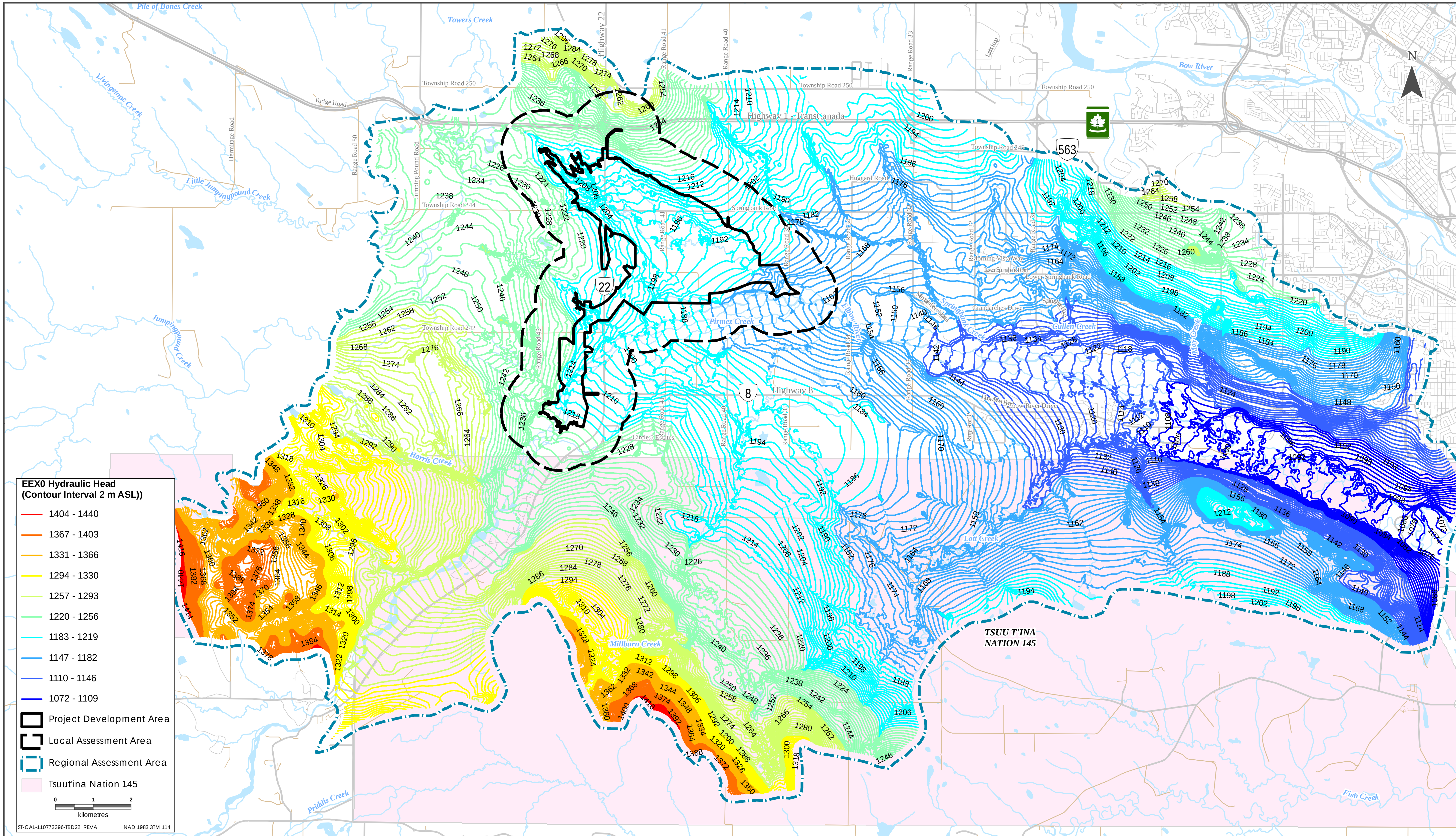
The PPX0 model output simulates groundwater conditions under non-flood average flow conditions in Elbow River, based on post-Project construction topography, where the diversion channel and dam structure have been added to the model domain. Figure 5-6 presents the steady-state head distributions for the PPX0 simulation.

The net change in head that would be attributable to the Project during dry operations is derived through subtraction of the PPX0 simulated heads from the EEX0 simulated heads. This was achieved through subtracting interpolated grids of the two simulated surfaces to yield a simulated net change in head grid. Figure 5-7 presents the simulated net change in head derived from both the EEX0 and PPX0 outputs.

From Figure 5-7, changes in head during dry operations are expected in areas near Project infrastructure, primarily near the diversion channel. Negative net change in groundwater levels are indicative of drawdowns caused by incision of the diversion channel through the subsurface. Slow seepage into the diversion channel over time would locally lower groundwater levels to the levels simulated in the PPX0 simulation. The maximum drawdowns noted within the diversion channel area are approximately -8.5 m. Drawdowns were greater (i.e. more lowering) near the upstream side of the diversion channel near its inlet, and in areas along the channel where channel incision into the existing topography would be greatest.

The extent of the net change in head as depicted in Figure 5-7 varies depending on location, but the net changes is restricted to within the LAA and north of the Elbow River. The propagation of effects through the subsurface is controlled by the magnitude of drawdown and the hydraulic properties of the underlying geologic units. Areas where the drawdown effects propagate farther away from the diversion channel are underlain by the more permeable basal sand and gravel unit.

An estimate of groundwater seepage rates into the diversion channel (when dry) was obtained through examination of steady-state flux rates at nodes that fall within the diversion channel. Based on the net flux at nodes within the diversion channel extracted from the PPX0 simulation, the estimated groundwater seepage rate into the channel is 0.013 m^3/s. This would represent an estimate of groundwater flows that are “intercepted” by the diversion channel when dry. These changes in groundwater discharge to Elbow River would not be perceptible, given the mean monthly flows in Elbow River are approximately 3 m^3/s to 4 m^3/s during winter months when flow is the lowest.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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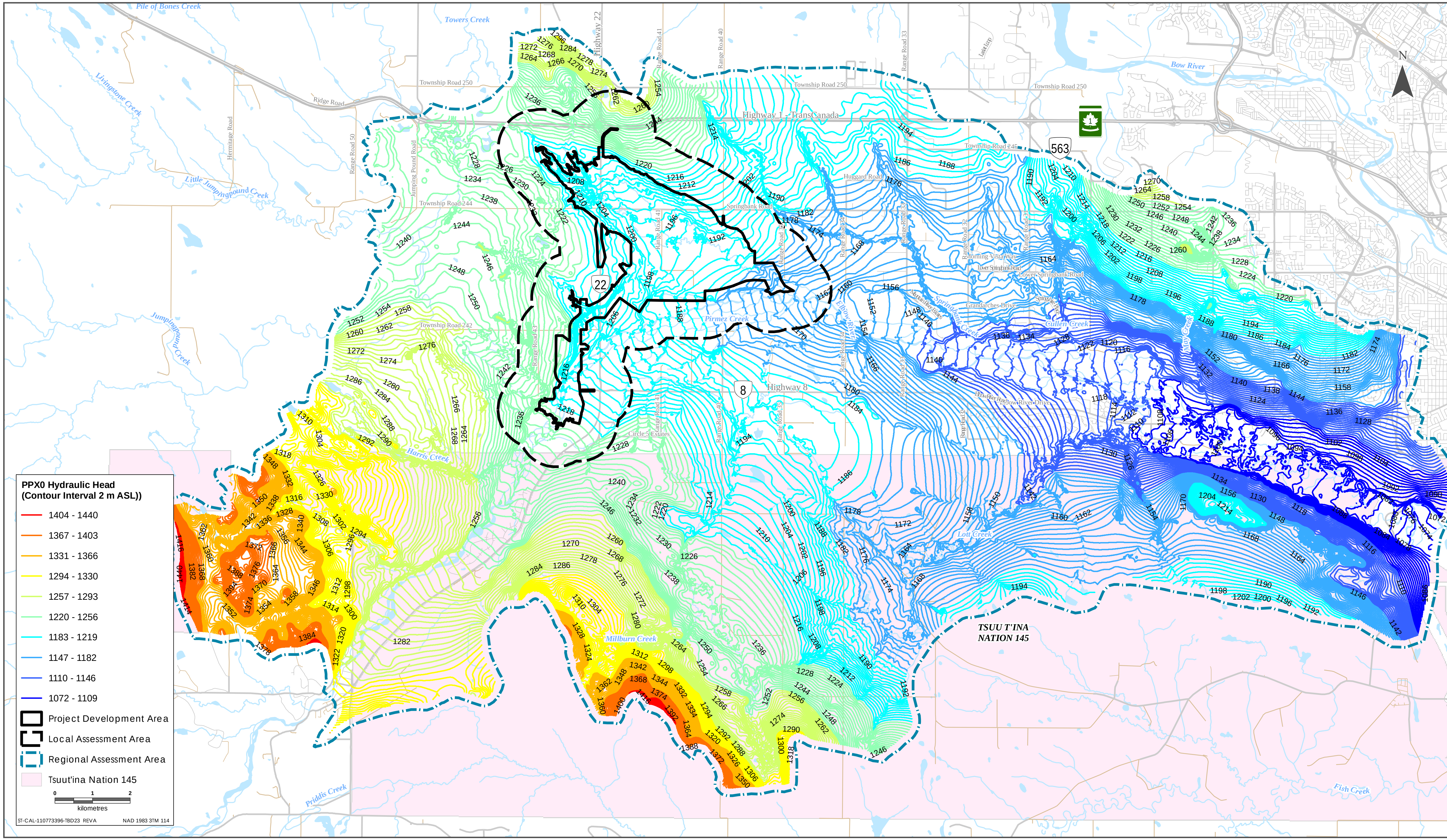
Simulated Steady State Heads for the EEX0 Scenario

Figure 5-5



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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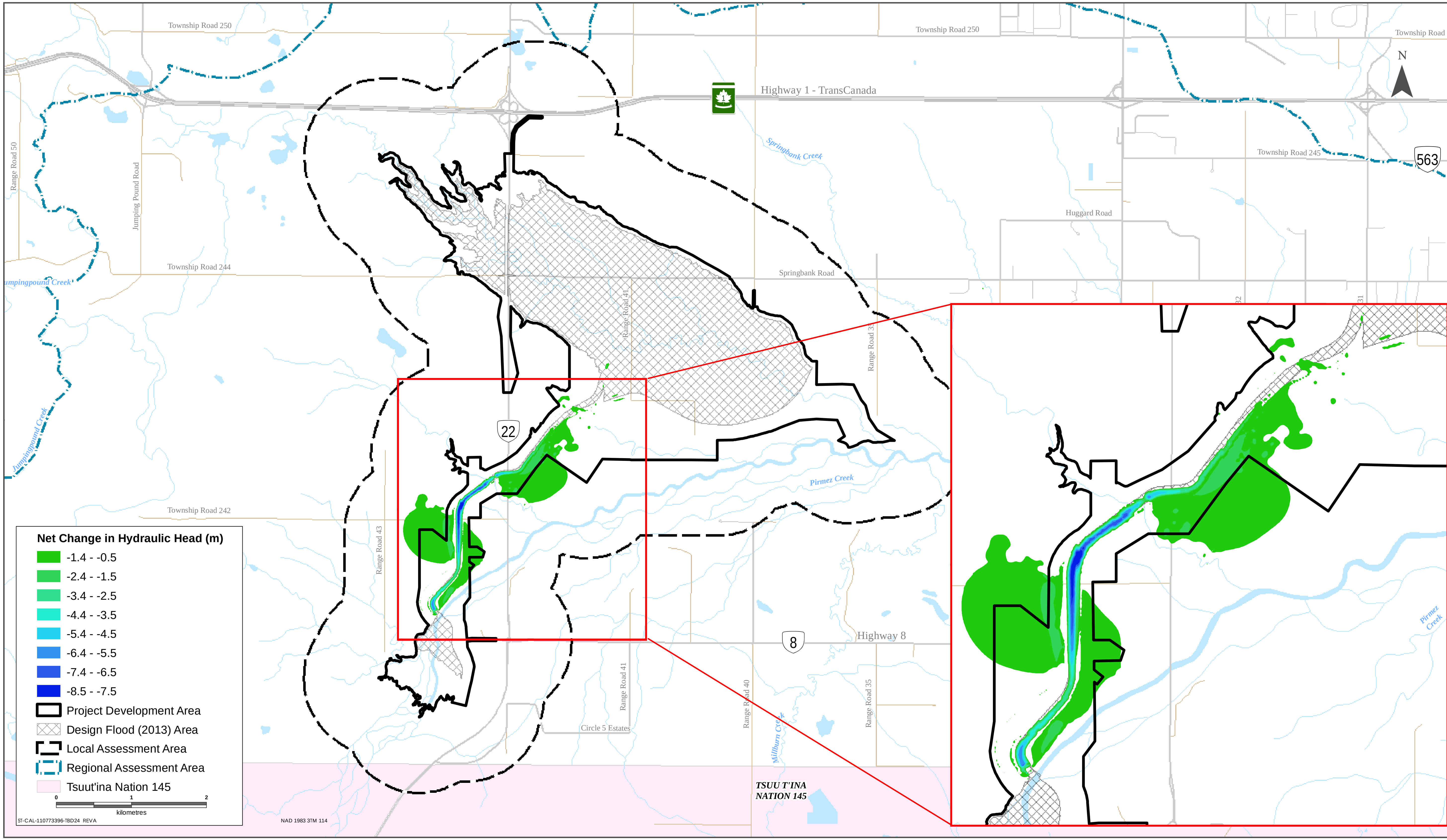
Simulated Steady State Heads for the PPX0 Scenario

Figure 5-6



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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Simulated Net Change in Head for the PPX0/EEX0 Scenario

Figure 5-7

Figure 5-8, Figure 5-9, and Figure 5-10 present local scale geologic cross sections through PDA. The locations of these three cross sections are shown on Figure 3-13 and are consistent with the cross section locations presented in the 3D CSM. The length of these cross sections has been limited to the LAA, such that greater resolution in these areas is provided (as compared to the regional scale cross sections presented in Section 3.1.3). These cross sections present both the EEX0 (without Project) and PPX0 (with Project) simulated groundwater levels such that they can be compared, and the modelled change in level can be observed in profile along with the ground surface topography and underlying hydrogeologic structure. The ground surface topography used in these cross sections represents the post-Project conditions, with the diversion channel and dam included (though not applicable for the EEX0 simulation).

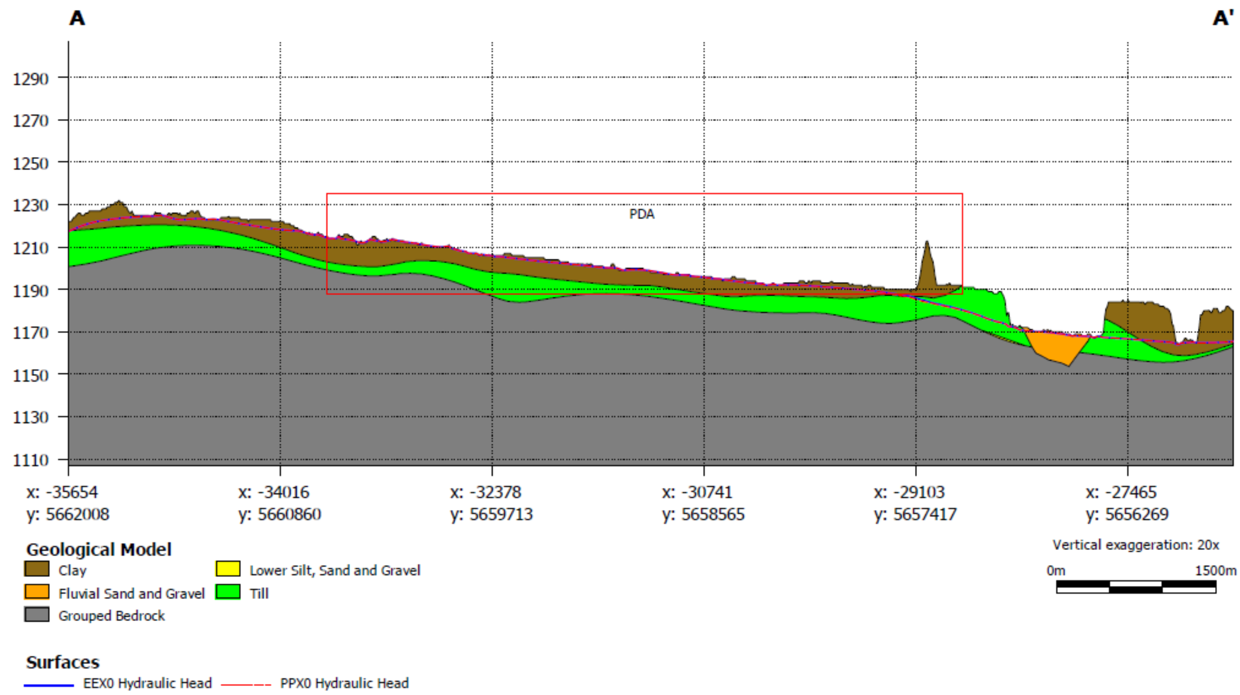


Figure 5-8 Local Scale Cross Section A-A' Through the Off-stream Reservoir for PPX0/EEX0 Scenarios

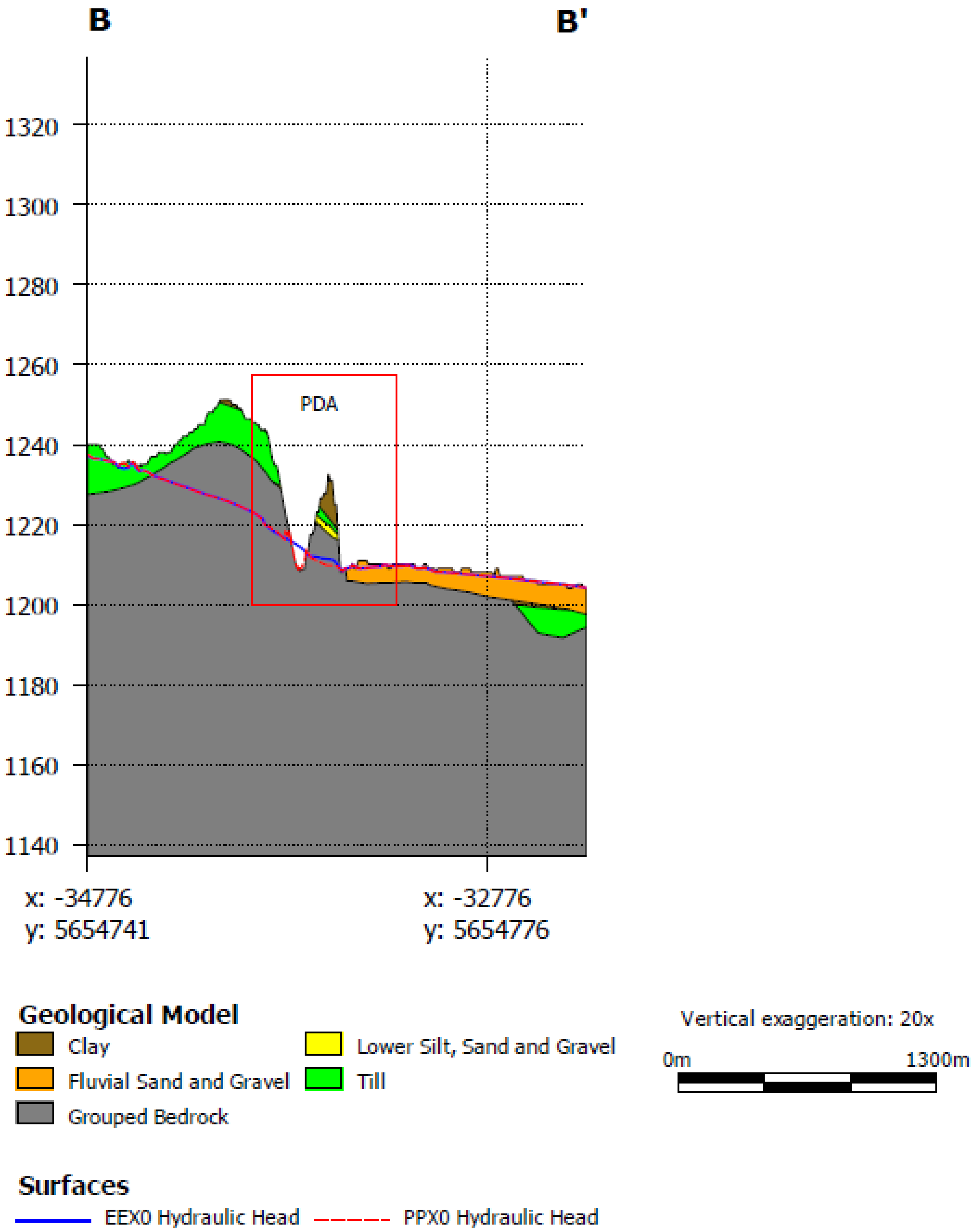


Figure 5-9 Local Scale Cross Section B-B' Through Diversion Channel for PPX0/EEX0 Scenarios

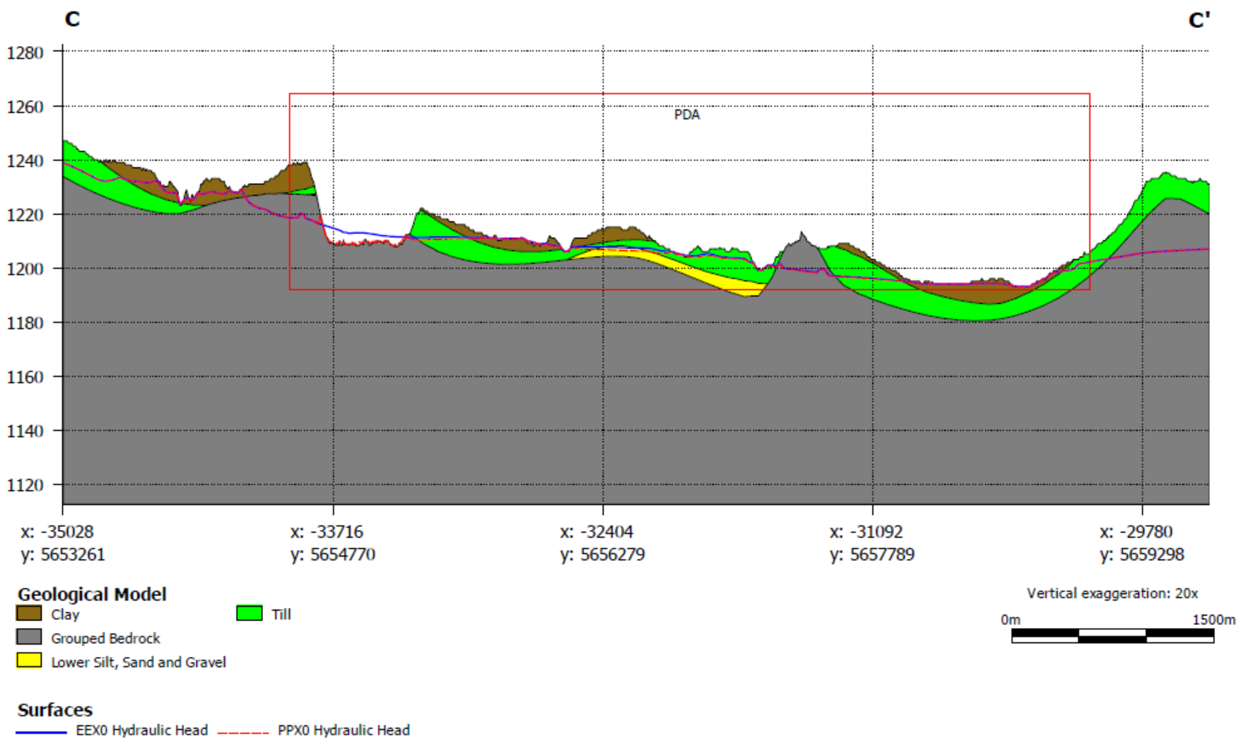


Figure 5-10 Local Scale Cross Section C-C' Through Diversion Channel and Off-stream Reservoir for PPX0/EEX0 Scenarios

These three cross sections reveal little change between the PPX0 and EEX0 simulated steady-state heads across the LAA. Areas where drawdown in groundwater levels occur are limited to areas near the diversion channel.

5.5.2 Design Flood Scenarios (EEX1/PPX1)

The EEX1 model output is a transient simulation of groundwater conditions under design flood conditions in Elbow River, based on the baseline, pre-Project topography. This simulation is designed to understand the effects on the groundwater system caused by a design flood in the absence of any Project infrastructure. Figure 5-3 presents an example hydrograph of a varying specified head boundary condition node within the diversion channel, near its outlet to the off-stream reservoir. This figure illustrates how water levels in the diversion channel and off-stream reservoir varied over the simulation.

Because the EEX1 simulation is a transient simulation, modelled head values at each of the model nodes are calculated at each timestep of the simulation. Figure 5-11 presents the simulated head distribution across the model domain at the 650 timestep, which was selected to highlight conditions when the off-stream reservoir is full and water levels within it are at their highest (though this is not applicable in this simulation as it represents pre-project construction conditions; however the same timestep is presented such that it can be compared to the PPX1 simulation at the same timestep).

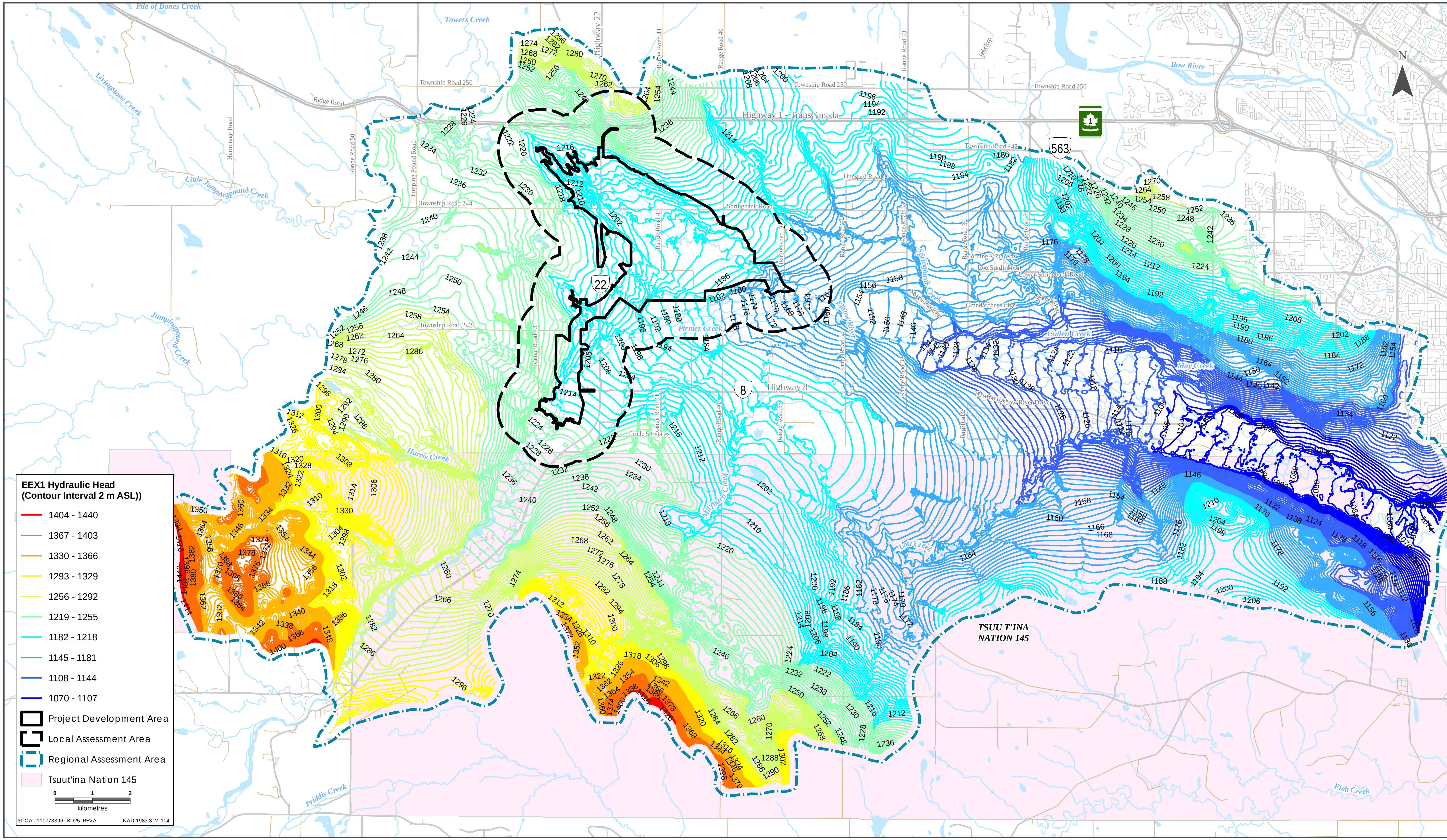
Examination of Figure 5-11 indicates that although a flood is near its peak in Elbow River, the simulated heads within the model domain are very similar to those of the non-flood conditions. Areas where groundwater levels are changed (relative to the non-flood EEX0 scenario) occur within the Elbow River valley within the fluvial deposits near the river where water levels are higher and appear to respond to a flood. Such changes in water level due to a flood are relatively small (3 m to 4 m) relative to the total change in head across the RAA (approximately 360 m). As such, regional scale changes in flow patterns are not expected during a flood, given the short duration and relatively small change exhibited.

The PPX1 model output is a transient simulation of groundwater conditions under design flood conditions in Elbow River, based on the post-Project topography, where the diversion channel and dam structure have been added to the model domain. This simulation is designed to understand the effects on the groundwater system caused by a design flood and operation of the Project.

Because the PPX1 simulation is a transient simulation, modelled head values at each of the model nodes are calculated at each timestep of the simulation. Figure 5-12 presents the simulated head distribution across the model domain at the 650 timestep, which was selected to highlight conditions when the off-stream reservoir is full and water levels within it are at their highest.

From Figure 5-12, localized changes in groundwater levels are expected near Project infrastructure including the diversion channel and off-stream reservoir. Localized changes in groundwater flow patterns would be expected near these features relative to the flow patterns inferred from the EEX1 simulation. Groundwater flow patterns near the off-stream reservoir would be expected to change due to the mounding effect caused by retention of water and increased local heads. Flow patterns in this area would exhibit radially outward directed flow before returning to the general regional flow direction toward Elbow River.

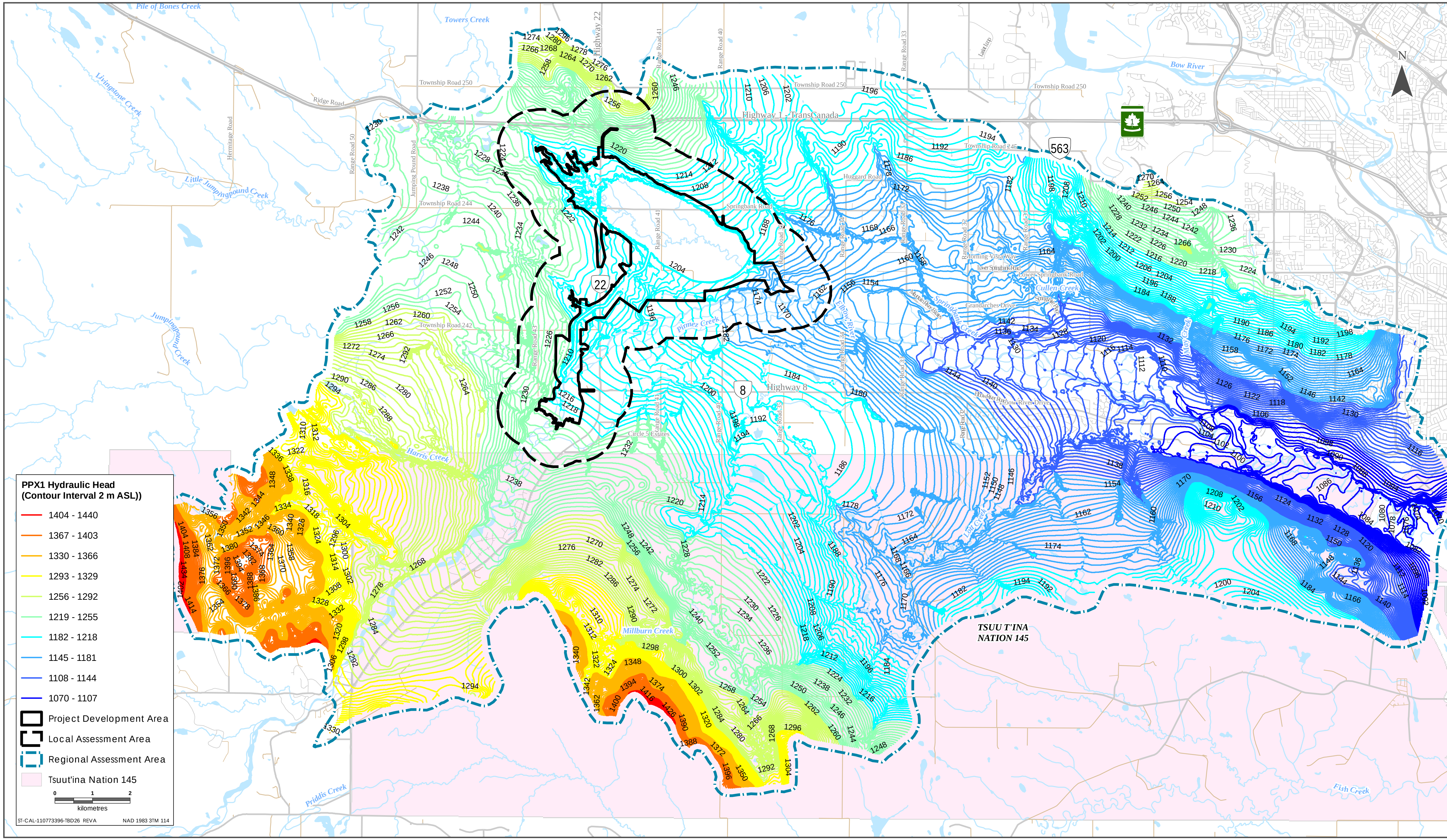
The net change in head that would be attributable to the Project during a design flood is derived through subtraction of the PPX1 simulated heads (at timestep 650) from the EEX1 simulated heads (also at timestep 650). This was achieved through subtracting interpolated grids of the two simulated surfaces to yield a simulated net change in head grid. Figure 5-13 presents the simulated net change in head derived from both the EEX1 and PPX1 outputs at the 650 timestep.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Simulated Head Distribution for the EEX1 Scenario at Timestep 650

Figure 5-11



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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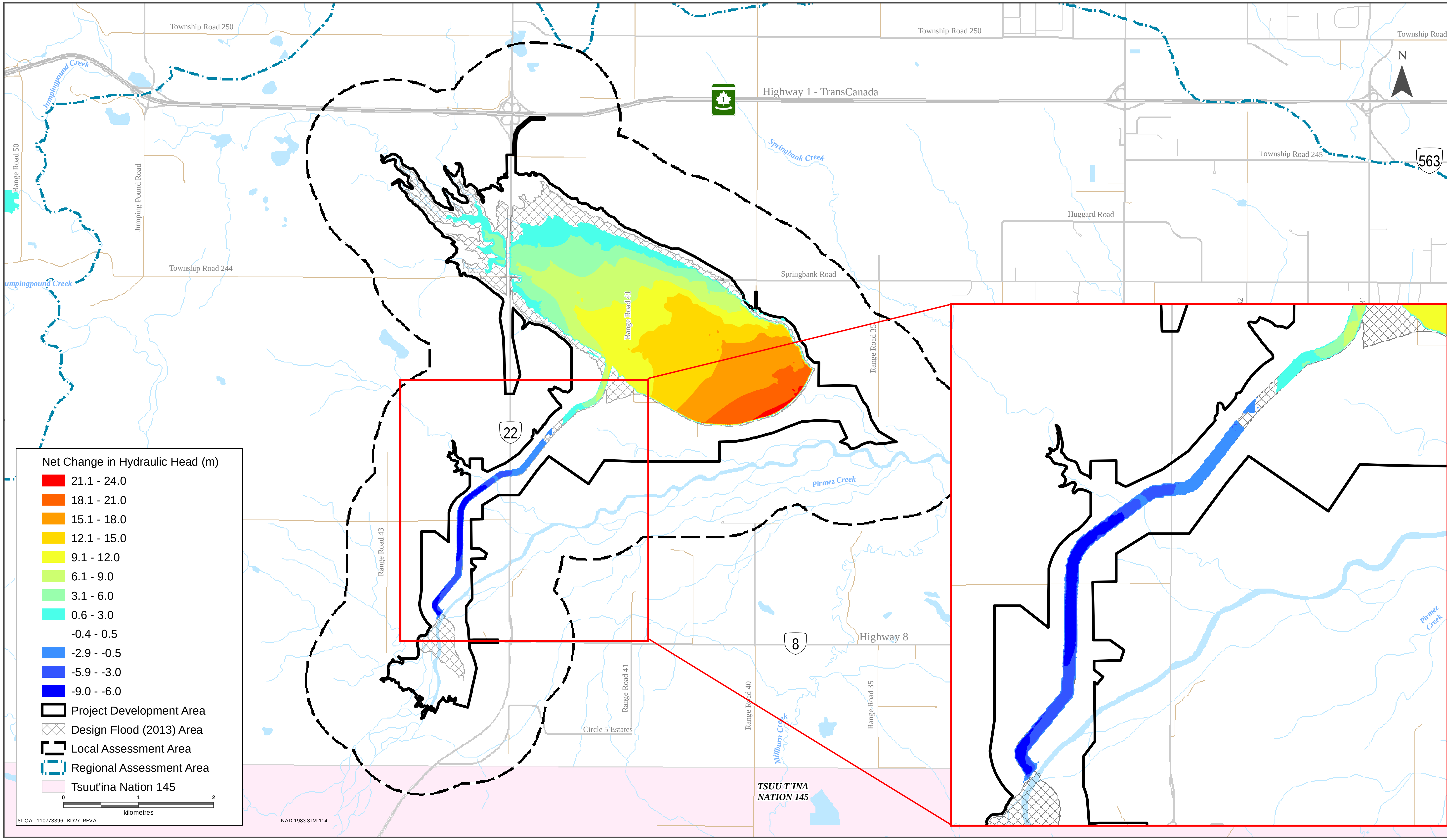
Simulated Head Distribution for the PPX1 Scenario at Timestep 650

Figure 5-12



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Simulated Net Change in Head for the PPX1/EEX1 Scenarios at Timestep 650

Figure 5-13

From Figure 5-13, net changes in head are expected near the diversion channel and off-stream reservoir. Near the upstream areas of the diversion channel, groundwater levels are expected to be up to 9 m lower compared to pre-Project conditions. In areas within the off-stream reservoir, groundwater levels are expected to be up to 24 m higher near the upstream toe of the dam structure, with decreasing net changes in a northwesterly direction toward higher elevation (i.e. uphill) areas of the reservoir. In all cases, the lateral extent of the net change in head is within the LAA and north of Elbow River (except for a small area of net negative change near the diversion inlet structure). Net negative change (drawdown) is still exhibited in these areas of the diversion channel because even when flowing during diversion, water levels are below the baseline elevations.

An estimate of seepage out of the reservoir area when full and just prior to commencement of release (when seepage rates out of the reservoir area would be at their maximum) was obtained through examination of the flux values at each of the nodes within the reservoir. Summation of the net fluxes yielded an estimated seepage rate of 426 m^3/day out of the reservoir. Even if all this seepage ends up as discharge in Elbow River, the additional flux would not be perceptible relative to flows in Elbow River during a design flood, which reaches an instantaneous peak flow of 1,170 m^3/s (equivalent to approximately $1.01x10^8$ m^3/day).

Figure 5-14, Figure 5-15, and Figure 5-16 present local scale geologic cross sections through the PDA The locations of these three cross sections are shown on Figure 3-13 and are consistent with the cross section locations presented in the 3D CSM. The length of these cross sections has been limited to the LAA, such that greater resolution in these areas is provided (as compared to the regional scale cross sections presented in Section 3.1.3). These cross sections present both the EEX1 (without Project) and PPX1 (with Project) simulated groundwater levels (at the 650 timestep) such that they can be compared/. The modelled change in level can be observed in profile along with the ground surface topography and underlying hydrogeologic structure. The ground surface topography used in these cross sections represents the post-Project conditions with the diversion channel and dam included (though not applicable for the EEX0 simulation).

Examination of the cross sections presenting the PPX1/EEX1 simulated water levels again show that changes in simulated groundwater levels are limited to areas near the diversion channel and off-stream reservoir, where divergence between the EEX1 and PPX1 surfaces occurs.

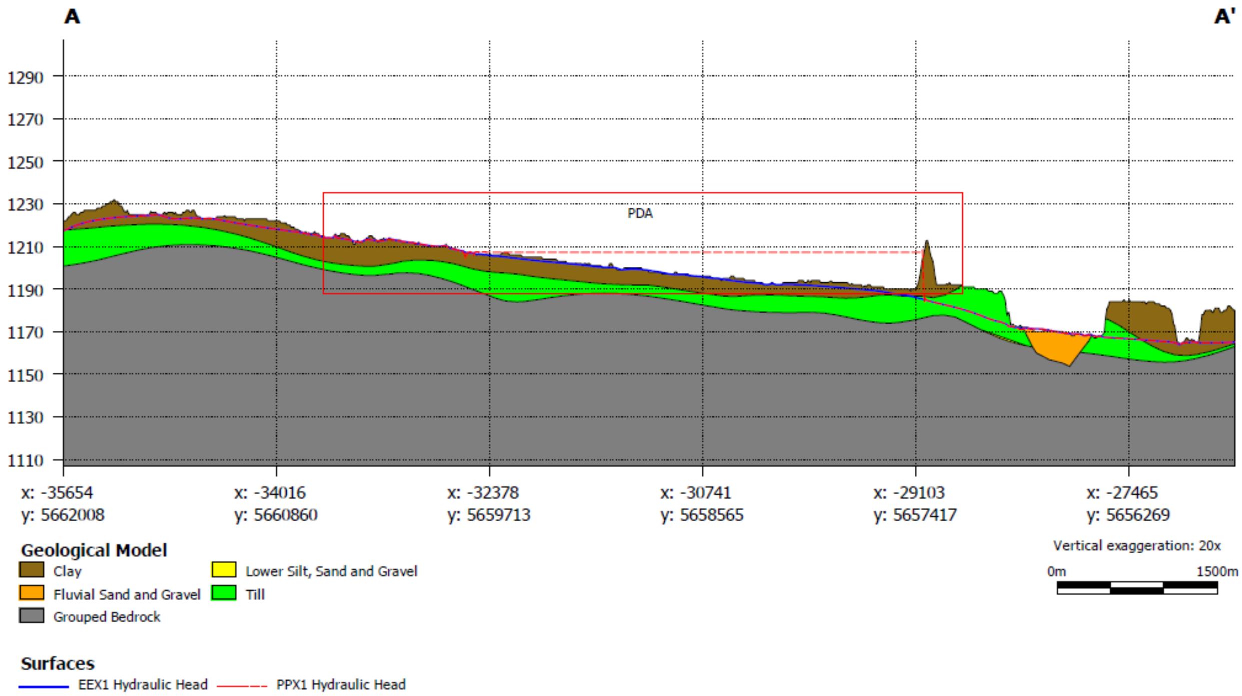

Figure 5-14 Local Scale Cross Section A-A' Through the Off-stream Reservoir for PPX1/EEX1 Scenarios at Timestep 650

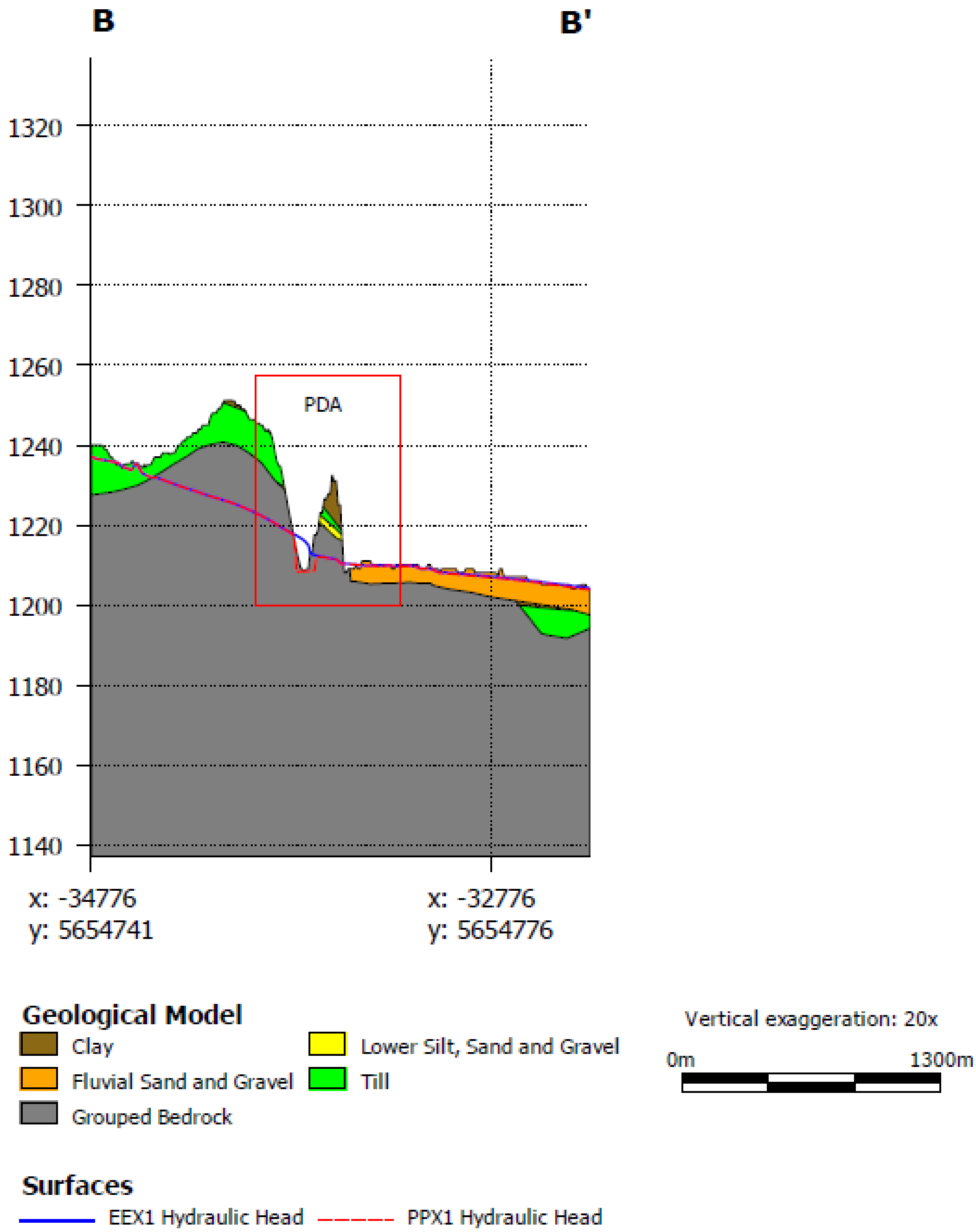

Figure 5-15 Local Scale Cross Section B-B' Through Diversion Channel for PPX1/EEX1 Scenarios at Timestep 650

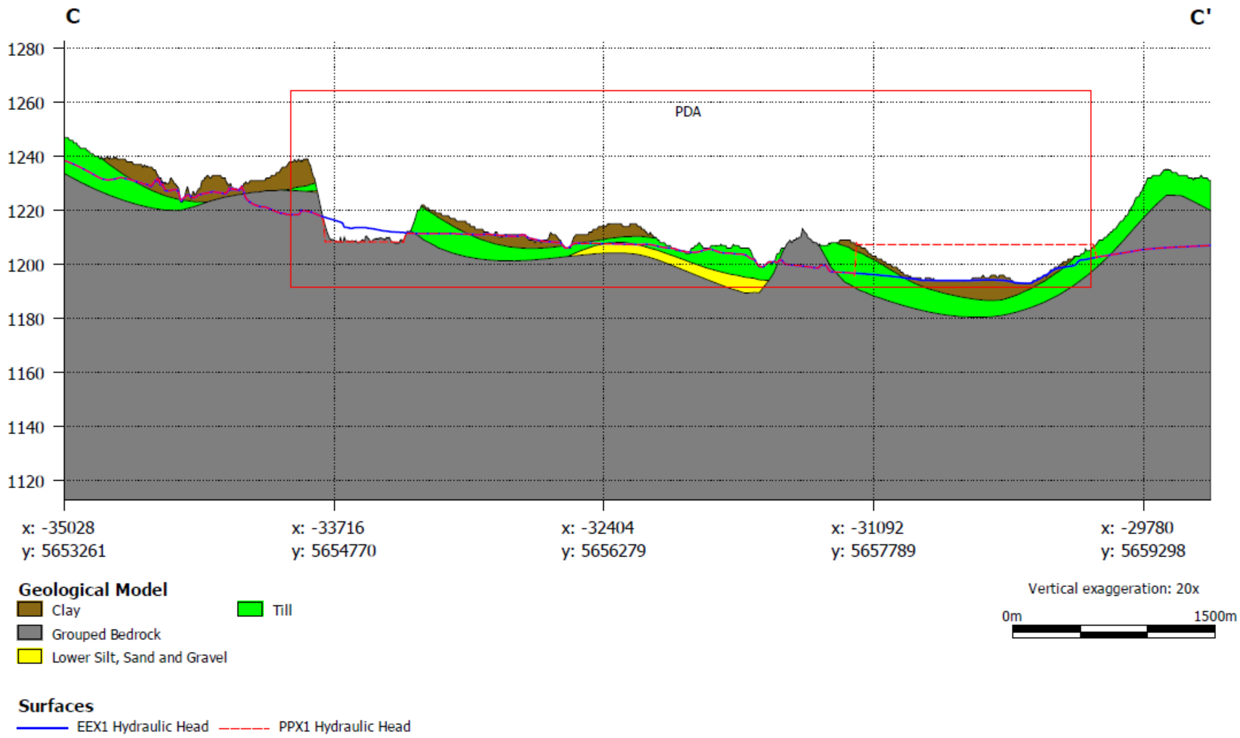

Figure 5-16 Local Scale Cross Section C-C' Through Diversion Channel and Off-stream Reservoir for PPX1/EEX1 Scenarios at Timestep 650

6.0 SUMMARY AND CONCLUSIONS

Compared to the hydrogeology assessment in the EIA, the interpretation of baseline information has now been enhanced to:

- highlight the complex groundwater flow regimes in the expanded RAA
- provide additional mapping of geologic units
- incorporate expanded cross sections highlighting hydrogeologic features in southern areas of the RAA
- expand mapping of water table and potentiometric surfaces
- provide additional interpretation of recharge/discharge areas
- provide an updated inventory of potential groundwater use in the expanded RAA

Expansion of the RAA to include areas south of Elbow River has reaffirmed the original interpretations of baseline information derived for the original (smaller) RAA. The major hydrogeologic control of the groundwater flow systems within the expanded RAA continues to be the Elbow River and its associated fluvial deposits.

The numerical groundwater flow model has been updated to expand the model domain to the expanded RAA, to adjust model parameters in response to information requests from AEP, CEA Agency, and feedback from Indigenous groups. Once the model had been updated with additional information from expanded areas of the RAA and re-parameterized, it was re-calibrated again using an updated dataset covering the expanded RAA.

Results of the steady-state calibration indicate good agreement between observed water levels and simulated water levels, both at calibrations points and between them based on comparison to interpreted water table and potentiometric surfaces derived from the 3D CSM. Residual statistics and graphical examination of residuals were used to evaluate the calibration and both confirm adequate model calibration and a lack of systemic bias in the residuals.

The calibrated groundwater flow model provided simulated flow scenarios representing both non-flood conditions (PPX0/EEX0) when the Project is not in operation, as well as a design flood representing flood conditions when the Project is in operation. The design flood (EEX1/PPX1) represents the greatest change in groundwater conditions in the RAA.

Simulation results for the non-flood scenario (EEX0/PPX0) highlight potential changes in groundwater levels resulting from construction and dry operation of the Project. The net change in groundwater levels for these scenarios and they are found to be limited to areas near the diversion channel, due to drawdown of water levels caused by incision of the diversion channel below the baseline groundwater levels. Maximum simulated drawdown (lowering of water levels) was approximately -8.5 m within the diversion channel near its inlet and in areas where its incision into ground surface would be deepest. The lateral extent of the drawdowns is limited to within the LAA in all areas. The net flux into the diversion channel (when dry) is estimated to be 0.013 m^3/s, which would not be perceptible given the mean monthly flows in Elbow River are approximately 3 m^3/s to 4 m^3/s during winter months when flow is the lowest.

For a design flood, when the effects on groundwater would be their greatest, effects on groundwater levels occur in localized areas near the diversion channel, dam structure, and off-stream reservoir. Changes in groundwater levels range from a lowering of approximately 9 m within the diversion channel, to an increase of 24 m near the upstream toe of the dam. In all cases, the lateral extent of the net change in head is within the LAA and north of Elbow River (except for a small area of net negative change near the diversion inlet structure). Seepage rate out of the off-stream reservoir (when full and just prior to commencement of release) is estimated to be approximately 426 m^3/day. Assuming all this incremental seepage discharges to Elbow River, it would not be perceptible compared to flow rates in the Elbow River during a design flood, which reach an instantaneous peak flow of 1,170 m^3/s (equivalent to approximately 1.01×10^8 m^3/day).

The understanding of groundwater conditions has been refined across an expanded RAA, including areas south of the Elbow River and on Tsuut'ina Nation Reserve lands. The simulation results from the updated model, while expanded in extent, show that effects on groundwater levels do not extend in a southerly direction across the Elbow River valley.

The overall significance determination for the hydrogeology effects assessment does not change and remains not significant.

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Attachment A BOREHOLE LOGS AND RESPONSE TEST ANALYSIS

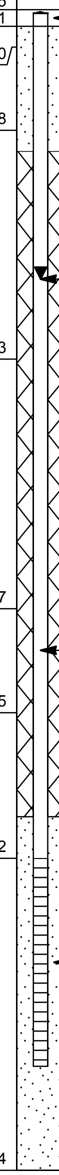
Monitoring Well: MW16-1-15 (GW1)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	19-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,211.71 m AMSL
Number:	110773396	**Top of casing elevation:**	1,212.51 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-33327.478
Contractor:	All Service Drilling Inc.	**Northing:**	5659967.274

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
			1211.95
0	0	Ground Surface	1211.71
		SAND AND GRAVEL Fine to coarse grained	0.00 1211.40
		SILT Medium brown, with clay, moist, high plastic	0.30 1210.18
5	2	CLAY Medium brown, trace silt, moist, high plastic, few intermittent <150 mm thick silt lenses	1.52 1206.83
10, 15	4		
		SILTY CLAY (TILL) Medium brown, with very fine to medium grained sand, some gravel, moist	4.88 1203.17
20, 25	6, 8		
		CLAY (TILL) Dark brown to dark grey, with gravel, some silt, low plastic	8.53 1201.65
30	10		
35		SILTSTONE Grey to greenish grey, few fractures	10.06 1199.52
40	12	SANDSTONE Medium grey, fine grained, moderate fracturing, minor oxidation and clay mineralization along fractures - @ 13.11 m: sand becomes interbedded with alternating grey and brown fine grained layers	12.19 1194.94
45, 50, 55	14, 16		
		End of Borehole	16.76

INSTALLATION DETAILS



Description
0.805 m Stick-up
Sand 0 to 1.83 m BGS
Groundwater 3.70 m BGS May 19, 2016
254 mm diameter borehole from 0 to 10.06 m
Bentonite
Solid pipe 51 mm diameter Schedule 40 PVC
102 mm diameter borehole from 10.06 to 16.76 m
Sand Sil 9 (4/10)
Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

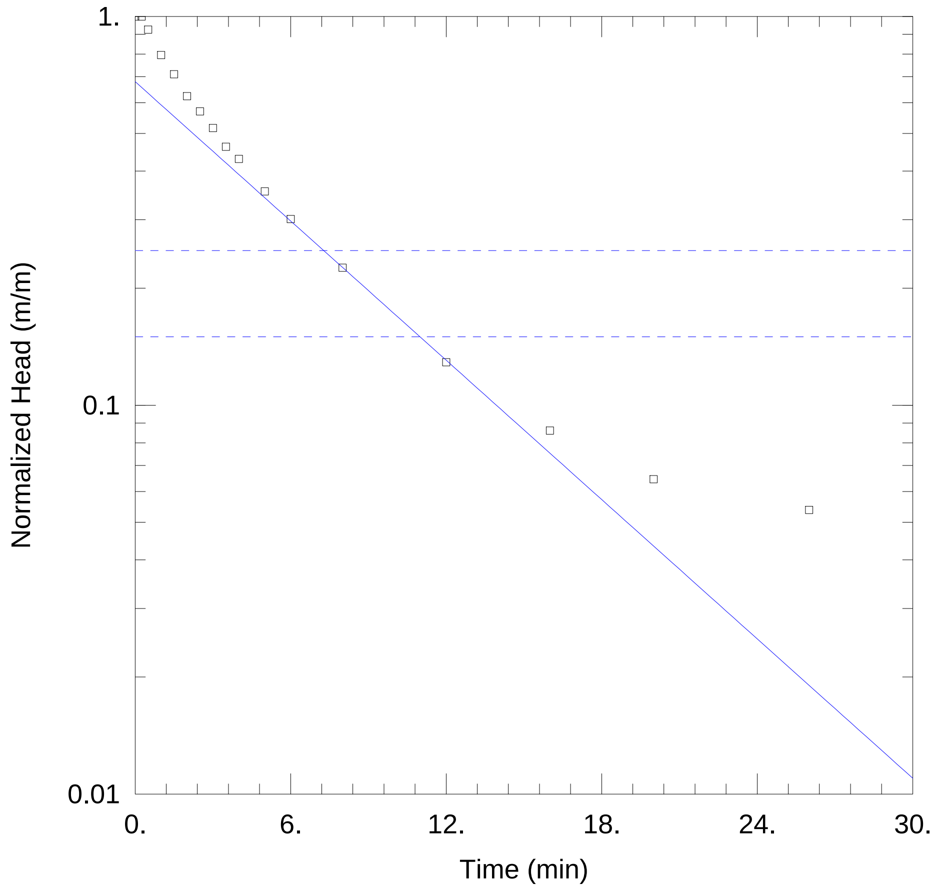
Screen Interval: 12.19 - 15.24 m BGS
Sand Pack Interval: 11.58 - 16.76 m BGS
Well Seal Interval: 1.83 - 11.58 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-1-15

Stantec

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-1-15-GW1.aqt
Date: 12/10/16
Time: 16:28:56

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-1-15-GW1 Test
Date: 7 Oct 2016

AQUIFER DATA

Saturated Thickness: 4.57 m
Anisotropy Ratio (Kz/Kr): 1.

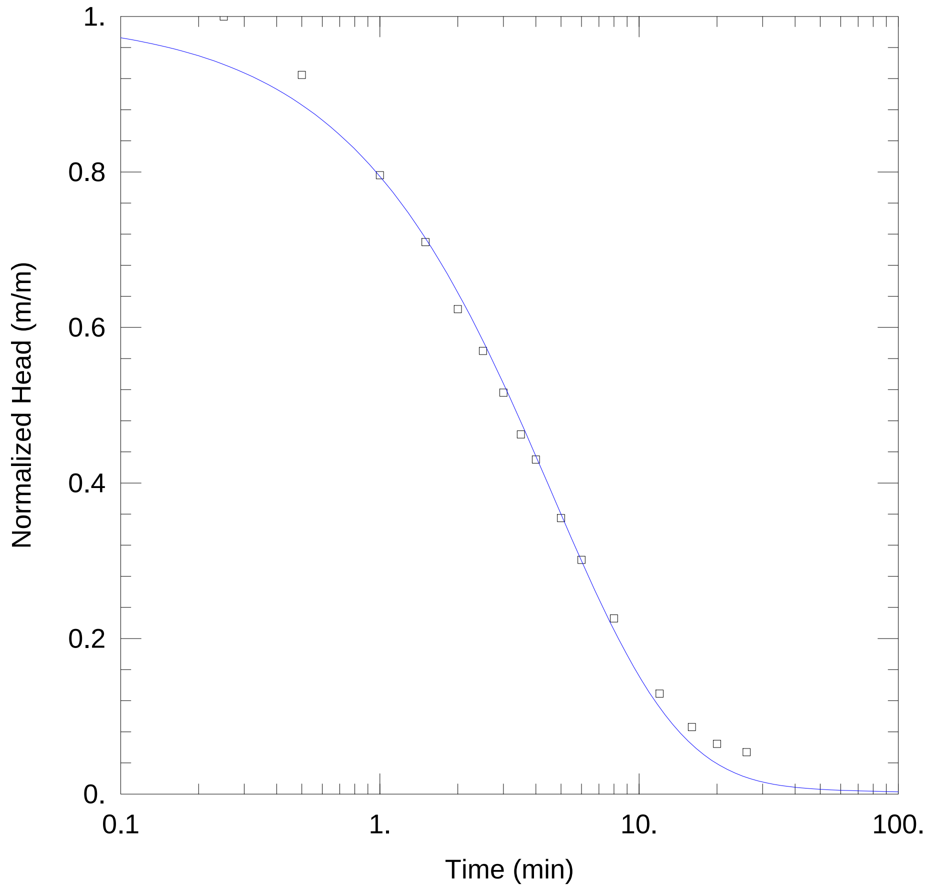
WELL DATA (MW16-1-15-GW1)

Initial Displacement: 0.465 m
Total Well Penetration Depth: 11.42 m
Casing Radius: 0.0254 m
Static Water Column Height: 12.94 m
Screen Length: 3.05 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 1.16E-6 m/sec
y0 = 0.3161 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-1-15-GW1.aqt
Date: 12/10/16 Time: 16:30:25

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-1-15-GW1 Test
Date: 7 Oct 2016

AQUIFER DATA

Saturated Thickness: 4.57 m

WELL DATA (MW16-1-15-GW1)

Initial Displacement: 0.465 m
Total Well Penetration Depth: 11.42 m
Casing Radius: 0.0254 m

Static Water Column Height: 12.94 m
Screen Length: 3.05 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 2.33E-6 m/sec
Kz/Kr = 1.

Ss = 5.295E-6 m^{-1}

Monitoring Well: MW16-2-6 (GW2)

Project: Springbank Off-Stream Reservoir Project (SR1)
Client: Alberta Transportation
Location: Rocky View County, Alberta
Number: 110773396
Field investigator: D. Nisbet
Contractor: All Service Drilling Inc.

Drilling method: Solid-stem auger (Track mounted)
Date started/completed: 26-May-2016
Ground surface elevation: 1,204.26 m AMSL
Top of casing elevation: 1,204.85 m AMSL
Easting: -31947.274
Northing: 5659623.886

SUBSURFACE PROFILE

Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
			1204.44
0		Ground Surface	1204.26
		SOIL Black to dark brown, moist	0.00
		CLAY Brown to beige, some silt, moist, high plastic	1203.95 0.30
		- @ 2.13 m: becomes mottled beige and grey, silt content increases to 15-30%	
		- @ 3.66 m: trace gravel and coal present	
		SILT (TILL) Light brown, some fine grained sand stringers, with gravel and clay, moist, low plastic	1197.86 6.40
		- @ 10.67 m: grades to gravelly silt	
		End of Borehole	1190.54 13.72

Depth scale: (ft) 0, 5, 10, 15, 20, 25, 30, 35, 40, 45; (m) 0, 2, 4, 6, 8, 10, 12, 14

INSTALLATION DETAILS

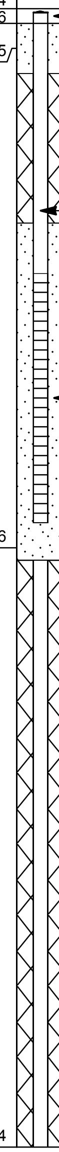


Diagram	Description
	0.595 m Stick-up
	Sand 0 to 0.61 m BGS
	152 mm diameter borehole
	Bentonite
	Solid pipe 51 mm diameter Schedule 40 PVC
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
	Bentonite

Screen Interval: 3.05 - 6.10 m BGS
Sand Pack Interval: 2.44 - 6.55 m BGS
Well Seal Interval: 6.55 - 13.72 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-2-6

Stantec

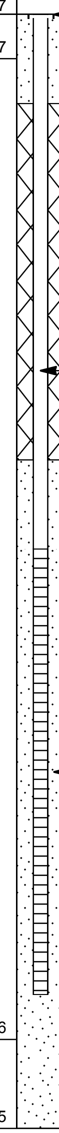
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-3-7 (GW3)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,201.07 m AMSL
Number:	110773396	**Top of casing elevation:**	1,200.98 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31904.435
Contractor:	All Service Drilling Inc.	**Northing:**	5659073.461

SUBSURFACE PROFILE — INSTALLATION DETAILS

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		Ground Surface	1201.07
		SAND AND GRAVEL (FILL)	0.00
		CLAY AND SILT Medium brown, moist, medium plastic	1200.77 0.30
5	2	- @ 1.83 m: silt content decreases to 30-40%, high plastic	
10, 15	4		
20	6	- from 5.18 to 6.10 m: layer of silt with clay, wet	
		SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, dry to moist, low to medium plastic	1194.06 7.01
25	8	End of Borehole	1193.45 7.62



Screen Interval: 3.66 - 6.71 m BGS
Sand Pack Interval: 3.05 - 7.62 m BGS
Well Seal Interval: 0.61 - 3.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-3-7

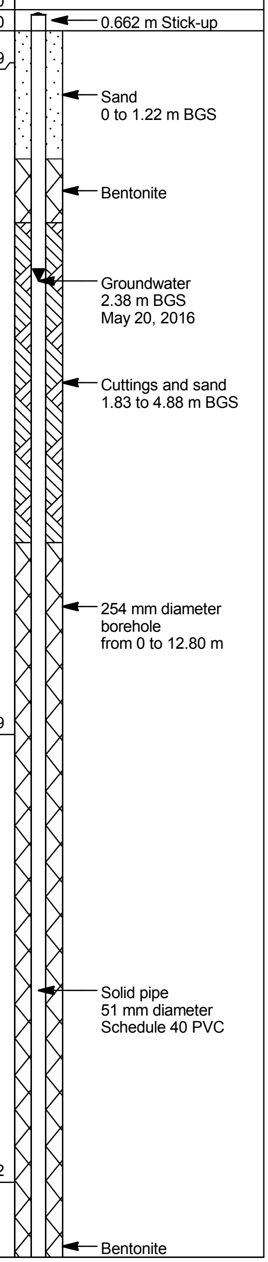
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-4-22 (GW4)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,204.30 m AMSL
Number:	110773396	**Top of casing elevation:**	1,204.96 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		1204.50
0	Ground Surface	1204.30
	TOPSOIL	0.00
	CLAY Light to medium brown, with silt, moist, high plastic	1203.99 0.30
6.71	SILTY CLAY (TILL) Medium brown, some very fine to fine sand, with gravel, moist, high plastic - @ 8.23 m: trace coal present - @ 9.45 m: sand component increases to 15-30% very fine to fine sand	1197.59 6.71
10.97	SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	1193.32 10.97



Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-4-22 (GW4)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,204.30 m AMSL
Number:	110773396	**Top of casing elevation:**	1,204.96 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
12	SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	1191.49 / 12.80
12.80	SANDSTONE Medium grey, very fine to fine grained, few fractures, some oxidation on fracture surfaces, no structure, massive - @ 14.94 m: sandstone becomes slightly banded with alternating light grey and dark grey layers, no oxidation present - @ 17.98 m: medium grained layers interbedded with finer grained layers become present - @ 20.12 m: sand begins to coarsen to medium grained sandstone, some clay along fractures	1182.66 / 21.64
21.64	SILTSTONE Dark grey, highly fractured and altered - @ 21.95 m: clay mineralization along fractures	1182.05 / 22.25
22.25	SANDSTONE Medium grey, very fine grained	1181.74 / 22.56
22.56	CLAYSTONE Dark grey to black, few fractures	1181.44 / 22.86
22.86	End of Borehole	

Depth scale: (ft) 40, 45, 50, 55, 60, 65, 70, 75; (m) 12, 14, 16, 18, 20, 22

Installation details (Diagram / Description):
- 102 mm diameter borehole from 12.80 to 22.86 m
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

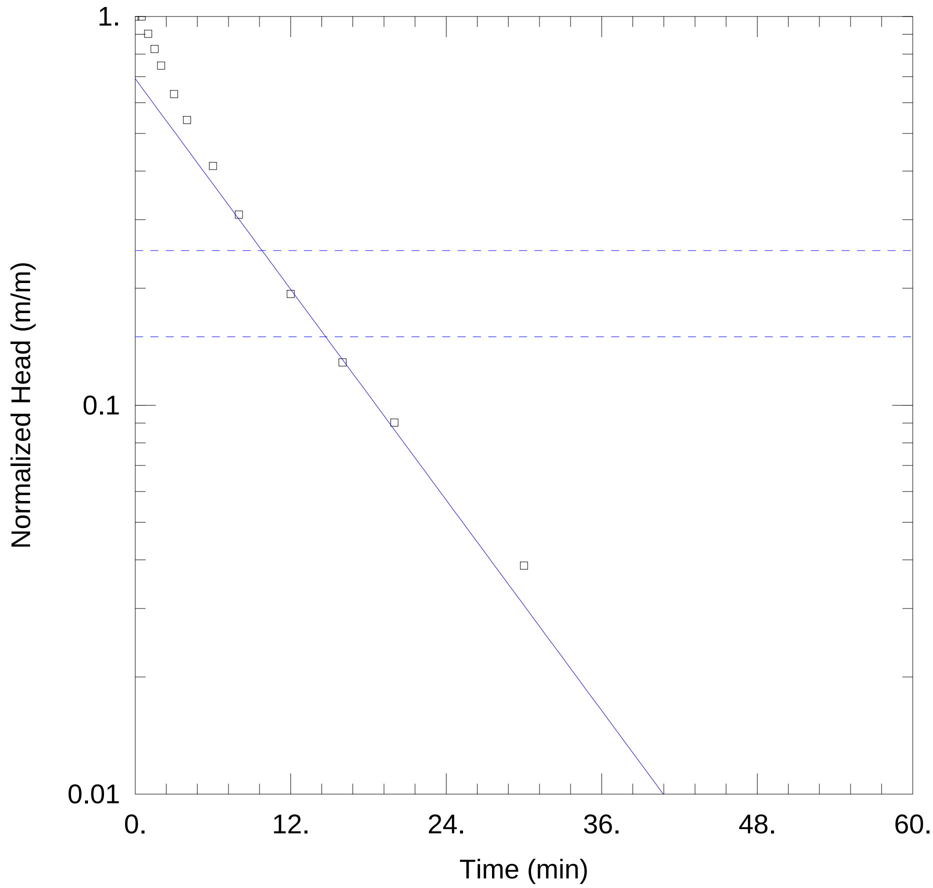
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Stantec

Drawn By/Checked By: M. Kuhl / D. King

STANTEC BOREHOLE AND WELL V2 110773396.GPJ STANTEC - DATA TEMPLATE.GDT 19/4/8 MKUHL



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-4-22-GW4.aqt
Date: 12/14/16 Time: 15:41:59

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-4-22-GW4
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 8.84 m Anisotropy Ratio (Kz/Kr): 1.

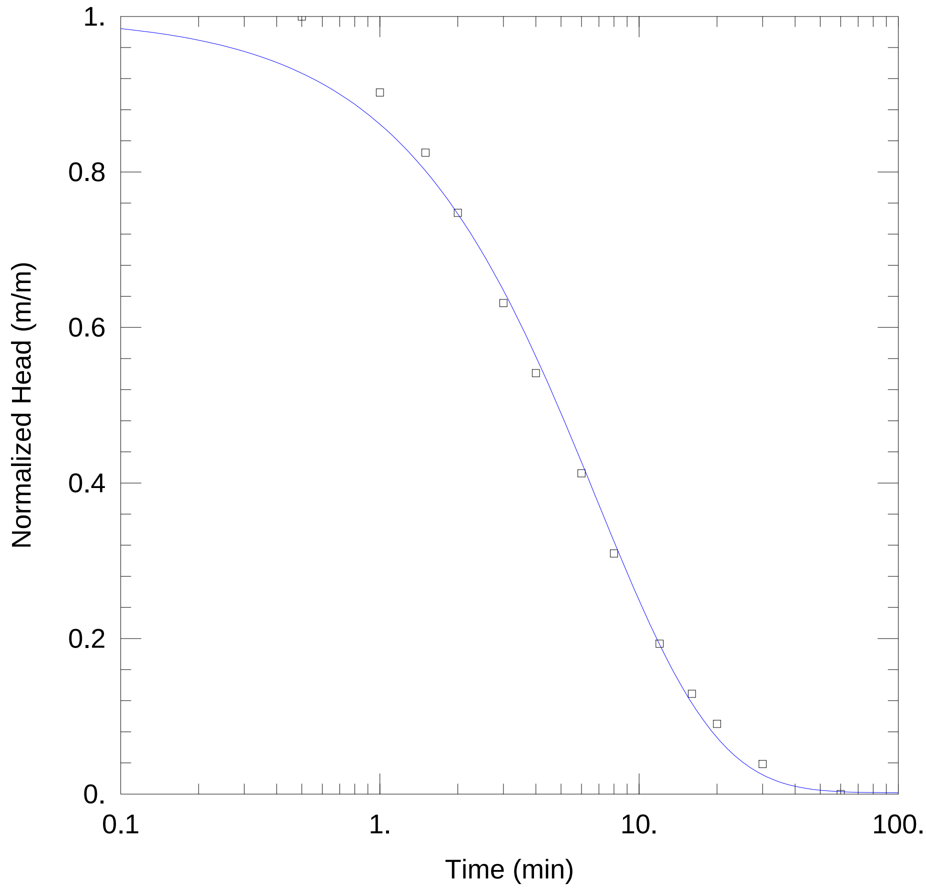
WELL DATA (MW16-4-22-GW4)

Initial Displacement: 0.388 m Static Water Column Height: 18.24 m
Total Well Penetration Depth: 18.24 m Screen Length: 3.05 m
Casing Radius: 0.0254 m Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 8.769E-7 m/sec y0 = 0.2685 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-4-22-GW4.aqt
Date: 12/14/16 Time: 15:43:30

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-4-22-GW4
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 8.84 m

WELL DATA (MW16-4-22-GW4)

Initial Displacement: 0.388 m
Total Well Penetration Depth: 18.24 m
Casing Radius: 0.0254 m
Static Water Column Height: 18.24 m
Screen Length: 3.05 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 1.931E-6 m/sec
Kz/Kr = 1.
Ss = 2.188E-11 m^{-1}

Monitoring Well: MW16-5-11 (GW5)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,210.63 m AMSL
Number:	110773396	**Top of casing elevation:**	1,211.30 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31863.152
Contractor:	All Service Drilling Inc.	**Northing:**	5658164.716

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Diagram	Description
				1210.83		
0	0		Ground Surface	1210.63		0.671 m Stick-up
			TOPSOIL	0.00		
			SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, moist, low plastic	1210.33 0.30		Sand 0 to 0.61 m BGS
5	2					
10						152 mm diameter borehole from 0 to 5.18 m
			CLAY Mottled brown and grey, some gravel, some silt, moist, high plastic	1207.28 3.35		
15	4					Bentonite
			SANDSTONE brown, very fine to fine grained, few fractures with minor oxidation, massive - @ 5.49 : oxidized clay infill in 50 mm fracture	1205.45 5.18		Solid pipe 51 mm diameter Schedule 40 PVC
20	6		- @ 7.01 m: becomes silty, finer grained, with dark and light brown cross-bedding			
25	8		- @ 8.23 m: 50 mm coal seam, sandstone becomes massive again, few irregular coal stringers			Sand Sil 9 (4/10)
30			- @ 8.84 m: coarsens to a fine grained sandstone, very few fractures, weakly bedded			
35	10					Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
40	12					
45	14					102 mm diameter borehole from 5.18 to 22.86 m
50			- @ 15.24 m: exhibits black and brown fine planar laminated beds, becomes very fine grained			
55	16		- @ 16.15 m: beds become irregular and highly deformed, exhibits minor displacement along fractures, microfolds in some bedding			Bentonite
60	18		CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle - from 18.90 to 19.20 m: few 13 to 38 mm thick coal seams	1192.34 18.29		
			SANDSTONE Grey, fine grained, becomes finer towards bottom of unit, weakly bedded	1191.43 19.20		
65	20		CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	1190.82 19.81		
70	22		SANDSTONE Green to greyish green, very fine grained, some shell fragments	1188.99 21.64		
75			CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	1188.38 22.25		
	24		End of Borehole	1187.77 22.86		

Screen Interval: 8.23 - 11.28 m BGS
Sand Pack Interval: 7.62 - 11.28 m BGS
Well Seal Interval: 0.61 - 7.62 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-5-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-6-11 (GW6S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,195.44 m AMSL
Number:	110773396	**Top of casing elevation:**	1,195.30 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31100.486
Contractor:	All Service Drilling Inc.	**Northing:**	5658135.293

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) Depth (m BGS)
Ground Surface	1195.44
TOPSOIL	0.00
SILT Light brown, some clay, moist to wet - @ 1.22 m: clay content begins to increase	1195.13 0.30
SILTY CLAY Light brown to light grey, medium to high plastic, mottled - @ 4.88 m: clay content decreases to 15-30%, high plastic	1193.00 2.44
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic - @ 9.14 m: silt content increases to > 40%	1187.51 7.92
CLAYSTONE Light to medium grey, dry, medium to high plastic when wetted	1185.07 10.36
End of Borehole	1184.77 10.67

INSTALLATION DETAILS

- Flush mount casing protector
- Sand 0.04 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 7.32 - 10.36 m BGS
Sand Pack Interval: 6.71 - 10.67 m BGS
Well Seal Interval: 0.30 - 6.71 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-11

Drawn By/Checked By: M. Kuhl / D. King

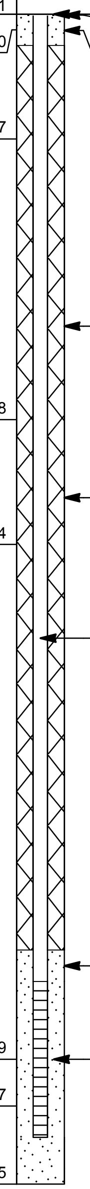
Monitoring Well: MW16-6-20 (GW6D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,195.51 m AMSL
Number:	110773396	**Top of casing elevation:**	1,195.41 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31100.423
Contractor:	All Service Drilling Inc.	**Northing:**	5658133.938

SUBSURFACE PROFILE

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	Ground Surface	1195.51
0.00	TOPSOIL	0.00
0.30	SILT Light brown, some clay, moist to wet - @ 1.22 m: clay content begins to increase	1195.20 0.30
2.44	SILTY CLAY Light brown to light grey, medium to high plastic, mottled - @ 4.88 m: clay content decreases to 15-30%, high plastic	1193.07 2.44
7.92	SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic - @ 9.14 m: silt content increases to > 40%	1187.58 7.92
10.36	CLAYSTONE - fom 10.36 to 18.90 m: light to medium grey, dry, medium to high plastic when wetted, some small intervals of soft clay fracture gouge throughout - from 18.90 to 20.42 m: black to dark grey, dry	1185.14 10.36
20.42	SILTSTONE Light grey, weathered to silt	1175.09 20.42
21.34	CLAYSTONE Dark grey, dry	1174.17 21.34
22.86	End of Borehole	1172.65 22.86

INSTALLATION DETAILS

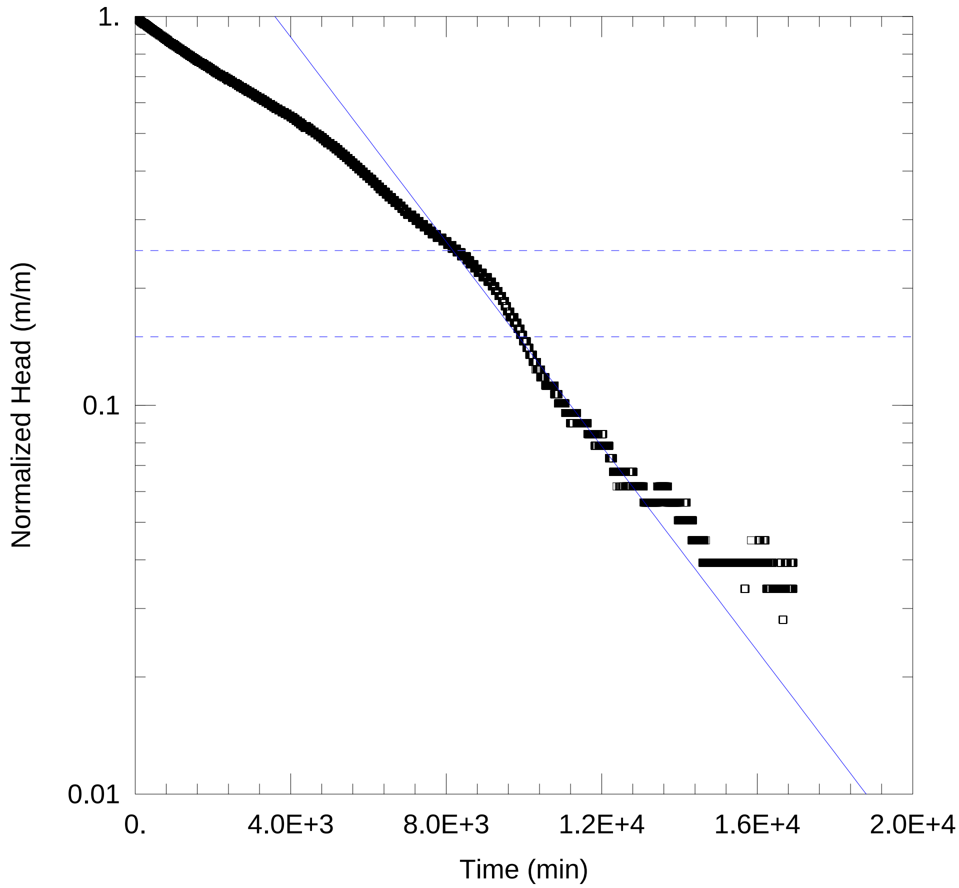


- Flush mount casing protector
- Sand 0.03 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite seal
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 18.90 - 21.95 m BGS
Sand Pack Interval: 18.29 - 22.86 m BGS
Well Seal Interval: 0.61 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-20



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-6-2-_GW6D.aqt
Date: 12/14/16 Time: 16:24:11

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-6-20-GW6D
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 3.05 m Anisotropy Ratio (Kz/Kr): 1.

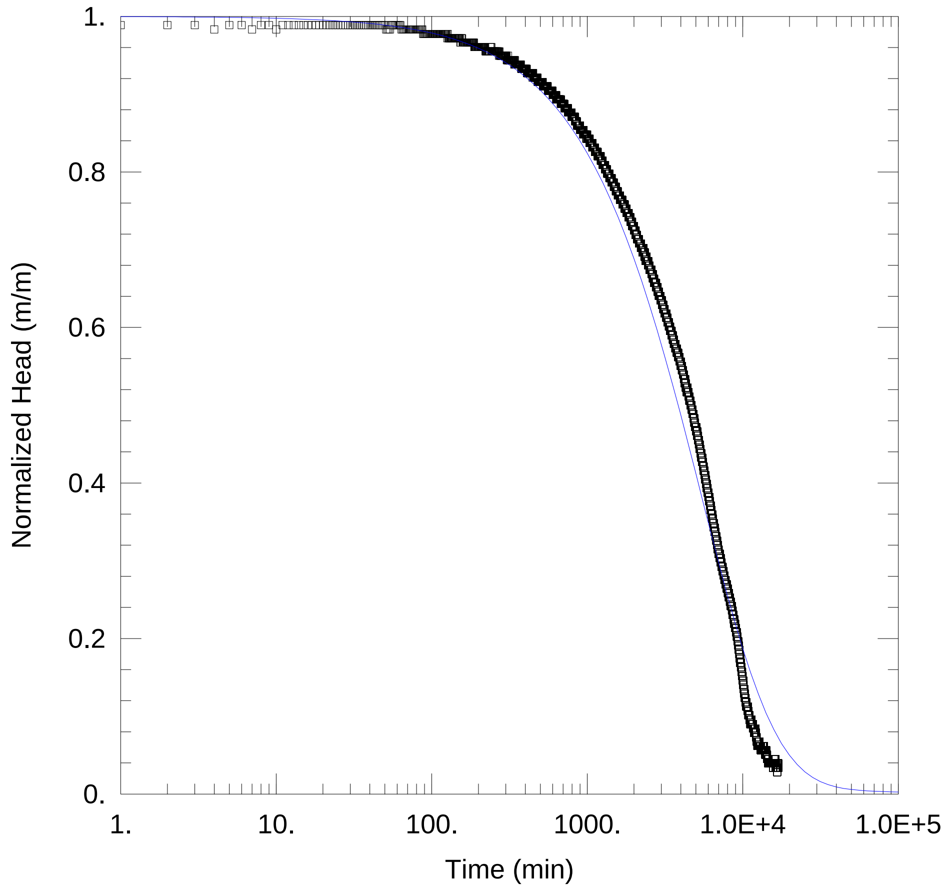
WELL DATA (MW16-6-20-GW6D)

Initial Displacement: 0.534 m
Total Well Penetration Depth: 21.92 m
Casing Radius: 0.0254 m
Static Water Column Height: 21.92 m
Screen Length: 3.05 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 2.828E-9 m/sec y0 = 1.586 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-6-2-_GW6D.aqt
Date: 12/14/16 Time: 16:21:14

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-6-20-GW6D
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 3.05 m

WELL DATA (MW16-6-20-GW6D)

Initial Displacement: 0.534 m
Total Well Penetration Depth: 21.92 m
Casing Radius: 0.0254 m
Static Water Column Height: 21.92 m
Screen Length: 3.05 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 3.839E-9 m/sec
Kz/Kr = 1.
Ss = 3.279E-11 m^{-1}

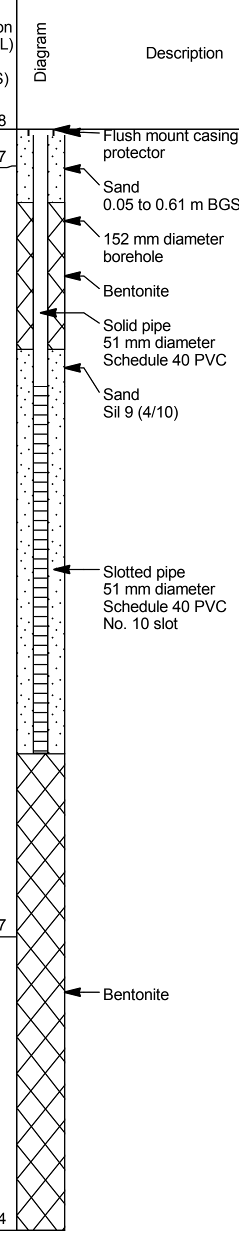
Monitoring Well: MW16-7-5 (GW7)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	28-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,199.28 m AMSL
Number:	110773396	**Top of casing elevation:**	1,199.12 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31098.792
Contractor:	All Service Drilling Inc.	**Northing:**	5658895.242

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
			Ground Surface	1199.28
			TOPSOIL	0.00
			SILTY CLAY Light to medium brown, moist, medium plastic	1198.97 0.30
5	2			
10	4			
15			- from 4.57 to 5.18 m: trace fine grained sand, some gravel	
20	6			
			SILTY CLAY (TILL) With very fine to fine grained sand (oxidized), with gravel, dry to moist, low plastic	1192.57 6.71
25	8			
30			End of Borehole	1190.14 9.14
	10			

INSTALLATION DETAILS



Screen Interval: 2.13 - 5.18 m BGS
Sand Pack Interval: 1.83 - 5.19 m BGS
Well Seal Interval: 0.61 - 1.83 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-7-5

Stantec

Drawn By/Checked By: M. Kuhl / D. King

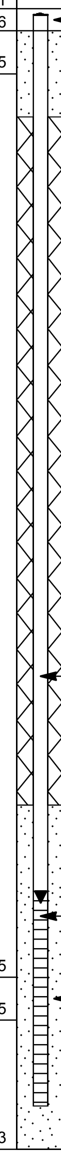
Monitoring Well: MW16-8-8 (GW8S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	25-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,218.16 m AMSL
Number:	110773396	**Top of casing elevation:**	1,218.67 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30875.717
Contractor:	All Service Drilling Inc.	**Northing:**	5659641.119

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
			1218.31
0	0	Ground Surface	1218.16
		SOIL Black, dry	0.00
		SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable	1217.85 0.30
5	2		
		- @ 2.44 m: some very fine grained sand seams become present	
10		- @ 3.35 m: becomes moist	
15	4		
20	6	- @ 5.79 m: red to orange, trace oxidized silt stringers	
		SILT AND SAND Brown, very fine grained, saturated	1211.45 6.71
		SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	1211.15 7.01
25	8	End of Borehole	1210.23 7.92

INSTALLATION DETAILS



Description
0.516 m Stick-up
Sand 0 to 0.61 m BGS
254 mm diameter borehole
Bentonite
Solid pipe 51 mm diameter Schedule 40 PVC
Sand Sil 9 (4/10)
Groundwater 6.27 m BGS May 25, 2016
Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.49 - 7.92 m BGS
Well Seal Interval: 0.61 - 5.49 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-8

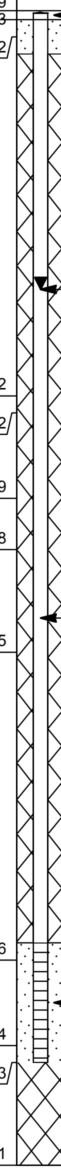
Monitoring Well: MW16-8-19 (GW8D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	25-May-2016 / 26-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,218.13 m AMSL
Number:	110773396	**Top of casing elevation:**	1,218.66 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30877.454
Contractor:	All Service Drilling Inc.	**Northing:**	5659641.18

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS) (top)	Elevation (m AMSL) / Depth (m BGS) (bottom)
Ground Surface	1218.29	
SOIL Black, dry	1218.13 / 0.00	
SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable - @ 2.44 m: some very fine grained sand seams become present - @ 3.35 m: becomes moist - @ 5.79 m: red to orange, trace oxidized silt stringers	1217.82 / 0.30	
SILT AND SAND Brown, very fine grained, saturated	1211.42 / 6.71	
SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	1211.12 / 7.01	
SILTSTONE Light brown to beige, dry, friable	1209.59 / 8.53	
CLAYSTONE Light to medium grey, few fructures - @ 10.36 m: becomes highly weathered, with abundant fractures, orangish brown clay mineralization along fracture surfaces	1208.68 / 9.45	
SILTSTONE Grey to dark grey, finely interbedded light and dark layers, unfractured - @ 14.02 m: thin very fine to fine grained sand layers become present	1206.85 / 11.28	
SANDSTONE Medium brown, fine grained, few fractures, minor oxidation and mineralization along fractures	1201.36 / 16.76	
CLAY Black, high plastic	1199.84 / 18.29	
SILTSTONE Grey to greenish grey, dry, friable, clay alteration along fracture surfaces	1199.53 / 18.59	
End of Borehole	1197.71 / 20.42	

INSTALLATION DETAILS



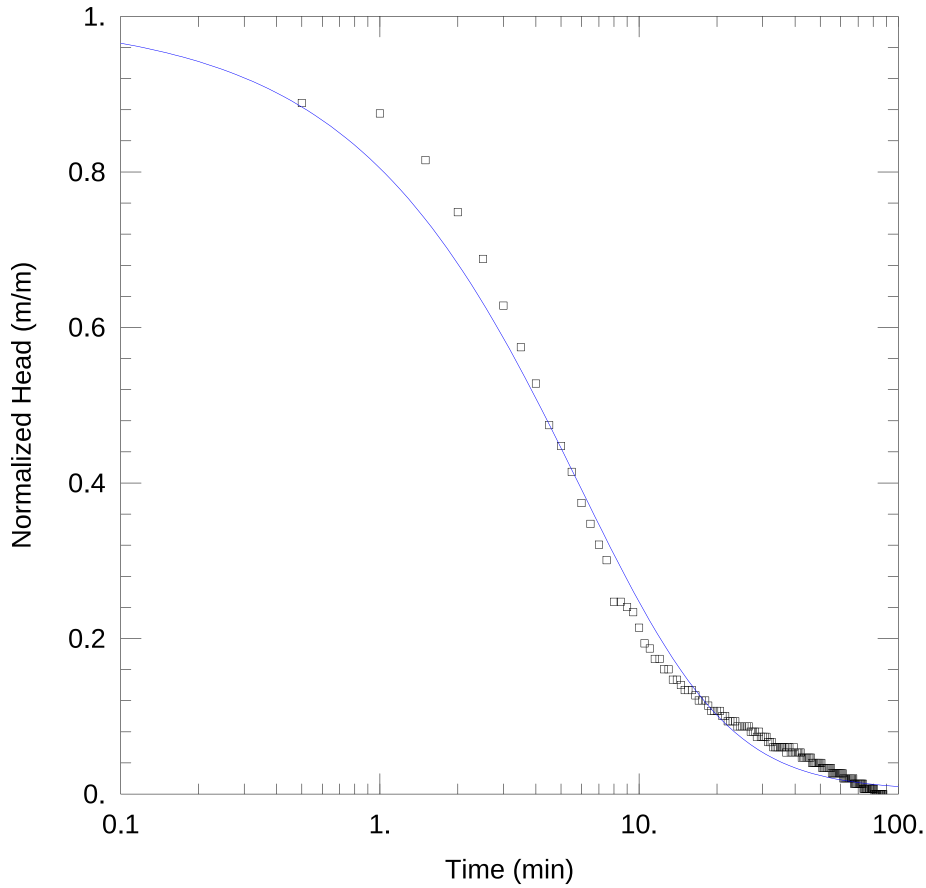
- 0.529 m Stick-up
- Sand 0 to 0.61 m BGS
- 254 mm diameter borehole from 0 to 8.53 m
- Groundwater 4.81 m BGS May 25/26, 2016
- Sand Sil 9 (4/10)
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- 102 mm diameter borehole from 8.53 to 20.42 m
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 16.46 - 18.59 m BGS
Sand Pack Interval: 16.46 - 18.59 m BGS
Well Seal Interval: 0.61 - 16.46 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-19

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-8-19-GW8D.aqt
Date: 12/14/16 Time: 17:11:49

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-8-19-GW8D
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.53 m

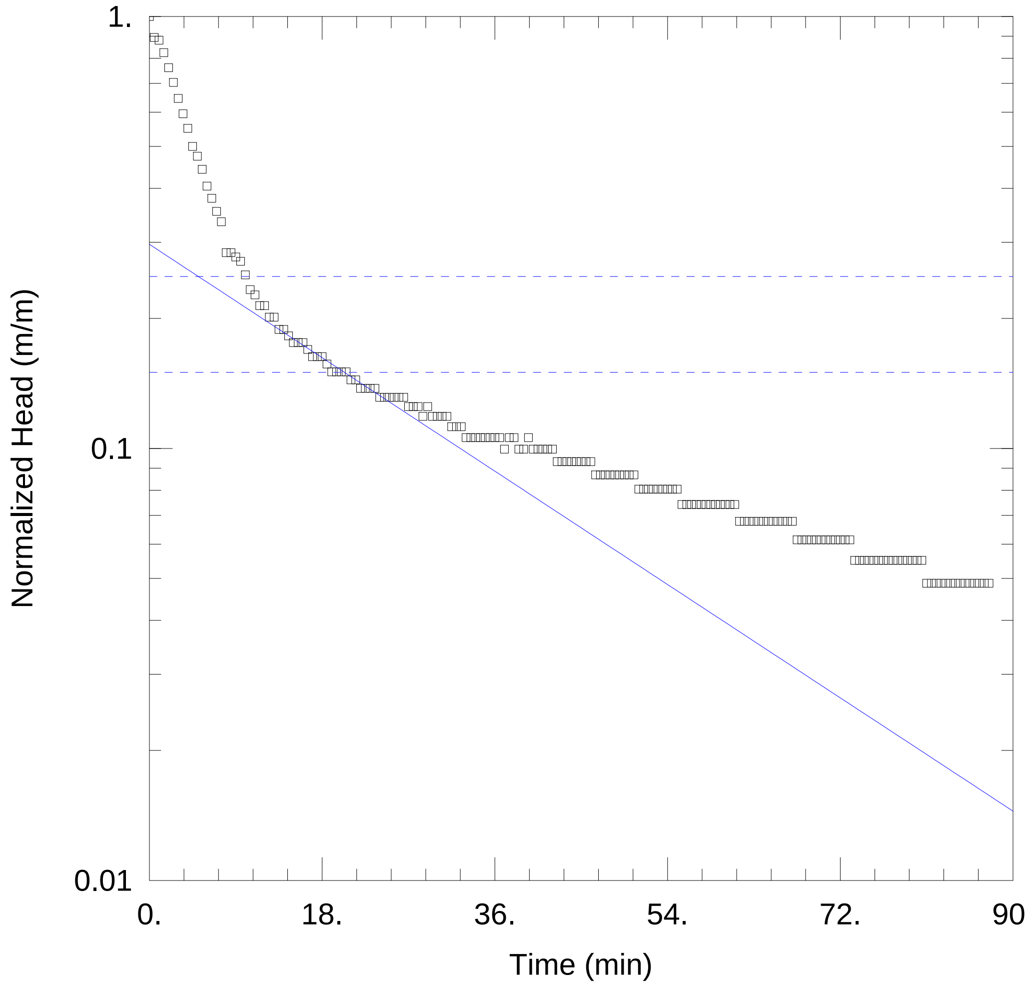
WELL DATA (MW16-8-19-GW8D)

Initial Displacement: 0.449 m
Total Well Penetration Depth: 14.32 m
Casing Radius: 0.0254 m
Static Water Column Height: 14.32 m
Screen Length: 2.13 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 2.19E-6 m/sec
Kz/Kr = 1.
Ss = 0.0002065 m^{-1}



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-8-19-GW8D_updated.aqt
Date: 12/22/16 Time: 13:48:57

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-8-19-GW8D
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.53 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW16-8-19-GW8D)

Initial Displacement: 0.472 m Static Water Column Height: 14.34 m
Total Well Penetration Depth: 14.34 m Screen Length: 2.13 m
Casing Radius: 0.0254 m Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 6.25E-7 m/sec y0 = 0.1401 m

Monitoring Well: MW16-9-6 (GW9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	02-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	367.14 m AMSL
Number:	110773396	**Top of casing elevation:**	1,204.37 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30236.405
Contractor:	All Service Drilling Inc.	**Northing:**	5659076.781

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
		Ground Surface	367.14
		TOPSOIL	0.00
		CLAY Light to medium brown, with silt, moist, high plastic, mottled	366.83 0.30
	1		
5			
	2		
10	3		
		- below 3.66 m: some seams of very fine grained sand (oxidized)	
	4		
15		- from 4.57 to 5.18 m: silt content increases to > 40%	
	5		
		SILTY CLAY (TILL) with very fine to fine grained sand, with gravel	361.96 5.18
	6		
20		End of Borehole	361.04 6.10

INSTALLATION DETAILS

Diagram	Description
	Flush mount casing protector
	Sand 0.04 to 0.61 m BGS
	152 mm diameter borehole
	Bentonite
	Solid pipe 51 mm diameter Schedule 40 PVC
	Sand Sil 9 (4/10)
	Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

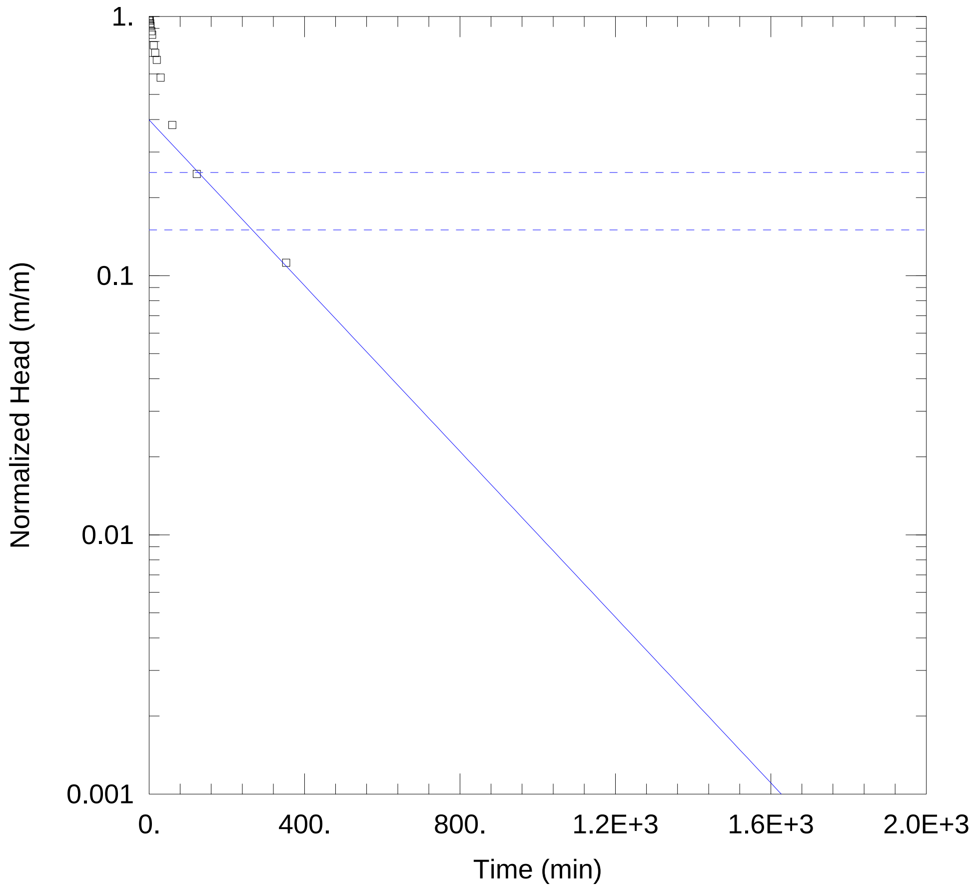
Screen Interval: 4.27 - 5.79 m BGS
Sand Pack Interval: 3.96 - 6.10 m BGS
Well Seal Interval: 0.61 - 3.96 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-9-6

Stantec

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-9-6-GW9.aqt
Date: 12/14/16 Time: 21:08:12

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-9-6-GW9
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.52 m Anisotropy Ratio (Kz/Kr): 1.

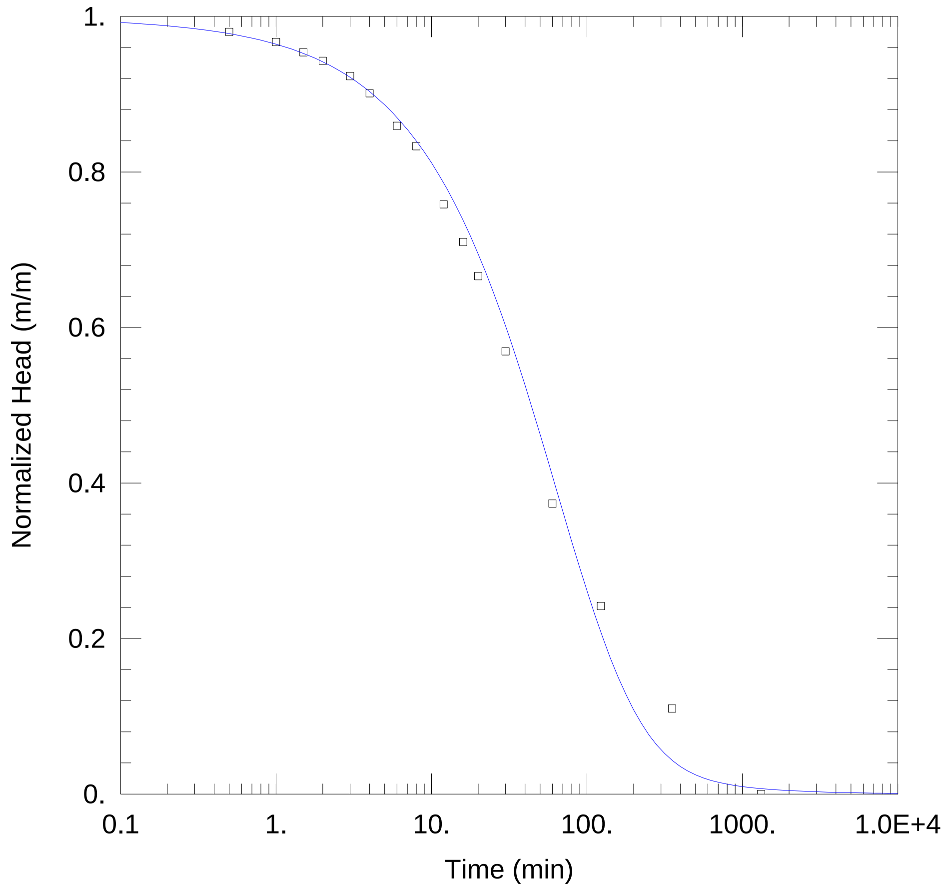
WELL DATA (MW16-9-6-GW9)

Initial Displacement: 0.446 m
Total Well Penetration Depth: 5.76 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.76 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 5.323E-8 m/sec y0 = 0.1779 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-9-6-GW9.aqt
Date: 12/14/16 Time: 21:10:23

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-9-6-GW9
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.52 m

WELL DATA (MW16-9-6-GW9)

Initial Displacement: 0.455 m
Total Well Penetration Depth: 5.76 m
Casing Radius: 0.0254 m

Static Water Column Height: 5.76 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 2.185E-7 m/sec
Kz/Kr = 1.

Ss = 0.0007215 m^{-1}

Monitoring Well: MW16-10-15 (GW10)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	10-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,195.40 m AMSL
Number:	110773396	**Top of casing elevation:**	1,196.24 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30461.405
Contractor:	All Service Drilling Inc.	**Northing:**	5658478.167

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		1195.65
0	Ground Surface	1195.40 / 0.00
0	TOPSOIL	1195.09 / 0.30
0.30	SILTY CLAY Light to medium brown, moist, medium to high plastic, mottled - below 3.66 m: some very fine grained sand, some gravel	1189.91 / 5.49
5.49	CLAYEY SILT Light grey to medium brown, moist, high plastic, mottled	1185.95 / 9.45
9.45	CLAY (TILL) Medium brown, some very fine grained sand, some gravel, with silt, dry to moist, medium plastic - @ 10.97 m: gravel content increases to 15-30%	1182.59 / 12.80
12.80	CLAYEY SILT (TILL) Medium to dark grey, with very fine grained sand, some gravel, dry, low plastic	1180.46 / 14.94
14.94	SILTSTONE Light to medium grey, dry	1177.11 / 18.29
18.29	End of Borehole	

Installation details (Diagram / Description):

- 0.848 m Stick-up
- Sand 0 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

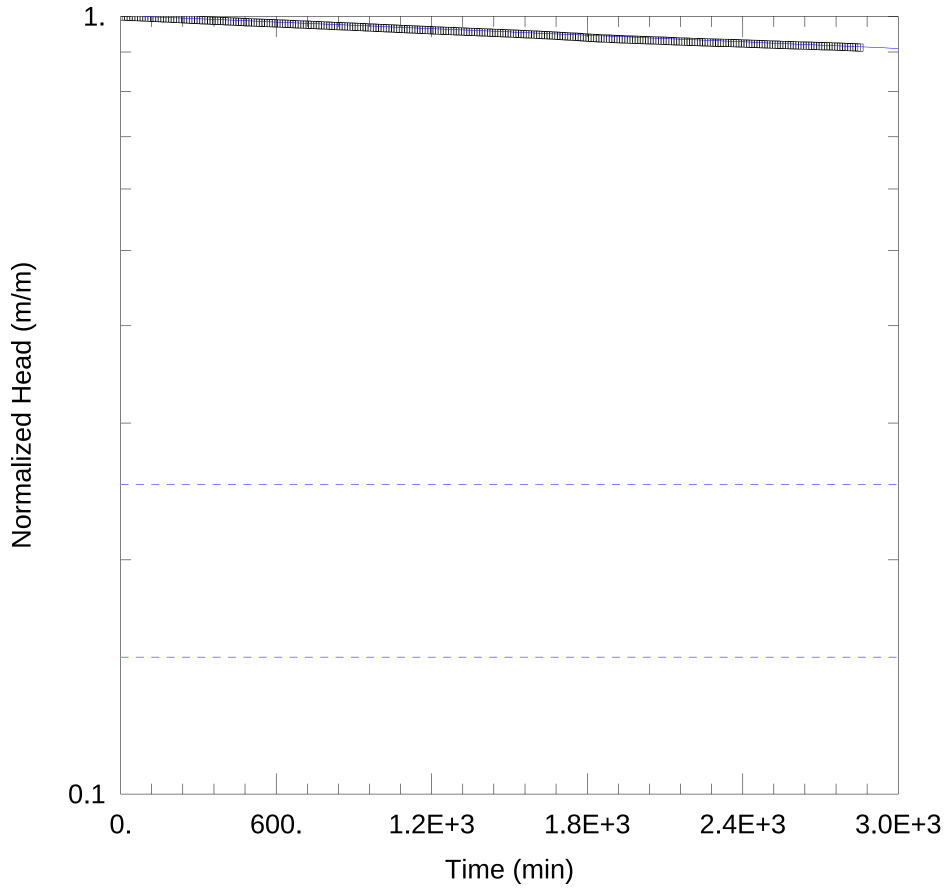
Screen Interval: 12.19 - 15.24 m BGS
Sand Pack Interval: 11.89 - 18.14 m BGS
Well Seal Interval: 18.14 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-10-15

Stantec

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-10-15-GW10.aqt
Date: 12/15/16 Time: 13:58:03

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-10-15-GW10
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 3.05 m
Anisotropy Ratio (Kz/Kr): 1.

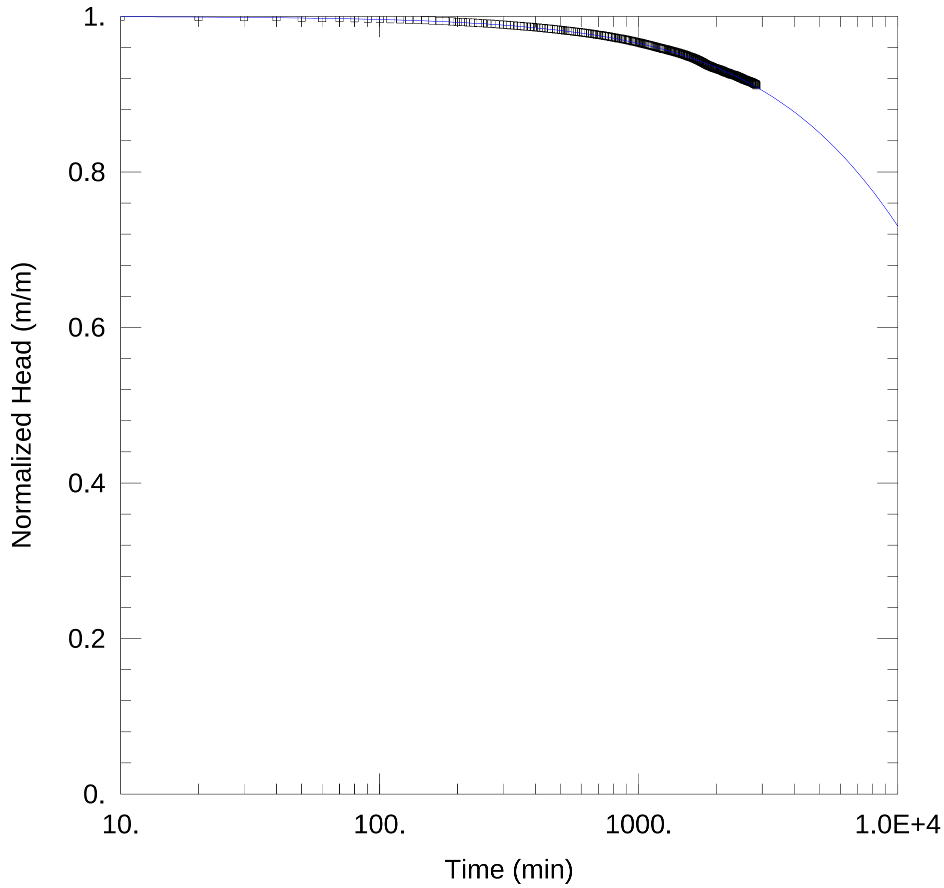
WELL DATA (MW16-10-15-GW10)

Initial Displacement: 12.4 m
Static Water Column Height: 12.65 m
Total Well Penetration Depth: 12.65 m
Screen Length: 3.05 m
Casing Radius: 0.0254 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 2.517E-10 m/sec
y0 = 12.43 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-10-15-GW10.aqt
Date: 12/15/16 Time: 13:56:40

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-10-15-GW10
Test Date: 5 Oct 2016

AQUIFER DATA

Saturated Thickness: 3.05 m

WELL DATA (MW16-10-15-GW10)

Initial Displacement: 12.4 m
Total Well Penetration Depth: 12.65 m
Casing Radius: 0.0254 m
Static Water Column Height: 12.65 m
Screen Length: 3.05 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 6.272E-10 m/sec
Kz/Kr = 1.
Ss = 3.279E-11 m^{-1}

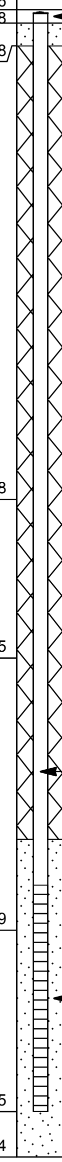
Monitoring Well: MW16-11-15 (GW11)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	30-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,193.68 m AMSL
Number:	110773396	**Top of casing elevation:**	1,194.27 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30269.84
Contractor:	All Service Drilling Inc.	**Northing:**	5657742.889

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1193.86
TOPSOIL	1193.68 / 0.00
CLAY Light to medium brown, with silt, moist, high plastic, mottled - @ 2.13 m: silt content increases to 30-40%, mottled brown and grey - @ 2.74 m: silt content decreases back to 15-30% - @ 5.79 m: clay content begins to decrease towards bottom of interval	1193.38 / 0.30
SILT Medium brown, some clay, moist	1187.28 / 6.40
SILT (TILL) Medium brown, with fine to medium grained sand, with gravel, some clay, moist	1185.15 / 8.53
SILT Medium brown, some very fine grained sand, moist to wet	1181.49 / 12.19
CLAY (TILL) Medium to dark grey, some very fine grained sand, some gravel, with silt, low plastic	1179.05 / 14.63
End of Borehole	1178.44 / 15.24

INSTALLATION DETAILS



Screen Interval: 11.58 - 14.63 m BGS
Sand Pack Interval: 10.97 - 15.24 m BGS
Well Seal Interval: 0.30 - 10.97 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-11-15

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-12-3 (GW12)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	19-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,189.98 m AMSL
Number:	110773396	**Top of casing elevation:**	1,190.89 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-29160.284
Contractor:	All Service Drilling Inc.	**Northing:**	5657858.348

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
				1190.26
0	0		Ground Surface	1189.98
			TOPSOIL	0.00
			CLAYEY SILT (TILL) Medium brown, moist, high plastic - @ 1.83 m: sand content increases to 30-40%, fine to medium grained sand, some gravel - @ 2.74 m: sand content decreases to 15-30%	1189.68 0.30
			SANDY SILT (TILL) Medium brown, some gravel, with clay, dry to moist, crumbly	1183.58 6.40
			SANDY CLAY (TILL) Medium to dark grey, some silt, dry to moist	1181.14 8.84
			CLAYSTONE Light grey to brown, dry	1178.40 11.58
			End of Borehole	1177.79 12.19

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40 (ft); 0, 2, 4, 6, 8, 10, 12 (m)

INSTALLATION DETAILS

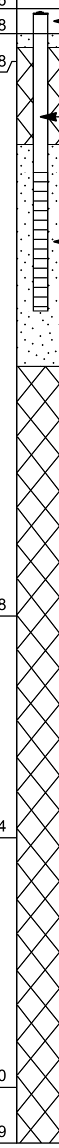


Diagram | Description

- 0.901 m Stick-up
- Sand 0 to 0.15 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 1.52 - 3.05 m BGS
Sand Pack Interval: 1.22 - 3.66 m BGS
Well Seal Interval: 0.15 - 1.22 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-12-3

Stantec

Monitoring Well: MW16-13-37 (GW13)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	08-Aug-2016 / 09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,222.34 m AMSL
Number:	110773396	**Top of casing elevation:**	0.00 m AMSL
Field investigator:	D. Nisbet	**Easting:**	n/a
Contractor:	All Service Drilling Inc.	**Northing:**	n/a

SUBSURFACE PROFILE | INSTALLATION DETAILS

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1222.34
GRAVEL (FILL)	0.00
CLAYEY SILT (TILL) Mottled light and medium brown, some very fine grained sand (slightly oxidized), dry to moist, medium plastic - @ 2.13 m: some gravel - @ 3.66 m: sand content increases to 15-30%	1222.04 / 0.30
SANDSTONE Very fine to fine grained, dry - from 9.14 to 9.75 m: saturated	1214.72 / 7.62
CLAYSTONE Medium brown, dry - below 10.36 m: few moist zones weathered to clay	1212.59 / 9.75
SILTSTONE Light grey, dry, friable - @ 12.80 m: saturated	1211.06 / 11.28
CLAYSTONE Medium grey to brown, some zones weathered to clay, other zones dry, friable - below 20.12 m: dry	1204.97 / 17.37
SILTSTONE Light to medium grey, in some zones fractured and weathered to silt	1197.35 / 24.99
CLAYSTONE Light to medium grey, dry, some fractured and weathered zones below 31.70 m: completely dry	1193.08 / 29.26
SILTSTONE Light grey, saturated	1187.59 / 34.75
CLAYSTONE Light to medium grey	1186.38 / 35.97
End of Borehole	1185.77 / 36.58

Installation details (Description):
- Flush mount casing protector
- Sand 0 to 0.30 m BGS
- 108 mm diameter borehole
- Bentonite grout
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval:	33.53 - 36.58 m BGS
Sand Pack Interval:	32.92 - 36.58 m BGS
Well Seal Interval:	0.30 - 32.92 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-14-33 (GW14)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,202.24 m AMSL
Number:	110773396	**Top of casing elevation:**	1,202.18 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-28592.189
Contractor:	All Service Drilling Inc.	**Northing:**	5659018.428

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft) (m) | Graphic Log | Lithologic Description | Elevation (m AMSL) Depth (m BGS) | Diagram | Description

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1202.24
GRAVEL	0.00
CLAYEY SILT (TILL) Brown, some very fine grained sand, moist, medium plastic	1201.93 0.30
SANDSTONE Light to medium brown, very fine grained sand, dry	1198.58 3.66
CLAYSTONE Medium grey, dry	1197.97 4.27
SANDSTONE Light to medium brown, very fine to fine grained	1193.70 8.53
SILTSTONE Light grey, dry	1189.13 13.11
CLAYSTONE Medium grey to brown, dry	1182.73 19.51
SILTSTONE Medium brown, saturated	1177.85 24.38
CLAYSTONE Light to medium grey	1172.67 29.57
SILTSTONE Light to medium grey, saturated	1171.15 31.09
CLAYSTONE Light to medium grey	1169.01 33.22
End of Borehole	1168.71 33.53

Installation details:

- Flush mount casing protector
- Sand 0.02 to 0.61 m BGS
- 108 mm diameter borehole
- Bentonite grout
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval:	29.88 - 32.93 m BGS
Sand Pack Interval:	29.87 - 32.93 m BGS
Well Seal Interval:	0.61 - 29.87 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-14-33

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-15-34 (GW15)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem/ air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	27-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,190.10 m AMSL
Number:	110773396	**Top of casing elevation:**	1,189.99 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-27818.819
Contractor:	All Service Drilling Inc.	**Northing:**	5658214.931

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1190.10
TOPSOIL	0.00
SILTY CLAY (TILL) Beige to light brown, moist, medium plastic - @ 1.83 m: some very fine grained sand stringers, some gravel	1189.80 0.30
SILTSTONE Light beige, dry	1186.29 3.81
SANDSTONE Light brown, very fine grained, dry	1184.61 5.49
SILTSTONE Light beige, dry, few thin sandstone layers throughout	1180.65 9.45
CLAYSTONE Medium grey, dry	1178.52 11.58
SANDSTONE Light brown, very fine to fine grained, dry	1177.60 12.50
SILTSTONE Light grey to light brown, dry - from 15.85 to 17.07 m: few seams of fine grained sand (oxidized)	1175.47 14.63
CLAYSTONE Medium to dark grey, dry - below 26.82 m: some siltstone layers - @ 31.09 m: light grey	1171.20 18.90
SILTSTONE Light to medium greenish grey - 32.92 m: saturated	1157.18 32.92
End of Borehole	1155.05 35.05

INSTALLATION DETAILS

- Flush mount casing protector
- Sand 0.02 to 0.61 m BGS
- 152 mm diameter borehole 0 to 3.81 m BGS
- 108 mm diameter borehole below 3.81 m BGS
- Bentonite seal
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC

Screen Interval: 32.92 - 34.44 m BGS
Sand Pack Interval: 32.61 - 35.05 m BGS
Well Seal Interval: 0.61 - 32.61 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-15-34

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-16-11 (DC-9)

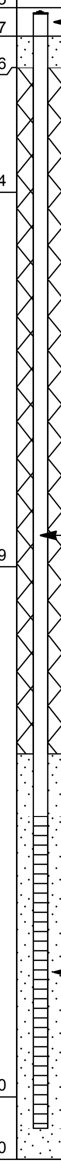
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	15-Apr-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,227.47 m AMSL
Number:	110773396	**Top of casing elevation:**	1,228.38 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-33453.625
Contractor:	All Service Drilling Inc.	**Northing:**	5655154.279

SUBSURFACE PROFILE

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		1227.75
0	Ground Surface	1227.47
0	SOIL Some clay, organics	0.00
0.30	SILT Brown to beige, minor very fine sand, some clay	1227.16 0.30
1.52	CLAY Mottled beige to grey, minor silt, moist	1225.94 1.52
5.18	CLAY (TILL) Some fine to very fine grained sand, some gravel, some silt, dry, friable	1222.29 5.18
10.36	SANDSTONE Very fine grained, dry, weathered, crumbles under minor force	1217.10 10.36
10.97	End of Borehole	1216.50 10.97

Depth scale: (ft) 0, 5, 10, 15, 20, 25, 30, 35; (m) 0, 2, 4, 6, 8, 10

INSTALLATION DETAILS



Description:

- 0.914 m Stick-up
- Sand
  0 to 0.30 m BGS
- 254 mm diameter borehole from 0 to 10.36 m
- Bentonite
- Solid pipe
  51 mm diameter
  Schedule 40 PVC
- Sand
  Sil 9 (4/10)
- Slotted pipe
  51 mm diameter
  Schedule 40 PVC
  No. 10 slot
- 102 mm diameter borehole from 10.36 to 10.97 m

Screen Interval: 7.62 - 10.67 m BGS
Sand Pack Interval: 7.01 - 10.97 m BGS
Well Seal Interval: 0.30 - 7.01 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-16-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-17-5 (DC-15)

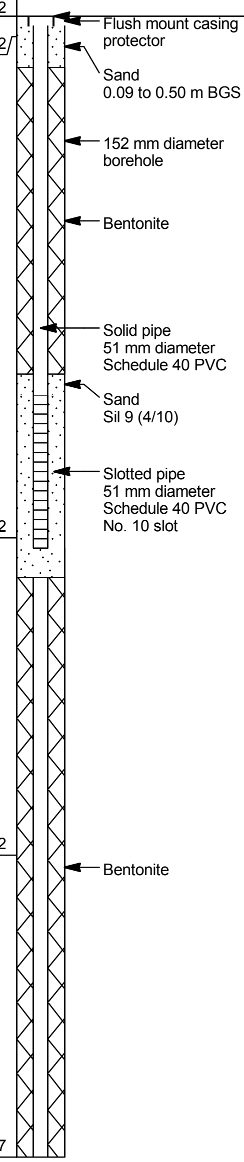
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,213.52 m AMSL
Number:	110773396	**Top of casing elevation:**	1,213.22 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-33226.452
Contractor:	All Service Drilling Inc.	**Northing:**	5656140.553

SUBSURFACE PROFILE

Depth (m BGS)	Graphic Log / Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	Ground Surface	1213.52
0.00	TOPSOIL	0.00
0.20	CLAY Mottled brown - from 0.2 to 2.5 m: minor silt, damp to moist, low to medium plastic - from 2.5 to 5.1 m: minor sand, some silt, moist, medium plastic	1213.32 / 0.20
5.10	SILTY CLAY (TILL) Minor sand, trace gravel, damp, some oxidation	1208.42 / 5.10
8.20	SILT Brown, minor fine grained sand, trace gravel, some clay, moist	1205.32 / 8.20
11.15	End of Borehole	1202.37 / 11.15

Depth scale: (ft) 5, 10, 15, 20, 25, 30, 35; (m) 2, 4, 6, 8, 10, 12

INSTALLATION DETAILS



Screen Interval: 3.70 - 5.20 m BGS
Sand Pack Interval: 3.50 - 5.49 m BGS
Well Seal Interval: 5.49 - 11.15 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-17-5

Stantec

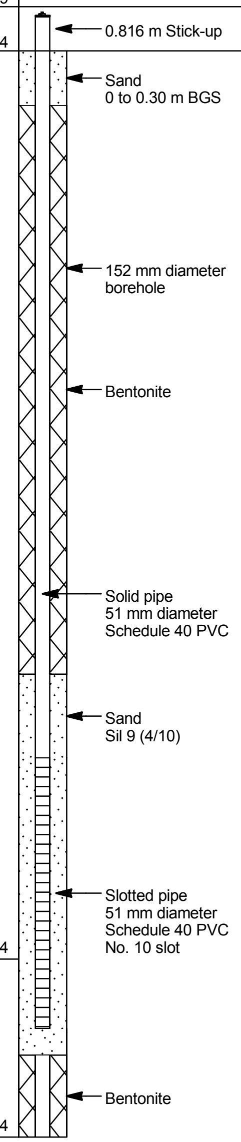
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-18-6 (DC-21S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,216.04 m AMSL
Number:	110773396	**Top of casing elevation:**	1,216.86 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32406.586
Contractor:	All Service Drilling Inc.	**Northing:**	5656749.506

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
			1216.29
0	0	Ground Surface	1216.04
		SILTY CLAY (TILL) Brown, minor sand, moist, low plastic	0.00
		SANDY CLAY	3.50
		- from 4.8 to 4.9 m: rafted bedrock	
			1210.94
		SAND AND SILT Light brown, medium grained, some gravel, moist	5.10
20	6		1209.94
		End of Borehole	6.10



Screen Interval: 3.97 - 5.49 m BGS
Sand Pack Interval: 3.50 - 5.64 m BGS
Well Seal Interval: 5.64 - 6.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-6

Stantec

Drawn By/Checked By: M. Kuhl / D. King

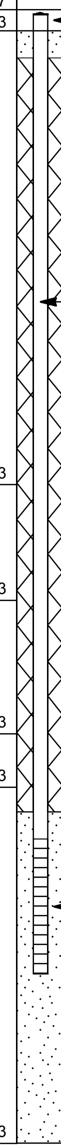
Monitoring Well: MW16-18-10 (DC-21D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,216.03 m AMSL
Number:	110773396	**Top of casing elevation:**	1,216.81 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32406.714
Contractor:	All Service Drilling Inc.	**Northing:**	5656750.577

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	1216.27
Ground Surface	1216.03
SILTY CLAY (TILL) Brown, minor sand, moist, low plastic - beginning @ 3.5 m: becomes sandy clay - from 4.8 to 4.9 m: rafted bedrock	0.00 1210.93
SAND AND SILT Light brown, medium grained, some gravel, moist	5.10 1209.63
SILTSTONE Grey to greenish, some fractures, oxidation along fractures	6.40 1208.13
SANDSTONE Grey to greenish, very fine grained, few fractures, oxidation on fratures surfaces	7.90 1207.53
CLAYSTONE - from 8.5 to 8.63 m: brown, minor silt, moist, weathered to soft clay - from 8.63 to 12.5 m: grey, oxidized fractures - @ 9.24 m: fracture intensity increases - from 9.65 to 10.9 m: highly fractured, oxidation and some clay along fractures - from 10.36 to 10.63 m: altered to clay - @ 12.10 m: becomes hard/cemented	8.50 1203.53
End of Borehole	12.50

INSTALLATION DETAILS



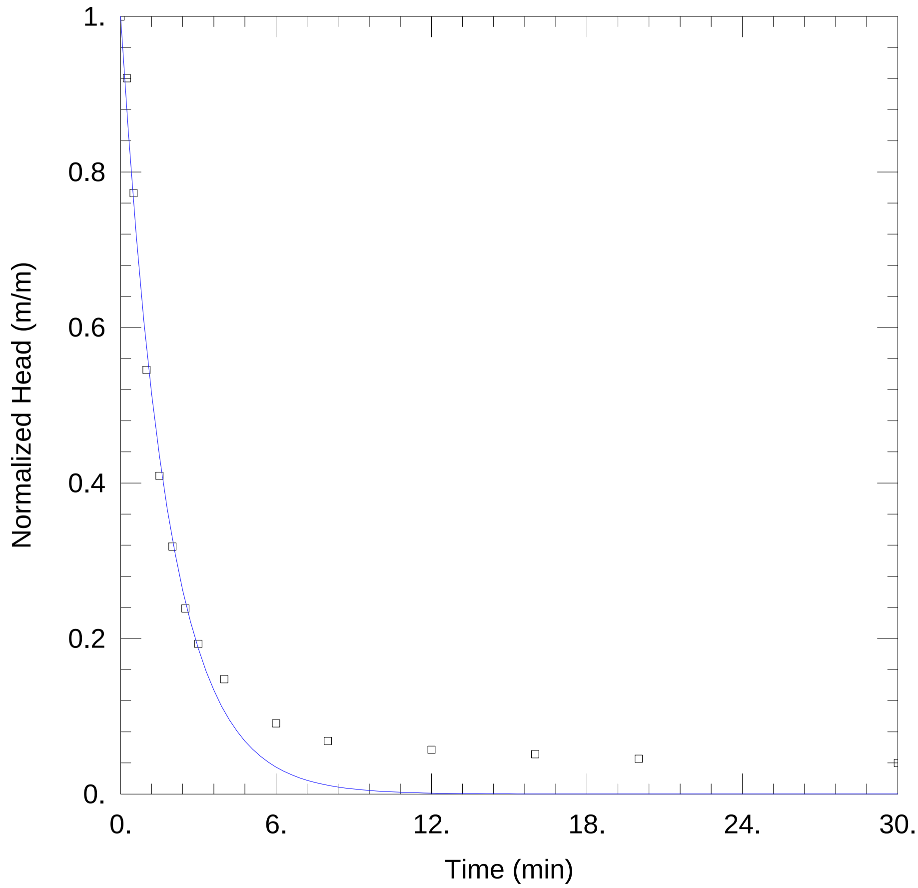
- 0.774 m Stick-up
- Sand 0 to 0.30 m BGS
- 254 mm diameter borehole from 0 to 6.40 m
- Solid pipe 51 mm diameter Schedule 40 PVC
- Bentonite
- 102 mm diameter borehole from 6.40 to 12.50 m
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 9.08 - 10.60 m BGS
Sand Pack Interval: 8.78 - 12.50 m BGS
Well Seal Interval: 0.30 - 8.78 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-10

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-18-10-DC-21D.aqt
Date: 12/15/16 Time: 16:26:28

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-18-10-DC-21D
Test Date: 20 Oct 2016

AQUIFER DATA

Saturated Thickness: 4. m
Anisotropy Ratio (Kz/Kr): 1.

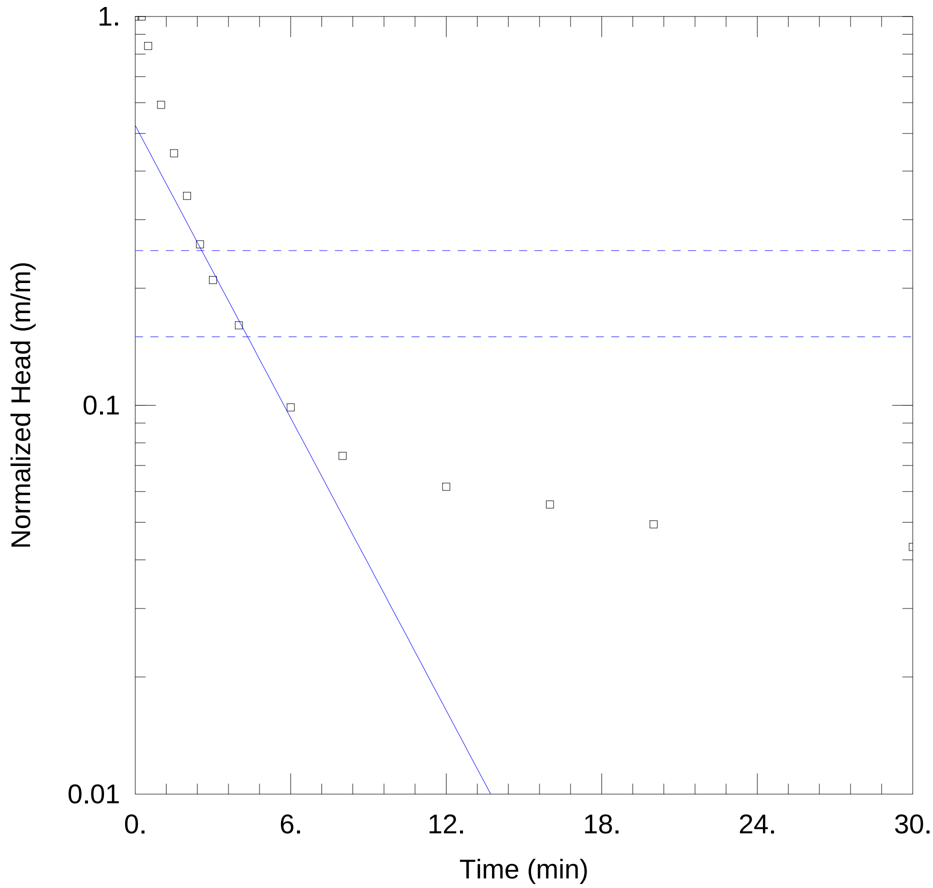
WELL DATA (MW16-18-10-DC-21D)

Initial Displacement: 0.44 m
Total Well Penetration Depth: 7.479 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.479 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 8.051E-6 m/sec
Le = 1000. m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-18-10-DC-21D.aqt
Date: 12/15/16 Time: 16:22:19

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-18-10-DC-21D
Test Date: 20 Oct 2016

AQUIFER DATA

Saturated Thickness: 4. m Anisotropy Ratio (Kz/Kr): 1.

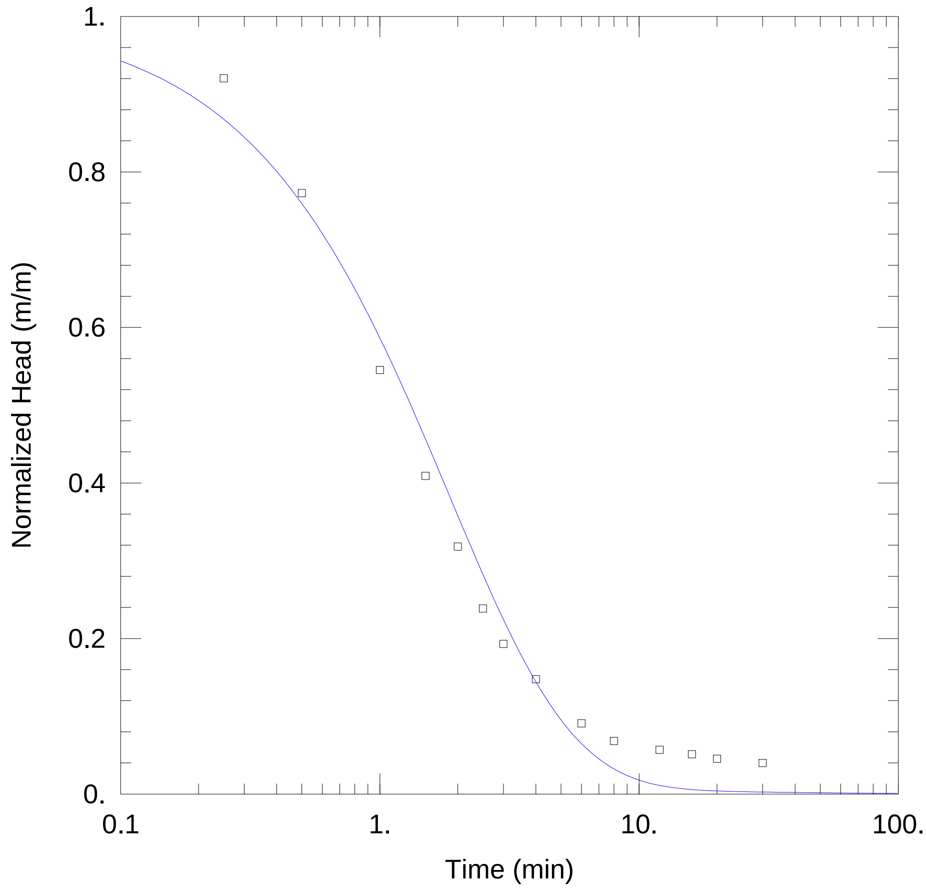
WELL DATA (MW16-18-10-DC-21D)

Initial Displacement: 0.405 m
Total Well Penetration Depth: 7.479 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.479 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.175E-6 m/sec y0 = 0.2125 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-18-10-DC-21D.aqt
Date: 12/15/16 Time: 16:25:01

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-18-10-DC-21D
Test Date: 20 Oct 2016

AQUIFER DATA

Saturated Thickness: 4. m

WELL DATA (MW16-18-10-DC-21D)

Initial Displacement: 0.44 m
Total Well Penetration Depth: 7.479 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.479 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

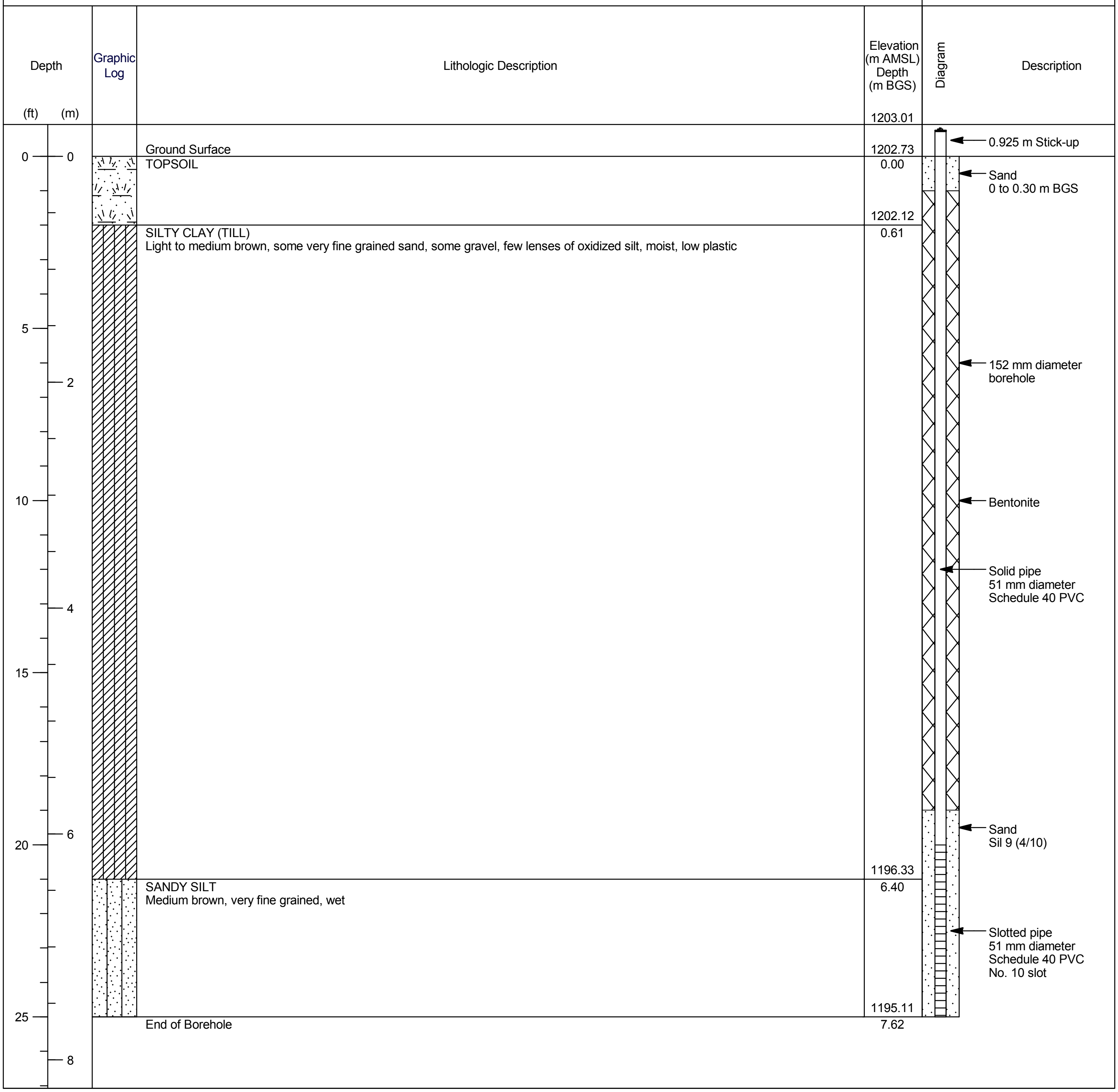
Aquifer Model: Confined
Solution Method: KGS Model

Kr = 9.627E-6 m/sec
Kz/Kr = 1.
Ss = 1.749E-9 m^{-1}

Monitoring Well: MW16-19-8 (DC-25S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,202.73 m AMSL
Number:	110773396	**Top of casing elevation:**	1,203.66 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31684.576
Contractor:	All Service Drilling Inc.	**Northing:**	5657262.245

SUBSURFACE PROFILE | INSTALLATION DETAILS



Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.79 - 7.62 m BGS
Well Seal Interval: 0.30 - 5.79 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-8

Stantec

Drawn By/Checked By: M. Kuhl / D. King

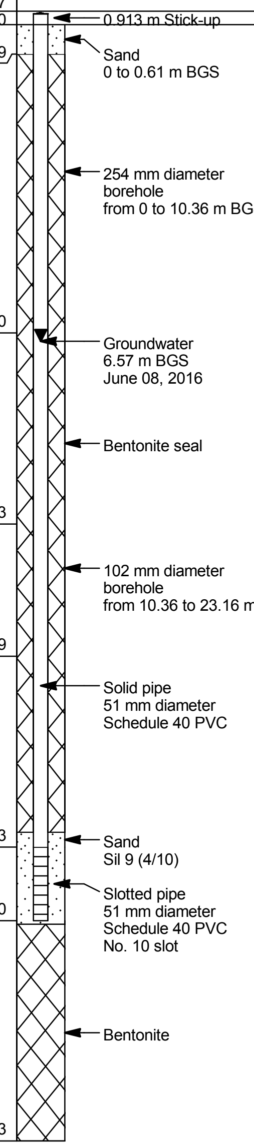
Monitoring Well: MW16-19-19 (DC-25D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	08-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,202.80 m AMSL
Number:	110773396	**Top of casing elevation:**	1,203.71 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31684.489
Contractor:	All Service Drilling Inc.	**Northing:**	5657263.177

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1203.07 / 1202.80
TOPSOIL	0.00
SILTY CLAY (TILL) Light to medium brown, some very fine grained sand, some gravel, few lenses of oxidized silt, moist, low plastic - @ 3.66 m: gravel content increases to 15-30%	1202.19 / 0.61
SANDY SILT Medium brown, very fine grained, wet	1196.40 / 6.40
SANDSTONE Light to medium brown, very fine to fine grained, few fractures, reddish orange oxidation - @ 12.50 m: becomes grey, few thin black stringers and minor cross-bedding	1192.43 / 10.36
CLAYSTONE Medium to dark grey, highly fractured, few 150 to 300 mm thick intervals of clay alteration in zones of intense fracturing - @ 15.54 m: 300 mm thick interval of green to greyish siltstone, minor bioturbation, few shell fragments - @ 16.76 m: 150 mm thick seam of anthracite present	1189.69 / 13.11
SANDSTONE Green to greyish, very fine to fine grained, planar bedding, few fractures, no oxidation	1185.73 / 17.07
CLAYSTONE Medium grey to dark grey, highly fractured, clay alteration along fractures, friable - @ 21.64 m: becomes hard and cohesive, few fractures	1184.20 / 18.59
End of Borehole	1179.63 / 23.16

INSTALLATION DETAILS

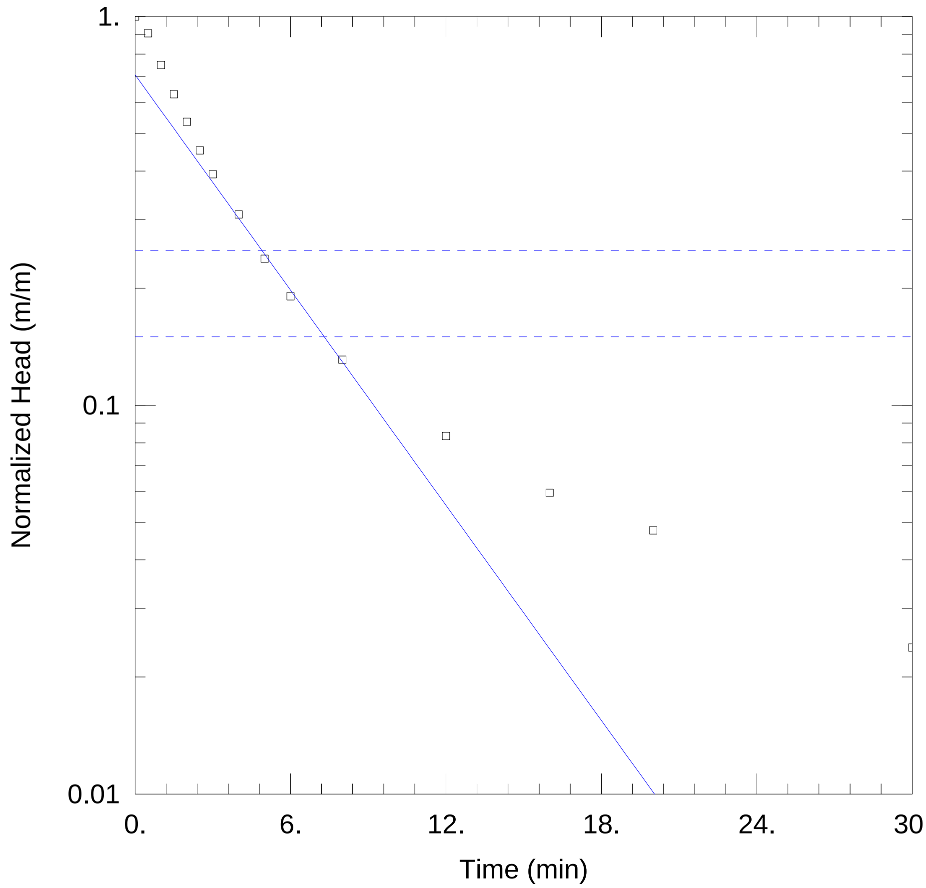


Screen Interval: 17.07 - 18.59 m BGS
Sand Pack Interval: 16.76 - 18.67 m BGS
Well Seal Interval: 0.61 - 16.76 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-19

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-19-19-DC25D.aqt
Date: 12/15/16 Time: 16:44:02

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-19-19-DC-25D
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.52 m
Anisotropy Ratio (Kz/Kr): 1.

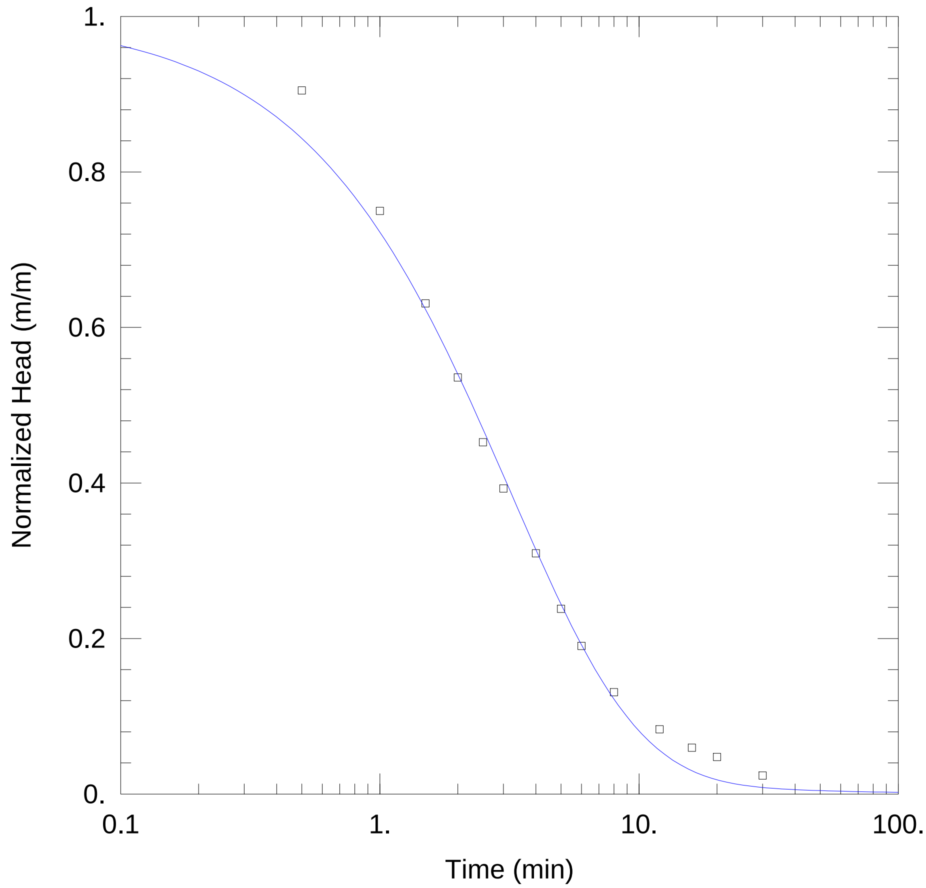
WELL DATA (MW16-19-19-DC-25D)

Initial Displacement: 0.42 m
Total Well Penetration Depth: 16.04 m
Casing Radius: 0.0254 m
Static Water Column Height: 16.04 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 3.072E-6 m/sec
y0 = 0.2973 m



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-19-19-DC25D.aqt
Date: 12/15/16 Time: 16:44:47

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-19-19-DC-25D
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.52 m

WELL DATA (MW16-19-19-DC-25D)

Initial Displacement: 0.42 m
Total Well Penetration Depth: 16.04 m
Casing Radius: 0.0254 m
Static Water Column Height: 16.04 m
Screen Length: 1.52 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 9.225E-6 m/sec
Kz/Kr = 1.
Ss = 1.319E-6 m^{-1}

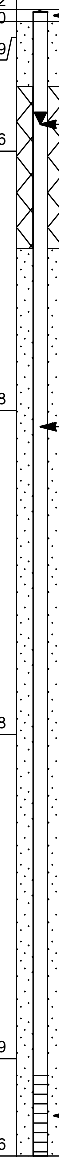
Monitoring Well: MW16-20-21 (D2)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	10-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,206.60 m AMSL
Number:	110773396	**Top of casing elevation:**	1,207.34 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-31218.384
Contractor:	All Service Drilling Inc.	**Northing:**	5657498.57

SUBSURFACE PROFILE

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	Ground Surface	1206.82
0	TOPSOIL	1206.60 / 0.00
0.30	SILTY CLAY Light brown, moist, medium plastic	1206.29 / 0.30
2.44	SILTY CLAY (TILL) Mottled brown and grey, with very fine sand lenses (tend to be orangish brown and oxidized), with gravel, moist	1204.16 / 2.44
7.32	SILT Medium brown, with clay, moist, crumbly - @ 9.45 m: beige, begins to contain some very fine sand lenses (150 mm thick) and some gravel, dry - @ 11.58 m: silt becomes dark brown to grey	1199.28 / 7.32
13.41	SILTSTONE Medium to dark grey, highly fractured, edges of large fractures have been weathered to silt, smaller fractures exhibit oxidation	1193.18 / 13.41
19.51	SANDSTONE Grey to dark grey, very fine to fine grained, with weak cross-bedding, few fractures	1187.09 / 19.51
21.34	End of Borehole	1185.26 / 21.34

INSTALLATION DETAILS



- 0.746 m Stick-up
- Sand 0 to 1.22 m BGS
- Groundwater 1.93 m BGS June 10, 2016
- Bentonite
- 152 mm diameter borehole from 0 to 13.41 m
- Solid pipe 51 mm diameter Schedule 40 PVC
- 102 mm diameter borehole from 13.41 to 21.34 m
- Sand
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval:	19.81 - 21.34 m BGS	Notes:		mm - millimetres
Sand Pack Interval:	4.27 - 21.34 m BGS	m AMSL - metres above mean sea level		Coordinate System - NAD 1983 3TM 114
Well Seal Interval:	1.22 - 4.27 m BGS	m BGS - metres below ground surface		Completed as Well MW16-20-20
		n/a - not available		

Stantec

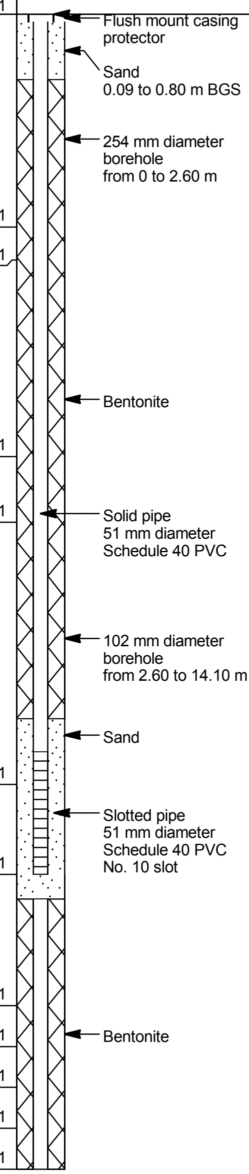
Monitoring Well: MW16-21-11 (D9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	01-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,202.61 m AMSL
Number:	110773396	**Top of casing elevation:**	1,202.30 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-30383.805
Contractor:	All Service Drilling Inc.	**Northing:**	5656987.083

SUBSURFACE PROFILE

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	Ground Surface	1202.61
0.00	OVERBURDEN	0.00
2.60	SANDSTONE Coarse grained, weathered, few fractures	1200.01 2.60
3.00	MUDSTONE AND CLAYSTONE Interbedded, massive - mudstone: brown, friable, has been weathered to clay along fractured - claystone: grey to light grey, with minor fractures, oxidation on fractures	1199.61 3.00
5.40	SANDSTONE Grey to brown, fine grained, well defined cross-bedding	1197.21 5.40
6.20	SILTSTONE Grey to brown, highly fractured and weathered, portions are highly friable and weathered to clay	1196.41 6.20
9.40	SANDSTONE Grey to brown, medium grained, planar laminated, competent core	1193.21 9.40
10.50	SILTSTONE Highly fractured with weathering to silt along fractures	1192.11 10.50
12.10	SANDSTONE Fine grained, finely cross-bedded, few fractures with oxidation along fracture surfaces	1190.51 12.10
12.60	SILTSTONE Grey, highly fractured and weathered	1190.01 12.60
13.10	SANDSTONE Fine grained, finely cross-bedded, few fractures	1189.51 13.10
13.60	SILTSTONE Highly fractured and friable	1189.01 13.60
14.10	End of Borehole	1188.51 14.10

INSTALLATION DETAILS



Screen Interval: 9.00 - 10.50 m BGS
Sand Pack Interval: 8.60 - 10.80 m BGS
Well Seal Interval: 10.80 - 14.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-21-11

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-22-26 (D27)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	21-Jul-2016 / 22-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,190.70 m AMSL
Number:	110773396	**Top of casing elevation:**	1,191.62 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-29330.853
Contractor:	All Service Drilling Inc.	**Northing:**	5656907.343

SUBSURFACE PROFILE — INSTALLATION DETAILS

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
0	0	Ground Surface	1190.98
		TOPSOIL	1190.70 / 0.00
		CLAY - from 0.61 to 2.44 m: beige to light brown, with silt, moist, high plastic - from 2.44 to 10.06 m: medium brown, trace fine grained sand, trace gravel, some silt, medium plastic	1190.09 / 0.61
		SILTY CLAY Medium brown, some very fine grained sand, trace gravel, medium plastic, minor oxidation within sand stringers - @ 11.28 m: sand content increases to 15-30%, gravel content increases to 5-15%	1180.64 / 10.06
		SANDY SILT Medium brown, with gravel, dry to moist, friable - below 15.85 m: dry	1179.43 / 11.28
		SANDY SILT (TILL) Medium to dark grey, some gravel, with clay, dry, medium plastic	1173.02 / 17.68
		SILTY CLAY (TILL) Dark grey, with gravel, dry to moist, medium plastic	1169.98 / 20.73
		SILTSTONE Light to medium grey	1164.80 / 25.91
		End of Borehole	1163.27 / 27.43

Depth scale (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95
Depth scale (m): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

Installation Details (Description):
- 0.917 m Stick-up
- Sand 0 to 0.15 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Groundwater Level 22.15 m BTOC July 22, 2016
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 22.86 - 25.91 m BGS
Sand Pack Interval: 22.56 - 27.43 m BGS
Well Seal Interval: 0.15 - 22.56 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-22-26

Stantec

Drawn By/Checked By: M. Kuhl / D. King

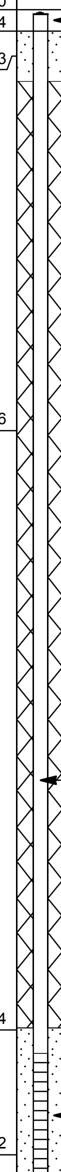
Monitoring Well: MW16-23-14 (D36S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,190.54 m AMSL
Number:	110773396	**Top of casing elevation:**	1,191.39 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-29019.682
Contractor:	All Service Drilling Inc.	**Northing:**	5657309.567

SUBSURFACE PROFILE / INSTALLATION DETAILS

Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		1190.80
0	Ground Surface	1190.54
	TOPSOIL	0.00
	CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	1190.23 0.30
	SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	1185.66 4.88
	SILT Light brown, trace very fine grained sand, moist - @ 13.41 m: becomes wet	1178.34 12.19
	CLAY Low plastic - from 13.72 to 14.02 m: some silt	1176.82 13.72
	End of Borehole	1176.54 14.00

Depth scale (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45
Depth scale (m): 0, 2, 4, 6, 8, 10, 12, 14



Installation details:
- 0.855 m Stick-up
- Sand 0 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 12.48 - 14.00 m BGS
Sand Pack Interval: 12.17 - 14.00 m BGS
Well Seal Interval: 0.61 - 12.17 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-23-14

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-23-36 (D36D)

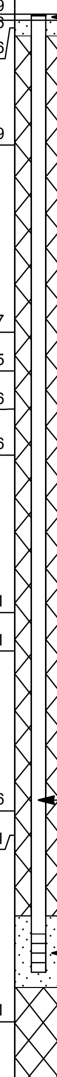
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,190.56 m AMSL
Number:	110773396	**Top of casing elevation:**	1,191.33 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-29019.349
Contractor:	All Service Drilling Inc.	**Northing:**	5657308.346

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155

Depth (m): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1190.79
TOPSOIL	1190.56 / 0.00
CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	1190.26 / 0.30
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	1185.69 / 4.88
SILT Light brown, trace very fine grained sand, moist - @ 13.41 m: becomes wet	1178.37 / 12.19
CLAY Low plastic - from 13.72 to 14.02 m: some silt - from 14.02 to 15.20 m: light grey, dry to damp, mottled	1176.85 / 13.72
SANDSTONE Medium brown, highly fractured	1175.36 / 15.24
CLAYSTONE Grey, highly fractured, clay fracture gouge present	1173.56 / 17.00
SANDSTONE Medium brown to grey	1167.41 / 23.15
SILTSTONE Grey, some oxidation on fractured surfaces - from 28.05 to 28.45 m: highly fractured - below 28.45 m: some bedding present	1165.91 / 24.65
SANDSTONE Grey, fine grained	1159.66 / 30.90
MUDSTONE Grey to dark grey, fractured	1158.71 / 31.85
SILTSTONE Grey, fractured - from 41.05 to 41.65 m: some bedding	1151.41 / 39.15
MUDSTONE Grey, fractured	1148.01 / 42.55
End of Borehole	1144.84 / 45.72



Installation details (Description):
- 0.764 m Stick-up
- Sand 0 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval:	35.70 - 37.20 m BGS	Notes: m AMSL - metres above mean sea level m BGS - metres below ground surface n/a - not available	mm - millimetres Coordinate System - NAD 1983 3TM 114 Completed as Well MW16-23-36
Sand Pack Interval:	35.00 - 37.80 m BGS		
Well Seal Interval:	0.61 - 35.00 m BGS		

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-24-30 (D51)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger / Coring
Client:	Alberta Transportation	**Date started/completed:**	19-Jul-2016 / 20-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,194.50 m AMSL
Number:	110773396	**Top of casing elevation:**	1,195.35 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-28761.753
Contractor:	All Service Drilling Inc.	**Northing:**	5657740.483

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
	1194.76
Ground Surface	1194.50 / 0.00
TOPSOIL	1194.19 / 0.30
SILT With sand, trace gravel, dry to damp	1192.25 / 2.25
CLAY Medium brown, trace sand and gravel, low plastic, minor oxidation, mottled - @ 11.9 m: becomes sandy	1180.80 / 13.70
SAND Some gravel, some clay, dry, oxidized	1179.30 / 15.20
SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures	1177.30 / 17.20
SANDSTONE Brown to grey, planar bedded	1171.33 / 23.16
SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures - below 24.08 m: fine planar laminations - below 24.69 m: grainsize begins to decrease towards bottom of interval	1169.20 / 25.30
CLAYSTONE Dark to medium grey, some fracturing, minor weathering along fractures	1168.29 / 26.21
SILTSTONE Light to medium grey, highly fractured, faint laminations and cross-bedding - below 27.13 m: some lenses of very fine grained sandstone	1167.07 / 27.43
CLAYSTONE Medium grey, highly fractured and weathered to clay throughout interval	1165.54 / 28.96
SANDSTONE Medium grey, very fine to fine grained, competent, few fractures	1163.71 / 30.78
End of Borehole	

INSTALLATION DETAILS

- 0.853 m Stick-up
- Sand
  0 to 0.61 m BGS
- 152 mm diameter borehole
- Groundwater Level
  8.39 m BTOC
  July 20, 2016
- Bentonite
- Solid pipe
  51 mm diameter
  Schedule 40 PVC
- Sand
  Sil 9 (4/10)
- Slotted pipe
  51 mm diameter
  Schedule 40 PVC
  No. 10 slot

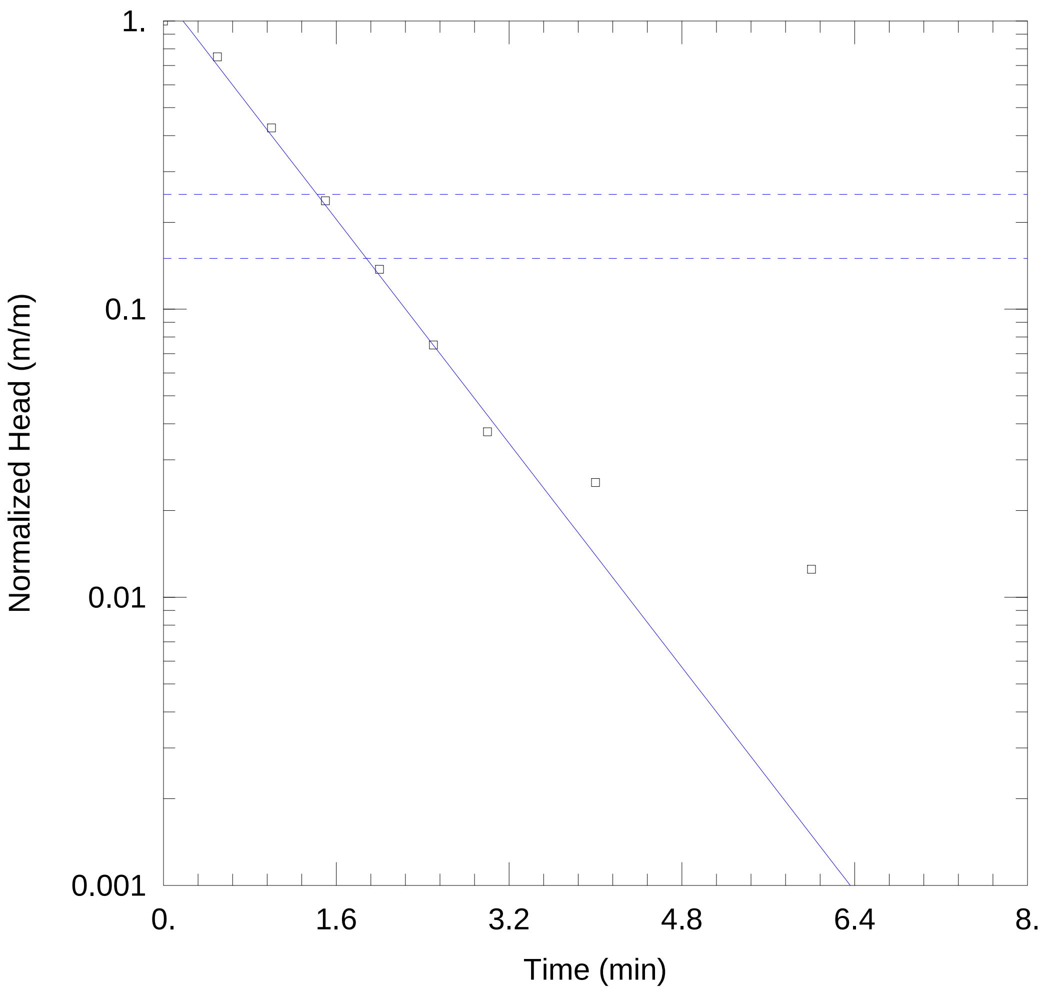
Screen Interval: 28.96 - 30.48 m BGS
Sand Pack Interval: 28.50 - 30.78 m BGS
Well Seal Interval: 0.61 - 28.50 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-24-30

Stantec

Drawn By/Checked By: M. Kuhl / D. King



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-24-30-D51.aqt
Date: 12/17/16 Time: 13:53:15

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-24-30-D-51
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 1.82 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW16-24-30-D-51)

Initial Displacement: 0.4 m
Static Water Column Height: 22.35 m
Total Well Penetration Depth: 22.35 m
Screen Length: 1.52 m
Casing Radius: 0.0254 m
Well Radius: 0.076 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 1.459E-5 m/sec
y0 = 0.4902 m

Monitoring Well: MW16-25-9 (BS3)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	19-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,197.44 m AMSL
Number:	110773396	**Top of casing elevation:**	1,198.37 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-29274.736
Contractor:	All Service Drilling Inc.	**Northing:**	5658230.981

SUBSURFACE PROFILE | INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)
				1197.73
0	0		Ground Surface	1197.44 / 0.00
			TOPSOIL	1197.14 / 0.30
			SILTY CLAY Light to medium brown, moist, medium plastic, some mottling	
5	2			
10			- @ 2.74 m: silt content decreases to 15-30%	
	4			
15			- @ 4.88 m: silt content increases to > 40%	
			- below 5.18 m: trace gravel	1191.96 / 5.49
20	6		SILT AND CLAY (TILL) Medium brown, some very fine grained sand, some gravel, moist, medium plastic	
25	8			
30				1188.30 / 9.14
			CLAYSTONE Light grey to brown, dry	1187.99 / 9.45
	10		End of Borehole	

Installation Details (Description):

- 0.931 m Stick-up
- Sand 0 to 0.15 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 6.10 - 9.14 m BGS
Sand Pack Interval: 5.79 - 9.45 m BGS
Well Seal Interval: 0.15 - 5.79 m BGS

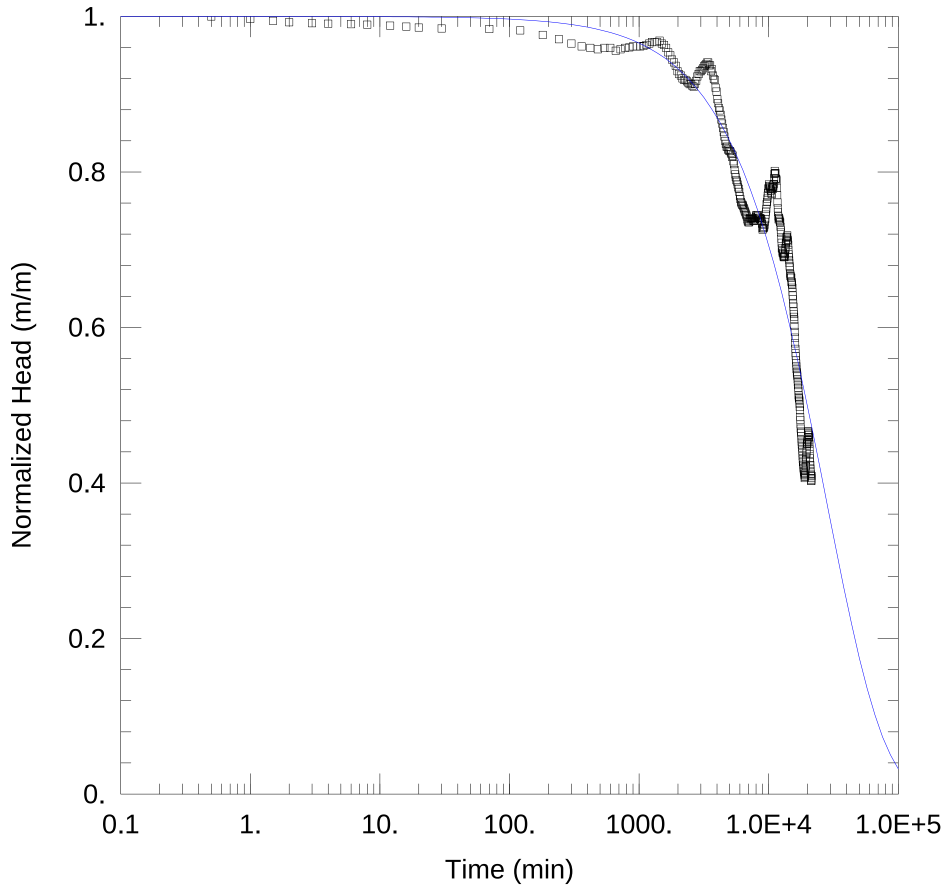
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-25-9

Stantec

Drawn By/Checked By: M. Kuhl / D. King

STANTEC BOREHOLE AND WELL V2 110773396.GPJ STANTEC - DATA TEMPLATE.GDT 19/4/8 MKUHL



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-25-9-BS3_initial static_barocorrected.aqt
Date: 12/21/16 Time: 14:45:03

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-25-9-BS3
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 2.196 m

WELL DATA (MW16-25-9-BS3)

Initial Displacement: 1.605 m
Total Well Penetration Depth: 2.196 m
Casing Radius: 0.0254 m

Static Water Column Height: 2.196 m
Screen Length: 2.196 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

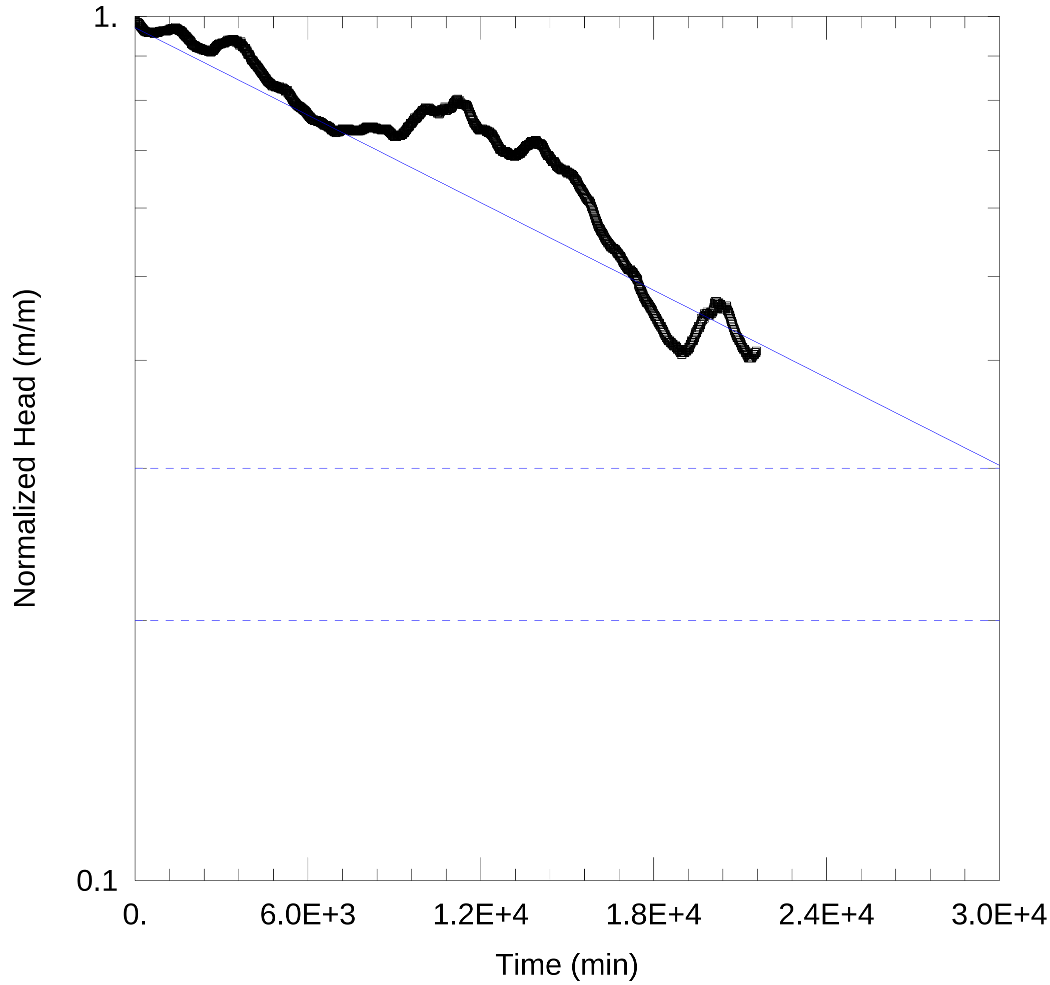
SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 2.353E-10 m/sec
Kz/Kr = 1.

Ss = 4.554E-11 m^{-1}



HYDRAULIC RESPONSE TEST

Data Set: C:\...\anl_MW16-25-9-BS3_initial static.aqt
Date: 12/20/16 Time: 12:58:28

PROJECT INFORMATION

Company: Stantec Consulting. Ltd.
Client: Alberta Transportation
Project: 110773396
Location: Rocky View County, AB
Test Well: MW16-25-9-BS3
Test Date: 6 Oct 2016

AQUIFER DATA

Saturated Thickness: 2.196 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW16-25-9-BS3)

Initial Displacement: 1.605 m
Total Well Penetration Depth: 2.196 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.196 m
Screen Length: 2.196 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 8.181E-10 m/sec y0 = 1.558 m

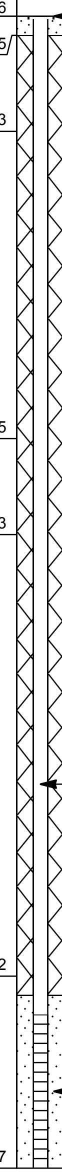
Monitoring Well: MW16-26-18 (H6)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,204.56 m AMSL
Number:	110773396	**Top of casing elevation:**	1,204.41 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32702.727
Contractor:	All Service Drilling Inc.	**Northing:**	5659178.128

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
		Ground Surface	1204.56
		TOPSOIL	0.00
		CLAY Light to medium brown, with silt, moist, high plastic, mottled	1204.25 0.30
5	2	SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic	1202.73 1.83
10, 15, 20	4, 6		
		SAND AND SILT Medium brown, very fine grained, moist - @ 7.32 m: saturated	1197.85 6.71
25	8	CLAY (TILL) Dark grey, with very fine grained sand, with gravel, with silt, dry to moist, low to medium plastic	1196.33 8.23
30, 35, 40, 45	10, 12, 14		
50		CLAYSTONE Grey, dry, crumbly - from 17.37 to 17.98 m: fractured, saturated interval	1189.32 15.24
55, 60	16, 18	End of Borehole	1186.27 18.29

INSTALLATION DETAILS



Screen Interval: 15.85 - 18.29 m BGS
Sand Pack Interval: 15.54 - 18.29 m BGS
Well Seal Interval: 0.30 - 15.54 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-26-18

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-27-12 (H9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	1,207.67 m AMSL
Number:	110773396	**Top of casing elevation:**	1,207.48 m AMSL
Field investigator:	D. Nisbet	**Easting:**	-32702.328
Contractor:	All Service Drilling Inc.	**Northing:**	5659766.161

SUBSURFACE PROFILE

Lithologic Description	Elevation (m AMSL) / Depth (m BGS)
Ground Surface	1207.67
TOPSOIL	0.00
SILTY CLAY Light to medium brown, moist, high plastic, mottled - @ 2.74 m: silt content increases to > 40%	1207.36 0.30
CLAY (TILL) Some gravel, with silt, moist, high plastic	1201.88 5.79
SAND AND SILT Medium brown, very fine grained, moist - @ 10.36 m: saturated	1198.83 8.84
SILT (TILL) Medium brown, with very fine grained sand, with gravel, with clay, dry to moist, medium plastic	1195.78 11.89
CLAY (TILL) Dark grey, with sand, with gravel, with silt, dry to moist, medium plastic	1193.95 13.72
CLAYSTONE Light grey, dry, some zones are highly fractured and saturated, crumbly	1191.82 15.85
End of Borehole	1188.77 18.90

Depth scale: (ft) 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65; (m) 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

INSTALLATION DETAILS

- Flush mount casing protector
- Sand 0.06 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 10.06 - 11.58 m BGS
Sand Pack Interval: 9.45 - 12.19 m BGS
Well Seal Interval: 0.30 - 9.45 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-27-9

Stantec

Attachment B WATER WELL DRILLING RECORDS

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
339046	18-Jun-02	Domestic	SW	5	24	2	5	24.4	
340302	29-Mar-02	Other	SW	5	24	2	5	13.7	
340303	20-Dec-01	Domestic	SW	17	24	2	5	61.0	
340304	22-Mar-02	Stock	NW	1	24	4	5	35.1	
341222	11-May-99	Domestic	SE	9	24	2	5	54.9	
341276	24-Nov-98	Domestic	5	5	24	3	5	44.2	
341315	20-Apr-00	Domestic	NE	1	24	3	5	82.3	
341316	25-Apr-00	Domestic	SE	2	24	3	5	59.4	
341341	14-Jul-00	Domestic	SE	15	24	2	5	83.8	
341365	14-Aug-00	Domestic	SW	28	24	3	5	22.9	
341366	15-Sep-00	Domestic	NE	16	24	4	5	41.1	
341435	25-Jun-98	Domestic	NE	20	24	3	5	34.1	
341454	23-Oct-98	Domestic	SW	30	24	2	5	76.2	
341458	25-Nov-98	Domestic	NW	5	24	3	5	22.9	
341480	25-Nov-98	Domestic	SE	2	24	4	5	26.2	
341491	31-Mar-99	Domestic	NE	12	23	5	5	24.4	
341497	01-Apr-99	Domestic	NW	16	24	2	5	83.8	
341510	30-Nov-00	Domestic	SE	2	24	4	5	59.4	
341524	30-Jan-01	Domestic	SW	26	24	3	5	59.4	
341634	05-Jul-02	Domestic	SE	34	24	3	5	73.2	
341638	03-May-00	Domestic	NW	27	24	3	5	23.2	
341639	29-Aug-02	Domestic	SE	10	24	4	5	42.7	
341641	26-Sep-02	Stock	SW	22	24	4	5	48.8	
341648	04-Nov-02	Domestic	SW	4	25	3	5	30.5	
341649	05-Nov-02	Domestic	SW	4	25	3	5	42.7	
349020	07-Nov-07	Domestic	NE	25	24	3	5	53.3	
349161	09-Aug-89	Stock	SW	26	24	3	5	70.1	
349174	30-Aug-89	Stock	NE	21	24	4	5	59.4	
349186	18-Nov-92	Domestic	SE	21	24	2	5	91.4	
349188	23-Nov-92	Domestic	NE	12	23	5	5	19.8	
349217	30-Aug-88	Domestic	NW	22	24	3	5	33.5	
349218	04-Oct-88	Domestic	NW	22	24	3	5	36.6	
349219	04-Oct-88	Domestic	NW	22	24	3	5	27.4	
349220	05-Oct-88	Domestic	NW	22	24	3	5	25.9	
349235	26-Jul-88	Domestic	NE	20	24	3	5	53.3	
349236	25-Jul-88	Domestic	NE	20	24	3	5	51.8	
349237	28-Jul-88	Domestic & Stock	SE	2	24	3	5	67.1	
349247	30-Sep-88	Domestic	NW	22	24	3	5	36.6	
349248	29-Aug-88	Domestic	NW	22	24	3	5	36.6	
349259	29-Sep-88	Domestic	NW	16	24	2	5	73.2	
349267	08-Apr-88	Domestic & Stock	SE	22	24	4	5	39.6	
349272	01-Jun-88	Stock	SW	27	24	4	5	45.7	Yes
349277	31-Mar-88	Domestic	NW	22	24	3	5	35.1	
349300	01-Feb-93	Domestic	NW	23	24	3	5	32.0	
349308	22-Sep-87	Stock	SW	26	24	4	5	48.8	Yes
349381	24-Nov-87	Domestic	NW	23	24	3	5	30.5	
349393	26-Dec-82	Domestic	SE	27	24	3	5	53.3	
349407	01-Nov-85	Domestic	NE	20	24	3	5	36.6	
349411	21-Oct-85	Domestic	NW	24	24	3	5	33.5	
349442	04-Sep-87	Domestic	SW	28	24	3	5	25.9	
349461	28-Jan-85	Domestic & Stock	SE	34	24	3	5	97.5	
349515	09-Feb-87	Domestic	NE	12	23	5	5	12.2	
349530	12-Apr-85	Stock	NE	28	24	4	5	33.5	
349531	19-Apr-85	Domestic	NE	28	24	4	5	15.2	
349532	19-Apr-85	Domestic	NE	17	24	4	5	76.2	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
349564	12-Nov-85	Domestic	SE	26	24	3	5	64.0	
349567	28-Apr-86	Domestic & Stock	SW	28	24	3	5	45.7	
349568	17-Apr-86	Domestic & Stock	SW	28	24	3	5	45.7	
349569	30-Apr-86	Domestic & Stock	SW	28	24	3	5	45.7	
349587	04-Jun-87	Domestic & Stock	NW	21	23	4	5	18.3	
349588	09-Apr-87	Domestic & Stock	SW	20	23	3	5	35.1	
349601	20-Nov-87	Domestic	NW	23	24	3	5	30.5	
349655	19-Oct-00	Domestic	SW	16	24	2	5	70.1	
349659	06-Jun-94	Domestic	NE	16	24	2	5	61.0	
349749	25-Aug-87	Domestic	NE	12	23	4	5	21.3	
349754	17-May-95	Domestic	SE	13	23	5	5	29.6	
349788	12-May-93	Domestic	SE	26	24	3	5	106.7	
349799	07-May-93	Domestic	NE	19	23	3	5	21.3	
349810	04-Jun-93	Domestic	SE	10	24	2	5	67.1	
349830	25-Jul-95	Stock	NW	22	24	3	5	67.1	
349833	16-Nov-95	Domestic	NE	16	24	3	5	46.3	
349834	17-Nov-95	Domestic	NE	28	24	3	5	21.0	
349841	20-Nov-95	Domestic	SW	26	24	3	5	27.4	
349880	03-May-96	Domestic	SE	16	24	2	5	61.0	
349905	19-Jul-96	Domestic	SW	10	24	2	5	74.7	
349908	03-Jul-96	Domestic	NE	20	24	3	5	36.6	
349916	07-Jul-96	Domestic	NE	9	24	2	5	73.2	
349933	16-Aug-96	Domestic	SE	2	24	4	5	64.0	
349986	09-May-97	Domestic	NE	21	24	3	5	32.0	
349995	03-Jul-97	Domestic	NE	26	23	5	5	65.5	
350004	06-Aug-97	Domestic	15	16	24	2	5	56.1	
350038	28-Oct-97	Domestic	SE	21	24	2	5	91.4	
350048	10-Nov-97	Industrial	SE	21	24	2	5	79.2	
350053	30-Aug-16	Domestic	SE	13	23	5	5	89.9	
350054	03-Feb-98	Domestic	NW	36	24	4	5	88.4	
350069	23-Apr-98	Domestic	NE	16	24	2	5	65.5	
350168	02-Aug-89	Domestic	SW	2	24	3	5	30.5	
350169	14-Feb-90	Domestic	SE	26	24	3	5	39.6	
350172	22-Feb-90	Stock	NE	26	24	3	5	11.6	
350173	23-Feb-90	Stock	NE	26	24	3	5	18.3	
350354	23-Feb-90	Domestic	SW	22	24	3	5	18.3	
350355	21-Feb-90	Domestic	SW	22	24	3	5	23.8	
350444	06-Apr-90	Domestic	NE	23	23	2	5	55.5	
350557	10-Apr-90	Domestic	SW	26	24	3	5	30.5	
350571	26-Mar-90	Domestic & Stock	NE	4	25	4	5	69.2	
350659	12-Mar-90	Domestic	1	15	24	2	5	42.7	
350660	08-Feb-90	Domestic	SW	22	24	3	5	18.3	
350661	02-Mar-90	Domestic	SW	28	24	3	5	54.9	
350662	03-Mar-90	Domestic	SW	28	24	3	5	36.6	
350663	04-Mar-90	Domestic	SW	28	24	3	5	42.7	
350901	16-May-90	Domestic	NE	13	23	5	5	35.1	
350927	04-May-90	Domestic	SW	2	24	3	5	32.0	
351071	07-Jun-90	Domestic	10	26	23	5	5	73.2	
351072	11-Apr-90	Domestic	SE	25	24	3	5	54.9	
351073	04-May-90	Domestic	SW	28	24	3	5	28.3	
351118	28-May-90	Domestic	2	10	24	2	5	71.6	
351119	04-Jun-90	Domestic	NW	10	24	2	5	68.6	
351120	08-Jun-90	Domestic	NW	10	24	2	5	45.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
351121	22-May-90	Domestic	SE	25	24	3	5	67.1	
351122	20-Apr-10	Domestic	8	25	24	3	5	88.4	
351124	27-Apr-90	Domestic	NE	33	24	3	5	19.8	
351158	17-Apr-90	Stock	SE	3	25	4	5	121.9	
351159	18-Apr-90	Domestic	SW	3	25	4	5	49.4	
351462	05-Jan-90	Domestic	NE	22	23	5	5	17.4	
351463	08-Jan-90	Domestic	NW	25	23	5	5	48.2	
351466	22-Dec-89	Domestic	NW	3	24	3	5	50.9	
351467	21-Nov-89	Domestic	SW	25	24	3	5	42.7	
351468	08-Nov-89	Domestic	SE	26	24	3	5	37.8	
351469	09-Feb-90	Domestic	SE	26	24	3	5	41.1	
351471	30-Oct-89	Domestic	SW	26	24	3	5	24.4	
351482	06-Jun-90	Domestic	NW	16	24	2	5	54.9	
351483	07-Jun-90	Domestic	SW	2	24	3	5	54.9	
351484	15-Jun-90	Domestic	SW	2	24	3	5	54.9	
351486	08-May-90	Domestic	SW	2	24	3	5	32.0	
351509	04-Jan-90	Domestic	SE	6	25	3	5	41.8	
351623	01-May-90	Domestic	SW	28	24	3	5	24.4	
351667	14-Jun-90	Domestic	NW	19	24	2	5	98.1	
351846	07-Jul-90	Domestic	NE	12	23	5	5	32.0	
352069	14-Apr-90	Domestic	SE	25	24	3	5	48.8	
352070	01-May-90	Domestic	SW	28	24	3	5	24.4	
352124	13-Sep-90	Domestic	NW	25	24	3	5	57.9	
352157	17-Jul-90	Domestic	SE	13	24	3	5	4.6	
352158	14-Sep-90	Domestic	SW	34	24	3	5	25.6	
352478	25-Sep-90	Domestic	SW	24	23	2	5	78.9	
352722	27-Sep-90	Domestic	15	21	24	3	5	19.5	
352723	27-Sep-90	Domestic	15	21	24	3	5	19.5	
353033	09-Oct-90	Domestic	SW	23	23	2	5	54.9	
353410	13-Sep-85	Domestic	SW	10	24	2	5	24.4	
353411	14-Sep-82	Domestic	SE	17	24	2	5	48.8	
353412	11-Aug-81	Domestic	SW	1	24	3	5	45.7	
353413	30-Nov-89	Domestic	NE	9	24	3	5	59.4	
353414	09-Mar-89	Domestic	NW	26	24	3	5	54.9	
353474	04-Sep-90	Domestic	NW	23	24	3	5	24.4	
353979	11-Jun-90	Domestic & Stock	SW	15	24	4	5	62.5	
353980	10-Dec-90	Domestic	SW	25	24	3	5	30.5	
354350		Domestic	NE	13	23	5	5	3.7	
354351		Domestic	NE	13	23	5	5	1.5	
354354		Domestic	NE	4	24	2	5	38.1	
354355		Domestic	NW	19	24	2	5		
354359	27-Oct-87	Domestic & Stock	SE	2	25	4	5	36.6	
355123	21-Dec-90	Domestic	SE	26	24	3	5	24.4	
355124	22-Dec-90	Domestic	SE	26	24	3	5	29.6	
355935	14-Mar-91	Domestic	9	16	24	3	5	61.0	
356257		Domestic	SW	1	24	3	5	61.0	
356258		Domestic	SW	5	24	3	5		
356259		Domestic	SW	5	24	3	5	50.3	
356260		Domestic	NW	14	24	3	5		
356261		Domestic	NW	16	24	3	5		
356262		Domestic	SE	21	24	3	5		
356263		Domestic	NW	22	24	3	5		
356264		Domestic	NE	23	24	3	5	33.5	
356265		Domestic	SE	24	24	3	5		
356267		Domestic	SE	26	24	3	5		

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
356268		Domestic	NW	27	24	3	5	24.4	
356269		Domestic	SW	28	24	3	5	30.5	
356270		Domestic	NW	30	24	3	5		
356276		Domestic	NW	11	24	4	5		
356356		Domestic		25	23	3	5	23.8	
356357		Domestic	NW	31	23	3	5		
356363		Domestic	NE	4	24	2	5		
356364		Domestic	SE	6	24	2	5		
356365		Domestic	NW	9	24	2	5		
356366		Domestic	SE	10	24	2	5	83.8	
356367		Domestic	SW	10	24	2	5		
356368		Domestic	NW	10	24	2	5		
356369		Domestic	NE	10	24	2	5	32.0	
356370		Domestic	NW	16	24	2	5		
356371		Domestic	NE	18	24	2	5		
356544	06-Feb-91	Domestic	NE	21	24	3	5	30.5	
356545	27-Feb-91	Domestic	NE	21	24	3	5	30.5	
356546	04-Mar-91	Domestic	NE	21	24	3	5	29.9	
356547	07-Mar-91	Domestic	NE	21	24	3	5	30.5	
357257	22-Mar-91	Domestic	SE	15	24	2	5	79.2	
357258	05-Apr-91	Domestic	NW	18	24	2	5	39.6	
357367	08-May-91	Domestic	SE	27	23	5	5	38.1	
357729	31-Aug-90	Domestic & Stock	SE	22	23	3	5	54.9	
357782	29-Jul-87	Domestic	NE	12	23	5	5	17.1	
357783	21-Sep-89	Stock	NW	21	24	4	5	26.8	
357974	27-May-91	Domestic	NE	12	23	5	5	32.0	
357975	18-Jun-91	Domestic	SW	4	24	3	5	35.1	
358138	11-May-91	Domestic	NE	21	24	3	5	30.5	
358139	26-Jun-91	Domestic	NW	23	24	3	5	24.4	
358140	26-Jun-91	Domestic	NW	23	24	3	5	24.4	
358263	12-May-94	Stock	NW	15	24	2	5	164.6	
358465	03-Aug-91	Domestic	NW	19	24	2	5	111.3	
358467	18-Jul-91	Domestic	SW	2	24	3	5	48.8	
358468	18-Jul-91	Domestic	SW	2	24	3	5	47.2	
358469	19-Jul-91	Domestic	SW	2	24	3	5	36.6	
358491	04-Jun-91	Domestic	9	21	24	3	5	19.8	
358492	05-Jun-91	Domestic	9	21	24	3	5	19.5	
358782	24-Jul-91	Domestic	SW	25	24	3	5	36.6	
358783	25-Jul-91	Domestic	SW	25	24	3	5	36.6	
358810	05-Jul-91	Domestic	SW	20	24	2	5	45.7	
359263	21-Jul-91	Domestic	SW	2	24	3	5	45.7	
359264	26-Jul-91	Domestic	NW	23	24	3	5	27.4	
359265	30-Jul-91	Domestic	NW	23	24	3	5	24.4	
359633	05-Jul-91	Domestic	NE	23	23	3	5	51.8	
359637	06-Jun-91	Domestic	NE	13	23	5	5	33.5	
359638	14-Aug-91	Domestic	SW	17	24	2	5	36.6	
359639	04-Jun-91	Domestic	16	16	24	3	5	25.6	
359640	30-Jul-91	Domestic	NW	23	24	3	5	30.5	
359815	30-Mar-91	Domestic	NW	19	24	2	5	59.4	
359886	16-Jul-91	Domestic	1	13	23	5	5	13.1	
359887	11-Sep-91	Domestic	SW	5	24	2	5	11.3	
359888	12-Sep-91	Domestic	SW	5	24	2	5	11.3	
359891	11-Sep-91	Domestic	SE	9	24	3	5	35.7	Yes
359993	03-May-87	Domestic	SW	1	24	3	5	33.5	
360069	25-Sep-91	Domestic	SW	26	23	5	5	91.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
360321	11-Oct-91	Domestic	7	26	23	5	5	39.6	
360322	04-Sep-91	Domestic & Stock	1	15	24	2	5	67.1	
360648	24-Aug-91	Domestic	NE	27	23	3	5	54.9	
360649	17-Oct-91	Domestic	SW	28	23	4	5	41.5	
360650	10-Oct-91	Municipal	NW	5	24	2	5	6.1	
360651	09-Oct-91	Domestic	NW	19	24	2	5	121.9	
361016	01-Oct-91	Domestic	NE	8	23	3	5	54.9	
361021	21-Nov-91	Stock	NE	28	24	3	5	24.4	
361022	21-Oct-91	Domestic	SE	13	24	4	5	47.2	
361443		Domestic	NE	12	23	5	5		
361444		Domestic	NE	12	23	5	5		
361445		Domestic	NE	13	23	5	5	3.7	
361446		Domestic	SE	5	24	2	5		
361447		Domestic	SE	15	24	2	5	73.2	
361448		Domestic	SW	16	24	2	5	9.1	
361449		Domestic	SE	15	24	3	5	54.9	
361450		Domestic	NW	23	24	3	5	24.4	
361451		Domestic	NE	23	24	3	5		
361452		Domestic	SW	24	24	3	5		
361453		Domestic	SW	28	24	3	5		
362749	07-Dec-91	Domestic	NE	20	24	3	5	44.5	
363237		Domestic	SE	13	23	5	5		
363238	27-Aug-85	Domestic & Stock	NE	11	24	3	5	71.6	
363278	22-Jan-92	Domestic	5	24	24	3	5	48.8	
363666		Domestic	NE	12	23	5	5		
363668		Domestic	SW	1	24	3	5		
363669		Domestic	NW	5	24	3	5		
363670		Domestic	SE	26	24	3	5		
363671		Domestic	SW	26	24	3	5		
363794		Domestic	NE	8	24	2	5		
363921	17-Mar-92	Industrial	SW	15	24	3	5	5.5	
363922	13-Mar-92	Industrial	SW	15	24	3	5	5.2	
363924	11-Mar-92	Industrial	SW	15	24	3	5	4.9	
363925	10-Mar-92	Industrial	SW	15	24	3	5	5.8	
364115	06-Mar-92	Domestic	SE	10	24	2	5	42.1	
364131		Domestic	NW	34	24	4	5	50.3	
364158	17-Feb-92	Domestic	15	15	23	5	5	29.0	
364585	15-Apr-92	Domestic	NW	9	24	3	5	36.6	
364586	19-Apr-92	Domestic	SW	18	24	3	5	33.5	
364649	30-Apr-92	Domestic	SE	5	24	3	5	48.8	
364650	09-May-92	Domestic & Stock	NE	27	24	4	5	36.6	Yes
364874	23-Mar-92	Domestic	NW	18	24	2	5	30.5	
364931	05-Jun-92	Domestic	NE	12	23	5	5	18.9	
364932	14-May-92	Domestic	NE	12	23	5	5	15.2	
364976		Domestic	SW	10	24	2	5		
365211	10-Jun-92	Domestic	NE	23	23	2	5	51.8	
365215	28-May-92	Domestic	NE	28	23	3	5	36.6	
365216	23-May-92	Domestic	SE	32	23	3	5	39.6	
365343	30-Jun-92	Domestic	NW	23	24	3	5	24.4	
365344	02-Jul-92	Domestic	NW	23	24	3	5	30.5	
365566	01-Jun-92	Domestic	SE	27	23	5	5	23.8	
365567	30-Jul-92	Domestic	SE	6	24	2	5	21.6	
365568	17-Jul-92	Domestic	SE	2	24	3	5	67.1	
365659		Domestic	NW	27	24	3	5		
365819	07-Aug-92	Domestic	SW	30	24	2	5	70.1	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
365865	21-Aug-92	Domestic	NE	4	24	2	5	51.8	
365882	29-Aug-91	Irrigation	NE	6	24	2	5	17.1	
366071	20-Oct-80	Domestic	SE	15	24	2	5	41.1	
366092	16-Oct-92	Domestic	SW	30	24	2	5	79.2	
366137	14-Aug-92	Domestic	NE	21	24	3	5	30.5	
366298	19-Aug-92	Domestic	NE	28	23	4	5	64.3	
366381	18-Aug-92	Domestic	13	13	23	5	5	32.6	
366382	21-Aug-92	Domestic	1	26	24	3	5	50.3	
366402	19-Aug-92	Domestic	NE	3	24	2	5	91.4	
366403	01-Sep-92	Domestic	SE	30	24	2	5	90.2	
366404	02-Oct-92	Domestic	NW	22	24	3	5	25.0	
366405	01-Oct-92	Domestic	NW	22	24	3	5	25.0	
366406	02-Oct-92	Domestic	NW	22	24	3	5	24.4	
366426		Domestic	16	15	23	5	5	32.0	
366427		Domestic	SE	27	23	5	5	24.4	
366597	01-Nov-92	Domestic & Stock	SW	14	24	3	5	50.3	
366863	15-Nov-92	Domestic	SW	2	24	3	5	36.6	
366864	04-Sep-92	Domestic	NW	4	24	3	5	59.4	
367028	30-Oct-92	Domestic	NW	18	23	4	5	41.1	
367030	18-Nov-92	Domestic	NW	16	24	3	5	30.5	
367108		Domestic	SW	26	24	3	5	30.5	
367130	23-Oct-92	Domestic	NW	2	24	4	5	48.8	
367322		Domestic	NW	18	24	2	5	61.0	
367394	12-Jan-93	Domestic	SE	5	24	3	5	30.5	
367430	05-Nov-92	Domestic	1	26	24	3	5	25.9	
367657	04-Oct-92	Domestic & Stock	NE	13	24	4	5	43.3	Yes
368836	03-Nov-92	Domestic & Stock	NE	5	24	3	5	54.9	
369194	28-Apr-93	Domestic	SW	2	24	3	5	30.5	
369195	19-Mar-93	Domestic	NE	5	24	3	5	48.8	
369196	24-Apr-93	Domestic	NW	7	24	3	5	55.5	
369197	13-Dec-92	Domestic	SW	9	24	3	5	45.7	
369198	03-Mar-93	Domestic	SE	26	24	3	5	50.3	
369418	08-Aug-75	Domestic	SW	20	24	2	5	45.7	
369592	04-Jun-93	Domestic	SE	9	24	2	5	54.9	
369942	01-Jan-75	Domestic & Stock	NW	15	24	2	5	51.8	
369969	08-Jul-93	Domestic	SE	23	23	2	5	67.1	
369970	10-Jul-93	Domestic	SW	19	23	4	5	24.4	
369971	24-Aug-93	Domestic	NE	16	24	3	5	36.6	
370087	14-Jul-93	Domestic	1	9	24	2	5	63.4	
370088	12-Jul-93	Domestic	6	9	24	2	5	74.4	
370089	14-Jul-93	Domestic	6	9	24	2	5	67.1	
370155	20-Jul-93	Domestic	NW	23	24	3	5	42.7	
370254	12-Aug-93	Domestic	SE	21	24	2	5	66.1	
370255	10-Sep-93	Domestic & Stock	5	1	25	4	5	45.7	
372401	12-Nov-93	Domestic	SW	14	24	3	5	61.0	
372435	07-Aug-93	Domestic	NW	4	24	3	5	55.5	
373477	20-Oct-95	Domestic	12	7	24	2	5	98.5	
373502	05-Oct-93	Domestic	NE	21	24	3	5	30.5	
376489	18-Dec-93	Domestic & Stock	SE	3	24	4	5	11.0	Yes
376490	30-Nov-93	Stock	SE	3	24	4	5	30.5	
376491	04-Dec-93	Stock	1	6	25	3	5	42.7	
376834	09-Oct-93	Domestic	NE	13	23	5	5	61.0	
376835	12-Oct-93	Domestic	NE	13	23	5	5	24.4	
376836	13-Oct-93	Domestic	NE	13	23	5	5	24.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
376838	05-Oct-93	Domestic	NE	27	23	5	5	30.5	
379295	01-Jun-95	Domestic	SE	17	24	3	5	61.0	
379655	04-Jun-95	Domestic	SE	8	24	3	5	48.8	
379659	02-Jun-95	Domestic	NE	8	24	3	5	50.3	
379663	06-Jun-95	Domestic	SW	9	24	3	5	47.2	
379701	18-Oct-95	Domestic	9	12	23	5	5	13.4	
381220	20-Apr-94	Domestic	NW	10	24	2	5	64.0	
381292	25-Jul-95	Domestic	NW	26	23	5	5	31.1	
381942	16-Aug-95	Domestic	NE	21	24	3	5	19.8	
386021	21-Jul-94	Domestic	SW	2	24	3	5	42.7	
386023	12-Aug-94	Domestic	4	24	24	3	5	24.4	
386027	16-Jul-94	Domestic	NE	21	24	3	5	30.5	
386031	26-Jul-94	Domestic	NE	21	24	3	5	33.5	
386033	20-Jul-94	Domestic	SW	22	24	3	5	18.3	
386037	23-Aug-94	Domestic	NW	22	24	3	5	18.3	
386042	22-Aug-94	Domestic	NW	22	24	3	5	23.8	
386046	22-Aug-94	Domestic	NW	22	24	3	5	19.8	
386048	23-Jun-94	Domestic	6	25	24	3	5	30.5	
386052	28-Jun-94	Domestic	6	25	24	3	5	30.5	
386086	27-Jun-94	Domestic	6	25	24	3	5	36.6	
386087	06-May-94	Domestic	NE	26	24	3	5	79.2	
387020	13-Jul-94	Domestic & Stock	NW	23	23	5	5	24.4	
387497	21-May-68	Domestic	NE	12	23	5	5	30.5	
387498		Domestic	NE	12	23	5	5	4.0	
387499		Domestic	NE	12	23	5	5	3.7	
387500		Domestic	NE	12	23	5	5	3.7	
387501		Domestic	NE	12	23	5	5	10.7	
387502		Domestic	NE	12	23	5	5	1.5	
387503	04-Jun-68	Domestic	NE	12	23	5	5	18.3	
387504	11-Jun-75	Unknown	NE	12	23	5	5	12.2	
387505		Unknown	NE	12	23	5	5	16.8	
387506		Unknown	NE	12	23	5	5	9.8	
387507		Domestic	NE	12	23	5	5	5.2	
387509	01-Sep-69	Domestic	NE	12	23	5	5	21.3	
387510	01-Jun-72	Domestic	NE	12	23	5	5	11.9	
387511	01-Nov-72	Domestic	NE	12	23	5	5	9.1	
387513		Domestic	NE	12	23	5	5	10.7	
387514	07-Mar-77	Domestic	NE	12	23	5	5	34.7	
387515	06-Jul-76	Domestic	NE	12	23	5	5	25.9	
387516		Domestic	NE	12	23	5	5	6.1	
387517	08-Jul-79	Domestic	NE	12	23	5	5	21.3	
387518		Domestic	NE	12	23	5	5	18.3	
387519	04-Nov-74	Domestic	NE	12	23	5	5	9.1	
387520	21-Jun-75	Domestic	NE	12	23	5	5	12.8	
387521	28-May-85	Domestic	NE	12	23	5	5	30.2	
387522	11-Jun-88	Domestic	SE	1	24	4	5	22.9	
387525	01-Jan-74	Domestic	SE	2	24	4	5	11.9	
387526		Domestic	SE	2	24	4	5	43.6	
387527	01-Jun-73	Domestic	SE	2	24	4	5	53.3	
387530	01-Jul-73	Domestic	SE	2	24	4	5	36.6	
387531		Domestic	SE	2	24	4	5	45.7	
387532		Domestic	SE	2	24	4	5	64.6	
387533		Domestic	SE	2	24	4	5	42.7	
387534	06-Apr-76	Domestic	SE	2	24	4	5	61.0	
387535		Domestic	SH	2	24	4	5	50.3	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387536		Domestic	SH	2	24	4	5	86.9	
387537		Domestic	SH	2	24	4	5	82.3	
387538		Domestic	SW	2	24	4	5	36.6	
387540	15-Feb-64	Domestic & Stock	SW	2	24	4	5	47.2	
387543	18-May-65	Domestic	SW	2	24	4	5	33.5	
387544	07-May-65	Stock	SW	2	24	4	5	58.5	
387545		Domestic	SW	2	24	4	5	38.1	
387546	01-Feb-64	Stock	SW	2	24	4	5	60.4	
387547		Domestic	SW	2	24	4	5	86.9	
387548	04-May-75	Domestic	SW	2	24	4	5	45.7	
387549	02-Dec-88	Domestic & Stock	SW	2	24	4	5	91.4	
387550	02-Dec-88	Domestic	SW	2	24	4	5	24.4	
387551		Domestic	SW	2	24	4	5		
387552	15-May-72	Domestic	NW	2	24	4	5	86.9	
387553	24-May-74	Domestic	NE	2	24	4	5	25.6	
387554	01-Oct-73	Domestic	SE	3	24	4	5	36.6	
387557		Domestic	SE	3	24	4	5	9.1	
387560	20-Sep-79	Domestic & Stock	SW	3	24	4	5	6.1	
387561		Domestic	SW	3	24	4	5	15.2	
387562	21-Nov-74	Stock	NE	3	24	4	5	10.7	
387563	01-Jul-60	Domestic		3	24	4	5	12.5	
387564	22-May-80	Other	NE	6	24	4	5	31.1	
387566	27-Sep-78	Domestic	NE	8	24	4	5	56.4	
387567		Domestic	NE	9	24	4	5	15.2	
387568		Domestic	SE	10	24	4	5	7.6	
387569		Domestic	SW	10	24	4	5	3.4	
387570		Domestic	NE	10	24	4	5		
387571	23-Aug-55	Domestic		10	24	4	5	125.6	
387572		Domestic	SW	11	24	4	5	33.5	
387573	23-May-79	Domestic	SW	11	24	4	5	49.4	
387574		Domestic	SW	11	24	4	5	42.7	
387575		Domestic	NW	11	24	4	5	6.1	
387576	01-Sep-71	Domestic	SE	13	24	4	5	26.8	
387577	09-Jun-66	Domestic	SE	13	24	4	5	26.5	
387578	03-May-74	Domestic	SE	13	24	4	5	30.5	
387586		Domestic	NE	12	23	5	5		
387587		Domestic	NE	12	23	5	5	19.8	
387589		Domestic	NE	12	23	5	5		
387590		Domestic	NE	12	23	5	5		
387593		Domestic	NE	12	23	5	5	12.2	
387594		Domestic	NE	12	23	5	5	9.1	
387595		Domestic	NE	12	23	5	5	22.9	
387596		Domestic	NE	12	23	5	5	3.7	
387597		Unknown	NE	12	23	5	5	70.1	
387598	08-Jun-89	Domestic	NE	12	23	5	5	54.9	
387603	29-Oct-81	Domestic	16	13	23	5	5	18.9	
387620		Domestic	SE	13	23	5	5	2.7	
387621		Domestic	SE	13	23	5	5	30.5	
387623	11-Sep-67	Unknown	SE	13	23	5	5	9.1	
387625	01-Jan-74	Domestic	SE	13	23	5	5	10.1	
387626	01-Nov-70	Domestic	SE	13	23	5	5	11.3	
387627	24-Feb-75	Domestic	SE	13	23	5	5	9.4	
387628	20-Sep-67	Domestic	SE	13	23	5	5	21.3	
387631	01-Jun-71	Domestic	SE	13	23	5	5	34.1	
387633	01-Apr-71	Unknown	SE	13	23	5	5	8.8	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387635	01-Nov-70	Domestic	SE	13	23	5	5	6.4	
387637		Domestic	SE	13	23	5	5	3.7	
387639		Domestic	SE	13	23	5	5	21.9	
387641		Domestic	SE	13	23	5	5	12.2	
387642		Domestic	SE	13	23	5	5	15.2	
387644		Domestic	SE	13	23	5	5	22.9	
387645	01-Feb-81	Domestic	1	13	23	5	5	28.0	
387646		Domestic	SE	13	23	5	5	6.1	
387647		Domestic	SE	13	23	5	5	4.3	
387649		Domestic	SE	13	23	5	5	3.7	
387650		Domestic	SE	13	23	5	5		
387652		Domestic	SE	13	23	5	5		
387653		Domestic	SE	13	23	5	5	4.0	
387660		Domestic	SE	13	23	5	5	3.0	
387661		Domestic	SE	13	23	5	5	4.0	
387662	16-Apr-76	Domestic	2	2	24	2	5	67.1	
387663		Domestic	SE	13	23	5	5	61.0	
387664	01-Jan-69	Domestic	16	13	23	5	5	3.7	
387665	28-Feb-64	Domestic	SW	2	24	2	5	45.1	
387670		Domestic	NW	13	23	5	5	3.0	
387671	25-Nov-97	Domestic	NW	13	23	5	5	91.4	
387672		Unknown	NW	13	23	5	5	3.0	
387673		Domestic	NW	2	24	2	5	45.7	
387674		Domestic	NW	2	24	2	5	40.2	
387675	30-May-89	Stock	NW	13	23	5	5	14.0	
387676		Domestic	NW	2	24	2	5	36.6	
387677		Domestic	NW	2	24	2	5	38.1	
387678		Domestic	NE	13	23	5	5	4.6	
387679		Domestic	NW	2	24	2	5	29.9	
387680		Domestic	NW	2	24	2	5		
387681	01-Jun-60	Domestic	NE	2	24	2	5	18.0	
387682		Domestic	NE	13	23	5	5	2.4	
387683		Domestic	EH	2	24	2	5	30.5	
387684		Domestic	NE	13	23	5	5	9.4	
387685		Municipal	EH	2	24	2	5		
387686		Domestic	NE	13	23	5	5	4.6	
387687		Domestic	NE	13	23	5	5	2.7	
387688	01-Sep-70	Domestic	NE	13	23	5	5	15.2	
387696	25-Jul-80	Stock	SW	15	24	4	5	12.8	
387697	01-Oct-69	Stock	NW	15	24	4	5	21.3	
387698		Domestic	NW	15	24	4	5		
387699	23-Mar-84	Stock	NE	15	24	4	5	45.7	
387700		Domestic	NE	15	24	4	5	36.6	
387701	01-Nov-85	Stock	NE	16	24	4	5	45.7	
387703	19-Apr-85	Unknown	NE	17	24	4	5	76.2	
387704	21-Feb-65	Unknown	NE	19	24	4	5	20.7	
387705	01-Aug-71	Unknown	NE	19	24	4	5	10.1	
387706	15-Jun-64	Domestic & Stock	NE	19	24	4	5	31.1	
387707	28-Jan-65	Unknown	NE	19	24	4	5	9.1	
387708	29-Jan-65	Unknown	NE	19	24	4	5	7.9	
387709		Domestic	NE	19	24	4	5	22.9	
387714	01-Nov-69	Domestic	NE	13	23	5	5	46.3	
387715	20-Jun-66	Domestic	NE	13	23	5	5	30.5	
387716	14-Aug-69	Unknown	SE	3	24	2	5	43.0	
387717	01-Apr-72	Domestic	NE	13	23	5	5	13.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387719	01-Sep-69	Domestic	NE	13	23	5	5	21.3	
387720	01-Mar-74	Domestic	NE	13	23	5	5	22.9	
387723	01-Jun-72	Domestic	NE	13	23	5	5	45.7	
387726		Domestic	NE	13	23	5	5	13.7	
387728		Domestic	NE	13	23	5	5	2.4	
387729	01-Jan-65	Domestic	NE	13	23	5	5	36.6	
387730		Domestic	NE	13	23	5	5	3.7	
387731		Domestic	NE	13	23	5	5	3.7	
387732		Domestic	NE	13	23	5	5		
387733		Unknown	NE	13	23	5	5	3.0	
387736	21-Sep-66	Domestic	NE	13	23	5	5	30.5	
387738		Domestic	SE	3	24	2	5	29.3	
387739		Domestic	NW	3	24	2	5	21.3	
387740	01-Sep-69	Domestic	NE	13	23	5	5	6.7	
387743		Domestic	NE	13	23	5	5	30.5	
387744	01-Oct-54	Domestic & Stock	NW	3	24	2	5	23.5	
387745		Domestic	NE	13	23	5	5	1.5	
387746		Domestic	NE	13	23	5	5		
387747	02-Jul-87	Domestic	NE	13	23	5	5	121.9	
387749	01-Nov-74	Domestic	NW	3	24	2	5	42.7	
387750		Domestic	NE	13	23	5	5	3.7	
387751	30-May-89	Domestic	NE	13	23	5	5	25.0	
387752	14-Apr-80	Domestic	NW	3	24	2	5	56.4	
387756		Domestic	NW	3	24	2	5	45.7	
387758	01-Oct-74	Domestic	NE	3	24	2	5	36.6	
387762	01-May-58	Unknown		3	24	2	5	31.4	
387765	04-Feb-72	Domestic	SE	4	24	2	5	48.8	
387770	15-Feb-67	Domestic	NE	4	24	2	5	64.0	
387772	01-Oct-66	Domestic	NE	4	24	2	5	64.0	
387774	22-Apr-66	Domestic	NE	4	24	2	5	80.8	
387776	01-Nov-66	Domestic	NE	4	24	2	5	64.0	
387778	01-May-57	Unknown	9	4	24	2	5	31.4	
387780		Domestic	SH	4	24	2	5	36.6	
387782		Domestic	NE	5	24	2	5	2.7	
387783		Domestic	NE	5	24	2	5	33.5	
387785		Domestic	NE	5	24	2	5	9.1	
387786	24-Oct-86	Domestic	NE	5	24	2	5	47.2	
387788		Domestic	SE	6	24	2	5	61.0	
387789	05-Apr-76	Domestic	NE	6	24	2	5	45.7	
387790	26-Feb-71	Domestic	SE	7	24	2	5	57.9	
387791		Domestic	SH	7	24	2	5		
387792		Unknown	NW	7	24	2	5		
387793	14-Apr-72	Domestic	SE	8	24	2	5	54.9	
387794		Domestic	SE	8	24	2	5		
387795		Domestic	SE	8	24	2	5		
387796	20-Jun-70	Domestic	SW	8	24	2	5	61.0	
387797		Domestic	NE	8	24	2	5	36.6	
387799		Domestic		8	24	2	5		
387800		Domestic	SE	9	24	2	5	45.7	
387801		Domestic	1	22	24	4	5	45.7	
387802	25-Nov-84	Stock	NW	22	24	4	5	45.7	
387803	01-Jun-72	Domestic	SE	9	24	2	5	50.3	
387805	15-Jan-85	Domestic & Stock	NW	22	24	4	5	35.1	Yes
387806	11-Oct-87	Domestic	SE	9	24	2	5	54.9	
387808	18-Jul-76	Domestic	NE	22	24	4	5	30.5	Yes

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387810		Domestic	SW	9	24	2	5	36.6	
387812	10-Jul-70	Domestic	NW	9	24	2	5	33.5	
387813	25-Oct-82	Stock	SE	23	24	4	5	64.0	Yes
387815		Domestic	SW	23	24	4	5		
387816	09-Nov-74	Domestic	NW	9	24	2	5	94.5	
387817		Domestic	NE	24	24	4	5	30.5	
387819	22-Oct-77	Unknown	NE	24	24	4	5	36.6	
387820	24-Oct-79	Stock	NE	24	24	4	5	39.6	
387821	21-May-86	Domestic	16	13	23	5	5	24.4	
387822	05-Jul-85	Domestic & Stock	SE	25	24	4	5	39.6	Yes
387823	28-Jun-87	Domestic & Stock	SE	25	24	4	5	41.1	Yes
387825	14-Aug-80	Stock	SW	25	24	4	5	30.5	Yes
387826		Domestic	NW	9	24	2	5	45.7	
387829		Domestic	NE	9	24	2	5	68.6	
387830		Domestic	NE	9	24	2	5	33.5	
387831		Domestic	NW	27	24	4	5	77.7	
387832		Domestic	NE	9	24	2	5	27.4	
387835	01-Jul-74	Domestic	NE	9	24	2	5	73.2	
387836	01-Jan-76	Stock	SW	28	24	4	5	18.3	
387838	18-Aug-84	Stock	NW	28	24	4	5	33.5	
387840	07-Dec-77	Domestic	NE	9	24	2	5	75.0	
387841	27-Oct-72	Stock	NE	28	24	4	5	30.5	
387842	12-Apr-85	Stock	NE	28	24	4	5	33.5	
387845		Domestic	SE	30	24	4	5	3.7	
387849		Domestic	SE	10	24	2	5	31.7	
387850		Domestic	SE	10	24	2	5	61.0	
387855	16-Jun-70	Domestic	SE	32	24	4	5	61.0	
387859		Domestic	NE	33	24	4	5	97.5	
387860		Domestic	NE	33	24	4	5	106.7	
387861	09-Jul-74	Domestic	NE	33	24	4	5	45.7	
387862	10-Nov-87	Domestic	SE	34	24	4	5	24.4	
387863	30-Aug-87	Domestic	SE	34	24	4	5	35.4	
387865		Domestic	SW	34	24	4	5	82.3	
387866	18-Mar-71	Domestic & Stock	NW	34	24	4	5	23.5	
387867	08-Sep-83	Stock	NW	34	24	4	5	35.1	
387868	06-Oct-64	Stock	SE	35	24	4	5	22.9	
387869	13-May-81	Domestic	SE	35	24	4	5	27.4	
387870	13-Apr-82	Domestic	SE	35	24	4	5	30.5	
387871	24-Oct-74	Domestic	SW	35	24	4	5	54.9	Yes
387872	08-May-72	Domestic	SW	35	24	4	5	24.4	
387873	12-Nov-81	Stock	SW	35	24	4	5	27.4	Yes
387874		Domestic	NW	35	24	4	5	45.7	
387875	16-Oct-80	Stock	SW	36	24	4	5	13.1	
387876	16-Apr-75	Domestic	SE	10	24	2	5	60.7	
387877	01-Jun-69	Domestic	SE	10	24	2	5	40.2	
387879	11-Jun-75	Domestic	SE	10	24	2	5	39.9	
387882	26-Mar-75	Domestic	SE	10	24	2	5	48.8	
387883		Domestic	SE	10	24	2	5	91.4	
387884		Domestic	SE	10	24	2	5	54.9	
387891	29-Jul-78	Domestic	SE	10	24	2	5	93.0	
387893	11-Aug-81	Domestic	SE	10	24	2	5	53.3	
387897		Domestic	SE	10	24	2	5		
387902		Domestic	SE	10	24	2	5	128.0	
387903	07-May-87	Domestic	1	10	24	2	5	91.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387904	13-Aug-60	Unknown	8	10	24	2	5	33.8	
387905	16-May-73	Domestic	SW	10	24	2	5	61.0	
387907		Unknown	SW	10	24	2	5	61.0	
387908		Unknown	SW	10	24	2	5	51.8	
387910	01-Jan-55	Unknown	SW	1	24	3	5	32.9	
387912	12-Sep-72	Domestic	SW	10	24	2	5	64.0	
387914	01-Nov-80	Domestic	SW	1	24	3	5	48.8	
387916	09-Apr-76	Domestic	SW	10	24	2	5	54.9	
387917	01-Jan-71	Domestic	SW	10	24	2	5	62.5	
387918	01-Nov-80	Domestic	SW	1	24	3	5	42.7	
387920	14-Jul-77	Domestic	SW	10	24	2	5	39.6	
387922		Domestic	SW	10	24	2	5	48.8	
387923	15-Aug-74	Unknown	SW	10	24	2	5	47.2	
387925		Domestic	NW	10	24	2	5		
387926		Domestic	NW	10	24	2	5	24.7	
387927		Domestic	NW	10	24	2	5	30.5	
387929	01-Jan-55	Unknown	NW	10	24	2	5	39.6	
387932	01-Oct-70	Domestic	NW	10	24	2	5	27.4	
387933	09-Jan-81	Domestic	SW	1	24	3	5	48.8	
387934	28-Feb-74	Domestic	NW	10	24	2	5	140.2	
387936	29-May-81	Domestic	SW	1	24	3	5	41.1	
387937	06-Mar-73	Domestic	NW	10	24	2	5	42.7	
387938	19-May-81	Domestic	SW	1	24	3	5	91.4	
387939	01-Sep-74	Domestic	NW	10	24	2	5	28.7	
387940	11-Jun-81	Domestic	SW	1	24	3	5	86.9	
387941	09-Jun-81	Domestic	SW	1	24	3	5	91.4	
387942		Domestic	NW	10	24	2	5	36.6	
387943	21-Jul-77	Domestic	NW	10	24	2	5	15.2	
387944	27-Oct-79	Domestic	NW	10	24	2	5	68.3	
387946		Domestic	NW	10	24	2	5	53.3	
387947	06-Sep-88	Domestic	NW	10	24	2	5	85.3	
387951	13-Mar-89	Domestic	NW	10	24	2	5	54.9	
387953	24-Jun-81	Domestic	SW	1	24	3	5	45.7	
387954		Domestic	NW	10	24	2	5		
387955		Domestic	NE	10	24	2	5		
387956	31-Jul-81	Domestic	SW	1	24	3	5	45.7	
387957		Domestic	NE	10	24	2	5	62.8	
387958	28-Aug-76	Domestic	NE	10	24	2	5	15.8	
387959	18-Jun-81	Domestic	SW	1	24	3	5	91.4	
387960	25-Jun-81	Domestic	SW	1	24	3	5	91.4	
387961	25-Jun-75	Domestic	NE	10	24	2	5	61.0	
387962	14-Sep-84	Domestic	SW	1	24	3	5	45.7	
387963	01-Nov-71	Domestic	NE	10	24	2	5	42.7	
387964	01-May-87	Domestic	SW	1	24	3	5	61.0	
387965	04-May-87	Domestic	SW	1	24	3	5	33.5	
387966	05-May-87	Domestic	SW	1	24	3	5	29.0	
387967	13-Jun-78	Domestic	15	10	24	2	5	36.6	
387968	07-May-87	Domestic	SW	1	24	3	5	33.5	
387969		Domestic	NE	10	24	2	5	128.0	
387970	22-Jun-81	Domestic	SW	1	24	3	5	46.3	
387971	14-Oct-83	Domestic	16	10	24	2	5	42.7	
387972	09-Sep-81	Domestic	SW	1	24	3	5	32.0	
387973	11-Aug-81	Domestic	SW	1	24	3	5	32.0	
387974		Domestic	NE	10	24	2	5	7.6	
387975		Domestic		10	24	2	5	85.3	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
387976		Domestic		10	24	2	5	54.9	
387977		Domestic	NW	1	24	3	5		
387978	26-Mar-69	Domestic	NE	1	24	3	5	42.7	
387979		Domestic		1	24	3	5	48.8	
387980	13-Mar-84	Domestic	SE	2	24	3	5	24.4	
387981	07-Mar-89	Domestic	SE	2	24	3	5	29.0	
387982	04-Jun-74	Domestic	SH	2	24	3	5	30.5	
387983		Domestic	SH	2	24	3	5	25.9	
387984	03-May-75	Domestic	SH	2	24	3	5	36.6	
387985		Domestic	SH	2	24	3	5	18.3	
387986		Domestic	SW	2	24	3	5	18.3	
387987	17-Jun-74	Domestic	SW	2	24	3	5	18.3	
387988	18-Jun-74	Domestic	SW	2	24	3	5	36.6	
387989	12-Jun-74	Domestic	SW	2	24	3	5	30.5	
387990	17-Jun-74	Domestic	SW	2	24	3	5	24.4	
387991	14-Jun-74	Domestic	SW	2	24	3	5	51.8	
387992	13-Jun-74	Domestic	SW	2	24	3	5	67.1	
387993	26-Jun-64	Domestic	SW	2	24	3	5	46.9	
387994	15-Jul-74	Domestic	SW	2	24	3	5	42.7	
387995	15-Aug-74	Domestic	SW	2	24	3	5	28.3	
387996		Domestic	SW	2	24	3	5	44.2	
387997		Domestic	SW	2	24	3	5	12.2	
387998	09-Jun-87	Domestic & Stock	SW	2	24	3	5	41.1	
387999	09-Jun-87	Domestic & Stock	SW	2	24	3	5	47.2	
388000		Domestic	SW	2	24	3	5	27.4	
388041		Domestic	12	10	24	2	5	50.3	
388046	06-Dec-74	Domestic		10	24	2	5	112.8	
388052		Domestic	SE	11	24	2	5	53.6	
388054	06-Oct-71	Domestic	NW	11	24	2	5	100.6	
388055	01-Sep-64	Domestic	NW	11	24	2	5	108.5	
388056	18-Oct-76	Domestic	NE	11	24	2	5	86.9	
388062	28-Jul-87	Domestic	SW	12	24	2	5	121.9	
388089	06-Aug-62	Domestic	SW	2	24	3	5	35.7	
388092		Domestic	SE	15	24	2	5	41.8	
388094		Domestic	SE	15	24	2	5	35.7	
388095	15-Apr-71	Domestic	SE	15	24	2	5	39.6	
388096	01-Apr-58	Domestic	SE	15	24	2	5	68.6	
388097	04-Nov-70	Domestic	1	15	24	2	5	40.8	
388098		Domestic	SE	15	24	2	5	30.5	
388099		Domestic	SE	15	24	2	5	45.7	
388100			5	2	24	3	5	38.4	
388102	01-Jul-70	Domestic	NW	2	24	3	5	26.5	
388104		Domestic	NW	2	24	3	5		
388105		Domestic	SW	15	24	2	5	76.2	
388106		Domestic	NW	2	24	3	5		
388107	27-Oct-78	Industrial	13	2	24	3	5	43.3	
388109		Domestic	NE	2	24	3	5		
388110		Domestic	SW	2	24	3	5	61.0	
388111		Domestic	NW	3	24	3	5	21.3	
388112	09-May-73	Domestic & Stock	NW	3	24	3	5	25.9	
388113	04-Jun-75	Domestic & Stock	NE	3	24	3	5	62.5	
388114	27-Sep-61	Domestic	NE	3	24	3	5	54.9	
388115	12-Sep-84	Domestic	NE	3	24	3	5	50.3	
388116		Domestic	NE	3	24	3	5		
388117	12-Nov-75	Domestic	SW	4	24	3	5	21.3	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388119	01-Nov-70	Stock	SE	5	24	3	5	27.7	
388120		Domestic	SW	5	24	3	5	41.1	
388122		Domestic	SW	5	24	3	5	48.8	
388123	01-Sep-70	Unknown	SW	5	24	3	5	68.0	
388125		Domestic	SW	5	24	3	5	28.0	
388126		Domestic	EH	5	24	3	5	27.4	
388127	16-Jun-88	Domestic	SW	5	24	3	5	48.8	
388129	08-Mar-89	Domestic	SW	5	24	3	5	61.0	
388130	23-Mar-89	Domestic	SW	5	24	3	5	50.3	
388131	24-Mar-89	Domestic	SW	5	24	3	5	24.4	
388133		Domestic	WH	5	24	3	5	45.7	
388134	01-May-71	Domestic	SW	5	24	3	5	45.1	
388135		Domestic	NW	5	24	3	5	38.1	
388136		Domestic	NW	5	24	3	5	38.1	
388137		Domestic	NW	5	24	3	5	50.3	
388138		Domestic	NW	5	24	3	5	30.5	
388139		Domestic	NW	5	24	3	5	22.9	
388140	12-Jul-83	Domestic	NW	5	24	3	5	39.6	
388142	08-Mar-89	Domestic	NW	5	24	3	5	22.9	
388144	14-Nov-89	Domestic	NW	5	24	3	5	36.6	
388145	24-Mar-70	Domestic	NW	5	24	3	5	26.8	
388147	29-Jun-67	Domestic	13	5	24	3	5	56.4	
388149	01-Aug-69	Domestic	NW	5	24	3	5	19.2	
388151	10-May-72	Domestic	NE	5	24	3	5	30.5	
388153	12-Jan-84	Domestic	NE	5	24	3	5	36.6	
388154		Domestic		5	24	3	5	36.6	
388155	22-Jun-74	Domestic		5	24	3	5	48.8	
388157		Domestic	NW	15	24	2	5	30.5	
388158		Domestic	NW	15	24	2	5	57.9	
388159	01-Sep-69	Domestic	NW	15	24	2	5	37.8	
388160		Unknown	NW	15	24	2	5	128.0	
388161		Domestic & Stock	NW	15	24	2	5	77.7	
388162	01-Jan-73	Domestic	NW	15	24	2	5	36.6	
388170		Domestic		15	24	2	5		
388171		Domestic		15	24	2	5		
388172		Domestic	NW	16	24	2	5	41.1	
388173	27-Apr-62	Domestic	NE	16	24	2	5	51.8	
388174		Domestic	NE	16	24	2	5	24.4	
388175		Domestic	NE	16	24	2	5	30.5	
388176	20-Feb-69	Domestic	NE	16	24	2	5	45.7	
388177	03-Mar-79	Domestic	16	16	24	2	5	47.5	
388179	16-Jun-87	Domestic	NE	16	24	2	5	57.9	
388180	14-Sep-82	Domestic	1	17	24	2	5	48.8	
388181	01-Jun-74	Domestic	SW	17	24	2	5	30.5	
388182	30-Sep-71	Domestic	SW	17	24	2	5	42.7	
388183		Domestic	SW	17	24	2	5	38.1	
388184		Unknown	5	17	24	2	5		
388185	17-Jun-71	Unknown	4	17	24	2	5	36.6	
388186	21-Mar-72	Unknown	NE	17	24	2	5	109.7	
388187	18-Feb-87	Stock	SE	18	24	2	5	59.7	
388188	01-Jan-60	Domestic	SW	18	24	2	5	76.2	
388190	02-Jun-67	Domestic	NW	18	24	2	5	67.1	
388192		Domestic	NW	18	24	2	5	38.1	
388193	01-Aug-71	Domestic	SE	24	23	5	5	18.3	
388194	23-Jul-74	Domestic	NW	18	24	2	5	21.3	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388195	25-Jun-77	Domestic	NW	18	24	2	5	39.6	
388196		Domestic	NE	24	23	5	5	70.1	
388197	01-Aug-71	Domestic	NE	24	23	5	5	45.7	
388198		Domestic	NE	24	23	5	5	57.9	
388200		Domestic	NE	24	23	5	5	48.8	
388201		Unknown	NE	24	23	5	5		
388203	20-Jul-78	Domestic	11	18	24	2	5	20.1	
388204	20-Jul-72	Unknown	SW	25	23	5	5	18.3	
388205	16-May-79	Domestic	11	18	24	2	5	22.9	
388206		Unknown	NW	25	23	5	5		
388207	05-May-80	Domestic	NW	18	24	2	5	18.3	
388208	01-Mar-71	Domestic	NE	25	23	5	5	38.1	
388209	26-Nov-79	Domestic	15	18	24	2	5	56.4	
388210	20-Aug-76	Domestic	NH	27	23	5	5	22.9	
388213	22-Jan-86	Domestic	13	18	24	2	5	22.9	
388215	13-Jan-86	Domestic	NW	18	24	2	5	29.0	
388216	11-Feb-87	Domestic	NW	18	24	2	5	30.5	
388219	17-Feb-87	Domestic	NW	18	24	2	5	41.1	
388220	30-Apr-87	Domestic	NW	18	24	2	5	19.8	
388221	29-Jun-89	Domestic	NW	18	24	2	5	19.8	
388223	11-Oct-89	Domestic	NW	18	24	2	5	22.9	
388224	13-Oct-89	Domestic	NW	18	24	2	5	22.6	
388227	01-Apr-60	Domestic	NW	18	24	2	5	59.7	
388232	11-Dec-87	Domestic	NH	18	24	2	5	51.8	
388239	23-Apr-71	Domestic	NE	18	24	2	5	121.3	
388246	01-Jan-68	Domestic	NE	18	24	2	5	47.2	
388247	01-Nov-70	Industrial	NE	18	24	2	5	27.7	
388249	19-Jul-74	Domestic	NE	18	24	2	5	115.8	
388250	01-May-73	Domestic & Stock	NE	18	24	2	5	62.5	
388252	01-Aug-71	Domestic	NE	18	24	2	5	126.5	
388253	01-May-73	Domestic & Stock	NE	18	24	2	5	158.5	
388255	03-Sep-69	Domestic	NE	18	24	2	5	164.6	
388256	30-May-77	Domestic	NE	18	24	2	5	50.0	
388257		Domestic	NE	18	24	2	5	152.4	
388258	23-Oct-87	Domestic	NE	18	24	2	5	59.4	
388260	10-Oct-87	Domestic	NE	18	24	2	5	61.0	
388262	14-Jul-86	Domestic	11	18	24	2	5	33.5	
388264	11-May-68	Domestic	SE	19	24	2	5	86.9	
388267	06-May-76	Domestic	SE	19	24	2	5	121.9	
388270	01-Nov-80	Domestic	SE	19	24	2	5	97.5	
388273	01-Nov-80	Domestic	SE	19	24	2	5	115.8	
388276	28-May-82	Domestic	SE	19	24	2	5	151.5	
388279		Domestic	SE	19	24	2	5		
388280		Domestic	7	19	24	2	5	13.7	
388282		Domestic	SW	19	24	2	5	10.7	
388299		Domestic	NE	7	24	3	5	54.9	
388300	07-Sep-89	Domestic & Stock	SE	9	24	3	5	59.4	Yes
388301	03-Dec-88	Domestic & Stock	NW	9	24	3	5	36.6	
388302	30-Sep-76	Domestic	SE	10	24	3	5	42.7	
388303		Domestic	SH	11	24	3	5	24.4	
388304	18-Apr-74	Domestic	SW	11	24	3	5	41.5	
388305	22-Apr-74	Domestic	SW	11	24	3	5	36.6	
388306	17-Apr-74	Domestic	SW	11	24	3	5	48.2	
388307	23-Apr-74	Domestic	SW	11	24	3	5	42.7	
388308	01-Jul-81	Municipal	SW	11	24	3	5	28.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388309		Domestic	SW	11	24	3	5	61.0	
388310		Domestic	6	11	24	3	5	29.9	
388311	09-Sep-76	Domestic	NW	11	24	3	5	21.3	
388312		Domestic	NW	11	24	3	5	4.3	
388313		Domestic	NW	11	24	3	5		
388314	02-Jun-86	Domestic & Stock	NE	11	24	3	5	41.1	
388316	01-Aug-81	Domestic	SW	12	24	3	5	22.9	
388317	01-May-84	Domestic	SW	12	24	3	5	61.0	
388325	13-Jul-89	Domestic	NW	12	24	3	5	50.3	
388326	08-Nov-65	Domestic	SW	19	24	2	5	18.6	
388327		Domestic	SW	19	24	2	5	13.7	
388328		Domestic	1	19	24	2	5	64.0	
388329		Domestic	SW	19	24	2	5	51.8	
388330		Domestic	SW	19	24	2	5	51.8	
388331		Domestic	SW	19	24	2	5	33.5	
388332		Domestic	SW	19	24	2	5	19.8	
388333		Domestic	SW	19	24	2	5	18.3	
388335	03-Jun-82	Domestic	SW	19	24	2	5	66.1	
388336	19-Aug-87	Domestic	SW	19	24	2	5	108.2	
388337		Domestic	NW	19	24	2	5	48.8	
388338		Domestic & Stock	NW	19	24	2	5	48.8	
388339		Domestic	NW	19	24	2	5		
388340	01-Dec-74	Domestic	NW	19	24	2	5	54.9	
388342	03-Nov-71	Domestic	NW	19	24	2	5	61.0	
388344		Domestic	NW	19	24	2	5	45.7	
388345		Domestic	NW	19	24	2	5	36.6	
388346	10-Oct-78	Domestic	NW	19	24	2	5	61.0	
388347	01-Jul-70	Domestic	NW	19	24	2	5	54.9	
388351		Domestic	NW	19	24	2	5	64.0	
388352		Domestic	NW	19	24	2	5	54.9	
388353	08-May-80	Domestic	NW	19	24	2	5	82.3	
388356	21-Jun-76	Stock	NE	19	24	2	5	160.6	
388357		Domestic	NE	19	24	2	5	18.3	
388359		Domestic	NE	19	24	2	5	33.5	
388361	30-Jul-58	Unknown		19	24	2	5	53.3	
388363		Domestic		19	24	2	5	15.2	
388366		Domestic		19	24	2	5	21.3	
388367	16-Apr-76	Domestic	SE	2	24	2	5	67.1	
388368		Domestic	SE	20	24	2	5	56.4	
388369		Domestic	SW	4	25	3	5	45.7	
388370	01-Sep-70	Domestic	SW	4	25	3	5	30.5	
388371		Domestic	SE	20	24	2	5	32.0	
388372		Domestic	SW	4	25	3	5	116.1	
388374	18-Apr-77	Domestic	SE	20	24	2	5	15.2	
388375	09-Jun-76	Domestic	SW	20	24	2	5	94.5	
388376	02-Jun-77	Municipal	3	5	25	3	5	139.3	
388377	01-Sep-74	Domestic	SW	20	24	2	5	75.3	
388379		Domestic	SW	20	24	2	5	67.1	
388380	30-Nov-79	Domestic	SW	20	24	2	5	61.0	
388385	18-May-76	Domestic & Stock	NW	20	24	2	5	82.3	
388387	11-Oct-83	Stock	1	6	25	3	5	24.4	
388388	10-Aug-78	Domestic	4	6	25	3	5	36.6	
388389	17-Mar-77	Domestic	NW	20	24	2	5	36.6	
388393	14-Apr-89	Domestic	SW	6	25	3	5	73.2	
388395		Domestic	SE	10	24	2	5	40.2	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388397	06-Sep-74	Domestic	SE	21	24	2	5	42.7	
388401	15-Mar-76	Domestic	SE	21	24	2	5	67.7	
388402	14-Jul-89	Domestic	NW	12	24	3	5	36.9	
388404	19-May-72	Domestic	SE	21	24	2	5	41.1	
388405		Domestic	NE	12	24	3	5	77.7	
388407	07-Oct-88	Domestic	SE	21	24	2	5	54.9	
388409		Domestic	SW	13	24	3	5	19.8	
388411	01-Apr-80	Domestic	SW	13	24	3	5	30.5	
388412	14-Aug-94	Domestic	SW	21	24	2	5	82.9	
388413	11-Feb-88	Domestic	SW	13	24	3	5	32.0	
388416	15-Feb-88	Domestic	SW	13	24	3	5	32.0	
388417	12-Feb-88	Domestic	SW	13	24	3	5	32.0	
388420		Domestic	SW	13	24	3	5		
388421	06-May-75	Domestic	SW	21	24	2	5	64.0	
388422	28-Feb-75	Domestic	NW	14	24	3	5	26.2	
388424		Domestic	NW	14	24	3	5		
388426		Domestic	WH	21	24	2	5	30.5	
388427	11-Jun-73	Domestic	NW	21	24	2	5	61.0	
388428	01-Jan-59	Unknown	11	21	24	2	5	38.1	
388432		Domestic	NW	14	24	3	5	18.3	
388434		Domestic	NE	14	24	3	5	9.1	
388435	01-Jan-71	Domestic	SE	15	24	3	5	119.8	
388438	13-Dec-83	Domestic	SE	15	24	3	5	31.4	
388440	03-Apr-72	Domestic	SW	15	24	3	5	41.1	
388441	21-May-71	Domestic	SW	15	24	3	5	36.6	
388446	02-Jun-71	Domestic	SW	15	24	3	5	39.6	
388450	28-May-71	Domestic	SW	15	24	3	5	39.6	
388451	15-Jul-71	Domestic	SW	15	24	3	5	38.1	
388454	01-Aug-72	Domestic	SE	16	24	3	5	32.0	
388455		Domestic	NW	16	24	3	5		
388456	12-Jul-71	Domestic	NE	16	24	3	5	32.0	
388458	01-Jun-81	Domestic	NE	16	24	3	5	36.6	
388477	01-Jan-60	Unknown	SE	21	24	2	5	50.3	
388719	25-Apr-69	Domestic	SW	29	24	2	5	121.9	
388722		Domestic	3	29	24	2	5		
388731	30-Jun-76	Domestic & Stock	SE	30	24	2	5	67.1	
388734	13-Sep-71	Domestic	SE	30	24	2	5	32.0	
388735	12-Jun-66	Domestic	SE	30	24	2	5	64.0	
388737		Domestic	SE	30	24	2	5	91.4	
388738	10-May-77	Domestic	SW	30	24	2	5	32.0	
388739	01-Jun-76	Domestic	SW	30	24	2	5	53.6	
388741		Domestic	SW	30	24	2	5		
388745	01-Oct-73	Unknown	9	30	24	2	5	217.0	
388859	01-Apr-84	Domestic	NE	16	24	3	5	33.5	
388860	07-Sep-89	Domestic	NE	16	24	3	5	29.6	
388861	08-Sep-89	Domestic	NE	16	24	3	5	29.6	
388862	22-May-79	Domestic & Stock	SE	17	24	3	5	39.6	
388863		Domestic	SW	17	24	3	5	29.3	
388864		Domestic	SW	17	24	3	5	22.9	
388865		Domestic	SW	17	24	3	5	41.5	
388866	25-Nov-81	Domestic	NW	17	24	3	5	42.7	
388867	01-Nov-68	Stock	NE	17	24	3	5	43.3	
388868		Domestic	NE	17	24	3	5	54.9	
388869		Domestic	SW	18	24	3	5		
388870	02-Dec-80	Domestic	SW	18	24	3	5	15.2	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388871	02-Dec-80	Domestic	SW	18	24	3	5	15.2	
388872	25-Apr-77	Domestic	SW	18	24	3	5	48.8	
388873		Domestic	SW	18	24	3	5		
388874	10-Jul-69	Domestic	SE	19	24	3	5	51.8	
388875	02-Nov-82	Stock	NW	19	24	3	5	61.0	
388876	15-Nov-68	Domestic	NE	19	24	3	5	30.5	
388877	16-Jun-81	Domestic	SW	1	24	3	5	41.1	
388879	21-May-81	Domestic	SW	1	24	3	5	45.7	
388880		Domestic	SW	13	24	3	5	28.3	
388881	19-Feb-79	Domestic	SW	13	24	3	5	28.7	
388890	19-Dec-66	Stock	SE	20	24	3	5	30.5	
388891		Domestic	SE	20	24	3	5		
388892	23-Sep-80	Unknown	NE	20	24	3	5	36.6	
388893	28-Mar-81	Domestic	NE	20	24	3	5	39.6	
388894	24-Feb-87	Domestic	NE	20	24	3	5	36.6	
388895	12-Aug-88	Domestic & Stock	NE	20	24	3	5	22.9	
388896		Unknown		20	24	3	5	18.9	
388897	29-Nov-74	Domestic	SE	21	24	3	5	29.0	
388898	09-Mar-73	Domestic	SE	21	24	3	5	24.4	
388899	01-Apr-73	Domestic	SE	21	24	3	5	25.9	
388900		Domestic	SE	21	24	3	5	41.8	
388901	01-Feb-78	Domestic	SE	21	24	3	5	36.6	
388902	06-Jan-88	Domestic	SE	21	24	3	5	30.5	
388903	23-Jul-88	Domestic	SE	21	24	3	5	21.3	
388904		Domestic	SE	21	24	3	5		
388905	05-Mar-71	Domestic	SW	21	24	3	5	93.3	
388906	19-Jun-85	Domestic	SW	21	24	3	5	74.7	
388907	17-Jan-75	Domestic	NW	21	24	3	5	25.9	
388908	04-Mar-75	Domestic	NW	21	24	3	5	24.4	
388909	21-Feb-75	Domestic	NW	21	24	3	5	24.4	
388910	25-Jan-75	Domestic	NW	21	24	3	5	24.4	
388911		Domestic	NW	21	24	3	5	54.9	
388912	05-Mar-81	Domestic	NW	21	24	3	5	45.7	
388913	29-May-87	Domestic	NW	21	24	3	5	40.8	
388914	26-May-77	Domestic	9	21	24	3	5	24.7	
388915	01-Aug-78	Domestic	NE	21	24	3	5	19.8	
388916		Domestic	NE	21	24	3	5		
388917	01-Feb-86	Domestic	NE	21	24	3	5	30.5	
388918	01-Mar-86	Domestic	NE	21	24	3	5	30.5	
388919	01-Mar-86	Domestic	NE	21	24	3	5	30.5	
388920		Domestic		21	24	3	5	27.4	
388921	28-Mar-72	Domestic	SW	22	24	3	5	23.5	
388922	23-Mar-89	Domestic	SW	22	24	3	5	24.4	
388923		Domestic	NW	22	24	3	5	18.3	
388924	21-Apr-75	Domestic	NW	22	24	3	5	24.4	
388925		Domestic	NW	22	24	3	5	33.5	
388926	09-Apr-88	Domestic	NW	22	24	3	5	27.4	
388927	13-Apr-88	Domestic	NW	22	24	3	5	32.0	
388928	24-Mar-89	Domestic	NW	22	24	3	5	61.0	
388929	06-Apr-89	Domestic	NW	22	24	3	5	22.9	
388930	06-Apr-89	Domestic	NW	22	24	3	5	22.9	
388931		Domestic	NW	22	24	3	5	28.0	
388932		Domestic	NW	22	24	3	5	19.8	
388933		Domestic	NW	22	24	3	5	30.5	
388934	21-Apr-75	Domestic	11	22	24	3	5	24.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
388935	18-Apr-75	Domestic	12	22	24	3	5	24.4	
388936		Domestic	13	22	24	3	5	30.5	
388937	16-Jul-71	Domestic	NW	22	24	3	5	30.5	
388938		Domestic	13	22	24	3	5	21.3	
388939	10-Aug-69	Domestic	NW	22	24	3	5	30.5	
388940	15-Aug-79	Stock	NE	22	24	3	5	67.1	
388941		Domestic		22	24	3	5	25.9	
388942	27-Jul-66	Domestic & Stock	SE	23	24	3	5	21.9	
388943		Domestic	SH	23	24	3	5	24.4	
388945	26-Oct-77	Domestic	SW	23	24	3	5	27.4	
388946	24-Jul-85	Domestic	SW	23	24	3	5	29.9	
388947		Domestic	WH	23	24	3	5	27.4	
388948	20-Jun-68	Domestic	NW	23	24	3	5	27.4	
388949	15-Sep-69	Domestic	NW	23	24	3	5	36.6	
388950	30-Apr-71	Domestic	NW	23	24	3	5	55.2	
388951	01-Dec-70	Domestic	NW	23	24	3	5	70.1	
388952		Domestic	NW	23	24	3	5	36.6	
388953		Domestic	NW	23	24	3	5	29.3	
388954		Domestic	NW	23	24	3	5	30.5	
388955	03-Apr-79	Domestic	NW	23	24	3	5	37.8	
388956	31-Jul-79	Unknown	NW	23	24	3	5	54.9	
388957		Domestic	NW	23	24	3	5	33.5	
388958	18-Apr-67	Domestic	NW	23	24	3	5	35.1	
388959	28-Oct-86	Domestic	NW	23	24	3	5	22.9	
388960	17-May-88	Domestic	NW	23	24	3	5	30.8	
388961		Domestic	14	23	24	3	5	27.4	
388962	27-Apr-72	Domestic	16	23	24	3	5	45.7	
388963	14-Nov-79	Domestic	16	23	24	3	5	67.1	
388964	01-Jul-79	Domestic	SE	24	24	3	5	18.3	
388990	25-Aug-84	Domestic	SW	1	25	4	5	25.0	
388992	26-May-89	Stock	SW	1	25	4	5	45.7	
389012	01-Jan-72	Domestic	NW	3	25	4	5	8.8	
389030	16-Dec-77	Domestic	SE	24	24	3	5	36.6	
389031		Domestic	SW	24	24	3	5		
389033	02-Nov-40	Domestic & Stock	NW	24	24	3	5	30.5	
389036	02-Nov-50	Domestic & Stock	NW	24	24	3	5	30.5	
389038	20-Oct-70	Domestic	NW	24	24	3	5	45.7	
389039	26-Jan-78	Municipal	NW	24	24	3	5	17.1	
389041		Domestic	NW	24	24	3	5		
389042		Domestic	NW	24	24	3	5	9.1	
389043		Domestic	NW	24	24	3	5	30.5	
389044	15-Nov-80	Domestic	NW	24	24	3	5	45.7	
389045	23-May-70	Domestic	13	24	24	3	5	48.8	
389046		Domestic	NH	24	24	3	5	25.9	
389047	01-Aug-74	Unknown	SE	25	24	3	5	61.0	
389048	03-Jan-68	Domestic	SE	25	24	3	5	36.6	
389049		Domestic	SE	25	24	3	5	53.6	
389051		Domestic	SE	25	24	3	5	73.2	
389052		Domestic	SE	25	24	3	5	50.3	
389053	13-Jan-88	Domestic	SE	25	24	3	5	61.0	
389054		Domestic	SW	25	24	3	5	57.9	
389056		Domestic	SW	25	24	3	5	70.1	
389057	28-Nov-69	Domestic	SW	25	24	3	5	79.2	
389058	10-Aug-75	Domestic	SW	25	24	3	5	58.5	
389060		Domestic	SW	25	24	3	5	45.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
389061	02-Jan-71	Stock	SW	25	24	3	5	67.1	
389062	30-Jun-74	Domestic	SW	25	24	3	5	24.4	
389067		Domestic	SW	25	24	3	5	56.4	
389068		Domestic	SW	25	24	3	5	33.5	
389069	01-Aug-80	Domestic & Stock	SW	25	24	3	5	36.6	
389070	14-May-80	Domestic	5	25	24	3	5	33.5	
389071	31-Aug-82	Stock	SW	25	24	3	5	48.8	
389072	15-Aug-88	Domestic & Stock	SW	25	24	3	5	65.5	
389073		Domestic	SW	25	24	3	5		
389074	25-Apr-89	Domestic	SW	25	24	3	5	79.2	
389075	09-Jun-71	Domestic	NE	25	24	3	5	36.6	
389076		Domestic	NE	25	24	3	5	64.9	
389077	01-Apr-74	Domestic	SE	26	24	3	5	39.6	
389078	09-Apr-74	Domestic	SE	26	24	3	5	59.4	
389079	14-Apr-87	Domestic	SE	26	24	3	5	121.9	
389080	12-Jul-88	Domestic	SE	26	24	3	5	48.8	
389081	25-Aug-88	Domestic	SE	26	24	3	5	42.7	
389082	25-Aug-88	Domestic	SE	26	24	3	5	67.1	
389083	26-Aug-88	Domestic	SE	26	24	3	5	48.8	
389084	03-Apr-89	Domestic	SE	26	24	3	5	43.9	
389085	26-Jun-76	Domestic	1	26	24	3	5	36.6	
389086	01-Jul-73	Domestic	SW	26	24	3	5	27.4	
389087	01-Oct-80	Domestic	SW	26	24	3	5	47.2	
389088	09-Mar-74	Domestic	SW	26	24	3	5	39.6	
389089	26-May-77	Domestic	SW	26	24	3	5	41.1	
389090	07-Jul-77	Domestic	SW	26	24	3	5	15.2	
389091	27-Feb-77	Domestic	SW	26	24	3	5	23.2	
389092		Domestic	SW	26	24	3	5	36.6	
389093	18-May-79	Domestic & Stock	SW	26	24	3	5	32.0	
389094		Domestic	SW	26	24	3	5	61.0	
389095	06-Jun-87	Domestic	SW	26	24	3	5	61.0	
389096	01-Jun-87	Domestic	SW	26	24	3	5	45.7	
389097		Domestic	SW	26	24	3	5	33.5	
389098	29-Mar-76	Stock	SW	26	24	3	5	21.3	
389099		Unknown		26	24	3	5	22.9	
389100		Domestic		26	24	3	5	61.0	
389101	11-Apr-79	Domestic	SE	27	24	3	5	53.3	
389102		Domestic	SE	27	24	3	5	30.5	
389103		Domestic	SE	27	24	3	5	48.8	
389104		Domestic	SE	27	24	3	5	12.2	
389105		Domestic	SE	27	24	3	5	39.6	
389106		Domestic	SE	27	24	3	5	39.6	
389107		Domestic	SE	27	24	3	5		
389108		Domestic	SE	27	24	3	5	51.8	
389109		Domestic	SE	27	24	3	5		
389110	05-Jul-73	Domestic	SH	27	24	3	5	27.4	
389111	15-Mar-73	Domestic	SH	27	24	3	5	30.5	
389112	15-Feb-73	Domestic	SH	27	24	3	5	30.5	
389113	29-Jun-73	Domestic	SH	27	24	3	5	30.5	
389114	22-Jun-73	Domestic	SE	27	24	3	5	30.5	
389115	10-Jul-73	Domestic	SH	27	24	3	5	30.5	
389116	13-Jul-73	Domestic	SH	27	24	3	5	30.5	
389124	20-Feb-73	Domestic	SH	27	24	3	5	30.5	
389125	24-Feb-73	Domestic	SH	27	24	3	5	28.7	
389127	27-Jun-73	Domestic	SH	27	24	3	5	27.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
389128	13-Jun-73	Domestic	SH	27	24	3	5	27.4	
389130	20-Jun-73	Domestic	SH	27	24	3	5	39.6	
389132		Domestic	SH	27	24	3	5	64.6	
389134		Domestic	SH	27	24	3	5		
389135	01-Aug-71	Industrial	SW	27	24	3	5	85.3	
389136		Domestic	SW	27	24	3	5	85.3	
389137	15-Feb-70	Unknown	SW	27	24	3	5	103.6	
389139	26-Aug-78	Domestic	SW	27	24	3	5	41.1	
389141		Domestic	SW	27	24	3	5	36.6	
389142	21-Aug-80	Domestic	SW	27	24	3	5	42.7	
389144		Domestic	SW	27	24	3	5	30.5	
389146		Domestic	SW	27	24	3	5	57.9	
389147		Domestic	SW	27	24	3	5		
389148		Domestic	SW	27	24	3	5	76.2	
389149	05-Oct-88	Domestic	SW	27	24	3	5	35.1	
389151		Domestic	SW	27	24	3	5	42.7	
389152	13-Dec-66	Domestic	NW	27	24	3	5	36.6	
389153	21-Jun-76	Unknown	NW	27	24	3	5	27.4	
389155		Domestic	NW	27	24	3	5	76.2	
389156		Domestic	NW	27	24	3	5	27.4	
389157		Domestic	NW	27	24	3	5	16.8	
389158	23-Sep-75	Domestic	NE	27	24	3	5	18.9	
389166	26-Sep-75	Domestic	NE	27	24	3	5	16.8	
389167	27-Jun-75	Domestic	NE	27	24	3	5	18.3	
389169	26-Jun-75	Domestic	NE	27	24	3	5	24.1	
389170	06-Oct-75	Domestic	NE	27	24	3	5	38.1	
389172	21-Jul-75	Domestic	NE	27	24	3	5	27.1	
389174	01-Jul-83	Domestic	NE	27	24	3	5	51.8	
389176	01-Jul-75	Domestic	NE	27	24	3	5	23.8	
389178	18-Dec-74	Domestic	NE	27	24	3	5	24.1	
389180	06-Mar-81	Domestic	NE	27	24	3	5	18.6	
389182	12-Aug-85	Domestic & Stock	NE	27	24	3	5	24.1	
389183		Domestic		27	24	3	5		
389184	22-Oct-76	Domestic	SE	28	24	3	5	21.3	
389185	24-Aug-76	Stock	SE	28	24	3	5	18.3	
389186	14-Jul-76	Unknown	7	28	24	3	5	18.3	
389187		Domestic	SE	28	24	3	5	18.3	
389188		Domestic	SE	28	24	3	5	16.8	
389189		Domestic	SE	28	24	3	5	27.4	
389192	01-Jan-71	Domestic	SW	28	24	3	5	25.9	
389194	01-May-71	Domestic	SW	28	24	3	5	25.6	
389196		Domestic	SW	28	24	3	5	12.2	
389198		Domestic	SW	28	24	3	5	39.6	
389199	02-May-86	Domestic & Stock	SW	28	24	3	5	24.4	
389201	03-Oct-89	Domestic & Stock	SW	28	24	3	5	22.9	
389202	02-Oct-75	Irrigation	SW	28	24	3	5	10.7	
389211	01-Oct-75	Domestic	SW	28	24	3	5	12.2	
389212	18-Mar-77	Domestic	SW	28	24	3	5	30.5	
389213	23-Nov-72	Domestic	NW	28	24	3	5	48.8	
389214		Domestic	NW	28	24	3	5	30.5	
389215		Domestic	NW	28	24	3	5	11.3	
389216		Domestic	NE	28	24	3	5	42.1	
389217	27-Jun-74	Domestic & Stock	NE	28	24	3	5	15.5	
389218	16-Oct-76	Domestic	NE	28	24	3	5	24.4	
389219	07-Mar-70	Domestic	NE	28	24	3	5	36.6	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
389220		Domestic	NE	28	24	3	5	30.5	
389221		Domestic	NE	28	24	3	5		
389222		Stock		28	24	3	5	37.2	
389223		Stock		28	24	3	5	13.7	
389233		Domestic	SE	29	24	3	5	15.2	
389234		Domestic	SE	29	24	3	5	14.0	
389235		Domestic	SE	29	24	3	5	13.7	
390220	23-Nov-78	Domestic	NE	17	24	3	5	31.1	
390238	11-Jul-79	Domestic	SE	17	24	3	5	4.9	
390430	18-Sep-94	Domestic	SE	10	24	4	5	48.8	
390484	12-Dec-79	Stock	SW	1	24	5	5	9.1	
390485	12-Dec-79	Stock	NW	1	24	5	5	27.4	
390489		Domestic	NH	33	24	4	5	24.4	
390490	01-Oct-74	Domestic	SE	13	24	4	5	3.7	
390593	23-Sep-64	Domestic	NE	23	23	2	5	27.4	
390594	07-Jul-68	Domestic	SE	26	23	2	5	29.0	
390595	28-Dec-69	Domestic	SW	24	23	4	5	27.4	
393383	08-Jul-94	Domestic	NE	21	24	3	5	30.5	
393385	11-Jul-94	Domestic	NE	21	24	3	5	30.5	
393387	26-Sep-94	Domestic	NE	3	24	3	5	48.8	
394101	01-Jul-75	Domestic	NE	24	23	4	5	61.0	
394246		Domestic	SE	13	23	5	5	4.6	
394591	05-Jul-77	Domestic	SE	29	24	3	5	36.6	
394595	30-May-78	Domestic	SE	29	24	3	5	18.3	
394598	11-Aug-88	Domestic	SE	29	24	3	5	27.1	
394604	08-Oct-80	Stock	SW	29	24	3	5	41.1	
394610	11-Aug-88	Stock	NE	29	24	3	5	10.7	
394613		Domestic	EH	29	24	3	5	22.9	
394614		Domestic	SE	30	24	3	5	73.2	
394615	03-Nov-79	Stock	SE	30	24	3	5	76.2	
394619		Domestic	NW	30	24	3	5		
394621	11-May-66	Domestic & Stock	8	30	24	3	5	78.6	
394626		Domestic	SW	30	24	3	5	19.8	
394627	04-Jun-82	Domestic	SW	30	24	3	5	199.6	
394628	20-Sep-75	Domestic & Stock	NW	30	24	3	5	48.8	
394634		Domestic	NW	30	24	3	5	18.3	
394635	01-Dec-73	Unknown	NW	30	24	3	5	25.9	
394636		Domestic	NW	30	24	3	5		
394637	30-Apr-73	Stock	NE	31	24	3	5	51.8	
394638	09-Sep-77	Stock	SE	32	24	3	5	39.6	
394641	24-Jan-89	Stock	SE	32	24	3	5	45.7	
394646	31-Aug-74	Stock	NE	32	24	3	5	20.7	
394648		Domestic	NH	33	24	3	5	36.6	
394650	15-May-74	Stock	NE	33	24	3	5	41.1	
394654		Domestic	NE	33	24	3	5		
394668	29-Sep-78	Domestic	NE	33	24	3	5	24.4	
394670		Domestic	SE	34	24	3	5	57.9	
394673	29-Jul-74	Stock	SE	34	24	3	5	42.7	
394680		Domestic	SE	34	24	3	5		
396522	14-Sep-93	Domestic	SW	16	24	2	5	129.5	
399673	30-Sep-94	Domestic	3	35	24	4	5	80.8	
399936	08-Sep-58	Municipal	NE	28	24	3	5	31.1	
400307	15-Dec-94	Domestic	NE	22	23	5	5	18.3	
400350	22-Feb-95	Domestic	SE	2	24	3	5	30.5	
400351	08-Nov-94	Domestic & Stock	SW	3	24	4	5	24.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
400890	29-Oct-75	Domestic	2	23	23	2	5	73.2	
400894	01-Sep-84	Domestic	SE	23	23	2	5	54.9	
400897	04-Oct-85	Domestic	SE	23	23	2	5	47.2	
400898	31-Aug-88	Domestic	SE	23	23	2	5	51.8	
400899	01-Sep-88	Domestic	SE	23	23	2	5	71.6	
400900	10-May-89	Domestic	SE	23	23	2	5	71.6	
400901	03-Jun-80	Domestic	NE	23	23	2	5	32.0	
400903	01-Dec-73	Domestic	SW	24	23	2	5	54.9	
400904	21-Jun-71	Domestic	SW	25	23	2	5	34.1	
400905	08-Nov-88	Domestic	SW	25	23	2	5	22.9	
400906	01-Jun-82	Domestic	SE	26	23	2	5	34.1	
400907	22-Feb-77	Domestic	NW	28	23	2	5	47.5	
400908	25-Aug-67	Domestic	NE	34	23	2	5	24.4	
400909	22-Aug-86	Irrigation	SE	36	23	2	5	106.7	
400928	17-Sep-62	Domestic	NW	6	23	3	5	39.6	
400931	28-Oct-63	Domestic	SE	7	23	3	5	41.8	
400932	18-Oct-63	Domestic	NE	7	23	3	5	29.0	
400935	26-May-81	Domestic	NE	7	23	3	5		
400936	05-Oct-88	Domestic	NE	7	23	3	5	13.7	
400939	01-Jan-85	Domestic	8	8	23	3	5	45.7	
400942	01-Sep-82	Domestic	NE	8	23	3	5	65.5	
400943	06-Oct-64	Domestic	SE	9	23	3	5	29.0	
400944	03-Oct-64	Domestic	SE	9	23	3	5	35.1	
400946	01-Sep-82	Domestic	SW	9	23	3	5	76.2	
400947	13-Jun-81	Domestic	NW	9	23	3	5	30.5	
400948	13-Jul-80	Domestic	NE	9	23	3	5	64.0	
400979	05-Jan-81	Domestic	8	16	23	3	5	77.7	
400980	20-Sep-63	Domestic	NW	16	23	3	5	30.2	
400981	22-May-80	Domestic	NW	16	23	3	5	36.6	
400982	13-Sep-62	Domestic	SE	17	23	3	5	41.1	
400983	25-Sep-62	Domestic	NE	17	23	3	5	24.4	
400984	01-Jul-82	Domestic	NE	17	23	3	5	30.5	
400985	29-Oct-65	Domestic	SE	18	23	3	5	24.7	
400986	06-Jun-79	Domestic	9	18	23	3	5	15.2	
400987	02-Jul-80	Domestic	SW	19	23	3	5	18.3	
400988	01-Jun-84	Domestic	11	19	23	3	5	64.3	
400989	09-Sep-86	Domestic	NW	19	23	3	5	78.0	
400991	07-Sep-88	Domestic	NW	20	23	3	5	29.0	
400992	19-Aug-86	Domestic	NE	20	23	3	5	75.3	
400997	19-Jun-87	Domestic	NW	26	23	3	5	64.0	
400999	13-Mar-87	Domestic	SW	27	23	3	5		
401002	01-Jul-82	Domestic	NW	28	23	3	5	29.0	
401003	31-Oct-87	Domestic	NW	28	23	3	5	35.1	
401004	01-Jul-84	Domestic	15	28	23	3	5	20.4	
401005	06-Sep-88	Domestic	NE	28	23	3	5	41.1	
401006	01-Aug-72	Domestic	SE	29	23	3	5	51.8	
401007	15-Jun-74	Domestic	4	29	23	3	5	67.1	
401008	14-Jan-59	Domestic	NW	29	23	3	5	34.7	
401009	01-Aug-72	Domestic	NW	29	23	3	5	21.3	
401010	01-Jun-75	Domestic	SE	30	23	3	5	30.5	
401011	28-Aug-86	Domestic	SW	30	23	3	5	47.2	
401012	13-Jun-74	Domestic	13	30	23	3	5	67.1	
401013	16-Jul-87	Domestic & Stock	NW	30	23	3	5	85.3	
401014	01-May-82	Domestic	NW	31	23	3	5	27.4	
401015	20-Aug-86	Domestic	SW	32	23	3	5	65.5	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
401016	01-Feb-71	Domestic	NW	32	23	3	5	30.2	
401017	23-Aug-67	Domestic	SE	33	23	3	5	15.2	
401018	30-Oct-79	Domestic	8	33	23	3	5	65.5	
401019	01-Mar-72	Domestic	SE	34	23	3	5	61.0	
401020	01-Feb-84	Domestic	2	34	23	3	5	72.8	
401023	14-Oct-86	Domestic	SE	34	23	3	5	61.0	
401025	01-Sep-71	Domestic	SW	34	23	3	5	30.5	
401026	05-Dec-69	Domestic	SW	34	23	3	5	61.3	
401027	24-Nov-69	Domestic	SW	34	23	3	5	30.8	
401028	01-Aug-67	Domestic	NE	34	23	3	5	24.4	
401029	17-May-63	Domestic	SE	35	23	3	5	43.3	
401030	01-Jul-82	Domestic	NW	35	23	3	5	42.7	
401162	22-Sep-94	Domestic	NW	17	24	4	5	79.2	
402318	11-Mar-95	Domestic	SE	19	24	3	5	43.9	
402460	15-Mar-95	Domestic	SW	28	24	3	5	18.3	
402461	29-Mar-95	Domestic	SW	12	24	4	5	43.9	
405681	01-Dec-72	Domestic	NE	13	23	4	5	10.7	
405684	24-Sep-80	Domestic	4	16	23	4	5	5.8	
405686		Domestic	SW	19	23	4	5	27.4	
405691		Domestic	NW	19	23	4	5	49.4	
405692	09-Dec-86	Domestic	NW	19	23	4	5	89.9	
405693	10-Jun-74	Domestic	16	20	23	4	5	7.6	
405694	04-Jun-74	Domestic	16	20	23	4	5	76.2	
405696	03-Nov-87	Domestic	NE	20	23	4	5	16.8	
405697	01-Aug-85	Domestic	5	21	23	4	5	14.9	
405698	18-Dec-69	Domestic	NE	21	23	4	5	22.9	
405702	01-Aug-75	Domestic	NE	24	23	4	5	36.6	
405707	23-Oct-86	Domestic	NW	25	23	4	5	59.4	
405710		Domestic	SE	26	23	4	5	25.9	
405711	01-Dec-73	Domestic	SW	28	23	4	5	54.9	
405712	01-Dec-73	Domestic	SW	28	23	4	5	76.2	
405715		Domestic	NW	30	23	4	5	44.2	
405719	01-Aug-72	Domestic	NE	34	23	4	5	21.9	
405720	13-May-77	Domestic	NE	34	23	4	5	50.3	
405725	11-Dec-86	Domestic	SW	36	23	4	5	35.1	
405726	01-Jan-74	Domestic	NW	36	23	4	5	79.2	
405728	08-Sep-79	Domestic	NE	36	23	4	5	36.6	
405729		Industrial	16	36	23	4	5	36.6	
406610	16-Mar-95	Domestic	NW	21	24	2	5	79.2	
410254		Domestic	NE	13	23	5	5	2.4	
416038	14-May-76	Domestic & Stock	NW	18	23	4	5	109.7	
416380	12-Oct-73	Domestic	SH	6	25	3	5	61.0	
416381	29-Oct-73	Domestic	SH	6	25	3	5	79.2	
416384	29-May-80	Stock	SE	3	25	4	5	53.3	
418094	27-May-74	Domestic	NE	12	23	5	5	12.2	
418095	05-May-82	Domestic	NE	13	23	5	5	48.8	
418098	02-Aug-84	Domestic	NE	24	23	5	5	30.5	
418133	12-Jun-95	Domestic	NE	16	24	2	5	73.2	
418134	27-Jun-95	Domestic	NE	21	24	3	5	29.0	
418135	26-Jun-95	Domestic	NE	21	24	3	5	24.4	
418136	28-Jun-95	Domestic	NE	21	24	3	5	24.4	
418137	29-Jun-95	Domestic	NE	21	24	3	5	24.4	
418138	28-Jun-95	Domestic	NE	21	24	3	5	24.4	
418139	27-Jun-95	Domestic	NE	21	24	3	5	24.4	
418140	26-Jun-95	Domestic	NE	21	24	3	5	24.4	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
418398	04-Sep-76	Domestic & Stock	16	4	24	2	5	38.1	
418402	19-Apr-82	Domestic & Stock	16	4	24	2	5	39.6	
443031	08-May-98	Domestic	SE	25	24	3	5	67.1	
458862	21-Mar-01	Domestic	6	16	24	2	5	71.6	
458910	10-Oct-01	Domestic	SW	28	24	3	5	35.1	
458911	11-Oct-01	Domestic	SW	28	24	3	5	41.1	
458922	13-Jul-01	Domestic	SW	5	24	3	5	30.5	
458923	05-Jul-01	Domestic	SW	5	24	3	5	53.3	
458924	07-Apr-07	Domestic	SW	5	24	3	5	57.9	
458927	02-Nov-01	Domestic	SW	5	24	3	5	48.8	
458941	10-Oct-01	Domestic	NE	12	23	5	5	36.6	
466073	22-Apr-96	Domestic	NE	13	23	5	5	3.7	
466075	28-May-96	Domestic	12	10	24	2	5	44.2	
466076	22-Jun-96	Domestic	NW	16	24	2	5	48.8	
466078	25-Jun-96	Domestic	NE	26	24	3	5	71.6	
466081	01-Apr-96	Domestic	6	28	24	3	5	48.8	
466082	01-May-96	Domestic	6	28	24	3	5	68.3	
466083	09-Jun-96	Domestic	SW	34	24	3	5	67.1	
466085	11-Jun-96	Domestic	SW	2	24	4	5	12.2	
466086	29-Jul-96	Domestic	SW	2	24	4	5	10.7	
466087	29-Jul-96	Domestic	SW	2	24	4	5	11.3	
467131	21-Sep-96	Domestic	SE	34	23	3	5	62.2	
467132	09-Sep-96	Domestic	NW	13	23	5	5	36.6	
467135	31-Mar-97	Domestic	SW	10	24	2	5	42.7	
467137	05-Sep-96	Domestic	10	21	24	2	5	73.2	
467140	08-Jul-97	Domestic	SE	9	24	3	5	50.3	Yes
467141	09-May-97	Domestic	NE	21	24	3	5	20.1	
467142	11-Oct-96	Domestic	NE	21	24	3	5	36.6	
467143	14-May-97	Domestic	NW	22	24	3	5	21.3	
467144	13-May-97	Domestic	NW	22	24	3	5	22.9	
467145	13-May-97	Domestic	NW	22	24	3	5	22.9	
467146	07-Sep-96	Domestic	SE	21	24	3	5	28.0	
467147	26-Aug-96	Domestic	SE	21	24	3	5	42.7	
467148	09-Sep-96	Domestic	SE	21	24	3	5	28.3	
467149	04-Jun-96	Domestic	8	29	24	3	5	18.3	
467150	12-Feb-97	Domestic	SW	35	24	3	5	36.0	
467152	31-Jul-96	Domestic	SW	2	24	4	5	12.8	
467153	31-Jan-97	Domestic	SW	2	24	4	5	12.2	
467154	09-May-97	Domestic	NE	16	24	4	5	15.2	
468492	16-Sep-96	Domestic	SW	24	23	2	5	83.8	
468496	08-Jul-96	Domestic	NE	25	23	5	5	6.1	
468499	27-Aug-96	Domestic	SE	2	24	4	5	42.7	
468791	03-Oct-97	Domestic	SW	2	24	3	5	48.8	
468792	02-Oct-97	Domestic	SW	2	24	3	5	54.9	
469180	20-Nov-97	Domestic	SE	26	23	2	5	19.2	
469182	02-Dec-97	Domestic	NW	8	23	3	5	54.3	
469186	08-Aug-94	Domestic	SW	17	23	3	5	18.3	
469187	08-Jun-98	Stock	SW	19	23	4	5	24.4	
469188	23-May-98	Domestic	SE	20	23	4	5	38.1	
469196	06-May-98	Other	SW	5	24	2	5	6.4	
469197	08-Aug-97	Domestic	SW	8	24	2	5	246.9	
469198	24-Jul-97	Domestic	SW	16	24	2	5	79.2	
469200	07-Mar-98	Domestic	SW	2	24	3	5	42.7	
469201	10-Dec-97	Domestic	SW	2	24	3	5	45.1	
469202	11-Jul-98	Domestic	SW	2	24	3	5	30.5	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
469203	01-Oct-97	Domestic	SW	2	24	3	5	42.7	
469204	03-Jun-98	Domestic	SE	3	24	3	5	42.7	
469205	05-Sep-97	Domestic	SW	5	24	3	5	67.1	
469206	10-Mar-97	Industrial	SW	11	24	3	5	30.5	
469207	26-Sep-97	Domestic	NW	16	24	3	5	30.5	
469208	27-Oct-97	Domestic	SW	16	24	3	5	38.1	
469209	01-Apr-98	Domestic	NW	22	24	3	5	18.9	
469210	01-Apr-98	Domestic	NW	22	24	3	5	18.9	
469211	28-Oct-97	Domestic	7	24	24	3	5	25.6	
469212	12-May-98	Domestic	SE	25	24	3	5	65.5	
469213	30-Nov-97	Domestic	SE	26	24	3	5	42.7	
469214	06-Dec-97	Domestic	SE	2	24	4	5	61.0	
469215	17-Jul-97	Domestic	SE	2	24	4	5	51.8	
469216	15-Oct-97	Domestic	NW	10	24	4	5	45.7	Yes
491215	19-Dec-98	Industrial	12	26	23	4	5	42.7	
491218	06-Nov-98	Domestic	NE	23	23	5	5	39.6	
491221	02-Jun-98	Industrial	SE	6	24	2	5	9.4	
491432	11-Mar-99	Domestic	NW	25	24	4	5	128.0	Yes
491785	06-Sep-96	Domestic	SW	5	24	3	5	55.2	
491786	19-Feb-99	Domestic	SE	30	24	3	5	43.3	
491787	22-Feb-99	Domestic	NE	24	24	4	5	43.3	
492941	18-May-99	Domestic	SW	2	24	4	5	91.4	
492942	07-Apr-99	Domestic	SE	24	24	4	5	43.3	
492943	22-Jun-99	Domestic	NW	27	24	4	5	36.6	Yes
493333	02-Aug-95	Domestic	SW	3	24	4	5	18.3	
493361	26-May-95	Domestic	3	21	24	2	5	91.4	
494533	02-Oct-98	Domestic	SW	2	24	3	5	42.7	
494534	02-Sep-99	Domestic	SE	2	24	3	5	49.7	
494535	28-Nov-98	Stock	5	5	24	4	5	15.2	
494536	28-Nov-98	Stock	15	8	24	4	5	15.2	
494767	02-Nov-99	Domestic	NW	13	23	5	5	51.5	
494768	16-Oct-99	Domestic	10	16	24	3	5	42.7	
494769	20-Jan-99	Municipal	SW	4	25	3	5	127.4	
495256	21-Dec-99	Domestic	SE	4	25	4	5	42.7	
495533	29-Oct-99	Domestic	NE	26	23	5	5	103.6	
495537	20-May-98	Irrigation	NE	6	24	2	5	17.4	
496088	06-Jun-00	Domestic	SW	1	24	3	5	91.4	
496089	17-Nov-99	Domestic	NW	4	24	3	5	100.6	
496466	28-Feb-00	Domestic	NE	28	23	3	5	41.1	
496573	15-Aug-99	Domestic	SE	16	24	2	5	80.8	
496647	18-Jul-00	Domestic	SE	36	24	4	5	9.1	
496648	15-Jul-00	Domestic	SE	36	24	4	5	24.4	
496808	20-Jan-00	Domestic	SW	1	24	3	5	30.5	
496809	01-May-00	Domestic	NW	18	24	2	5	24.4	
497172	26-Sep-00	Stock	SW	5	24	3	5	97.5	
497689	08-Sep-00	Domestic	SW	15	24	4	5	36.6	
497692	18-Apr-01	Other	SW	4	25	3	5	36.6	
497695	18-Apr-01	Other	SW	4	25	3	5	36.6	
497696	17-Apr-01	Other	SW	4	25	3	5	36.6	
497697	17-Apr-01	Other	SW	4	25	3	5	36.6	
497700	11-Apr-01	Other	SW	4	25	3	5	36.6	
498380	12-Apr-01	Domestic	SE	10	24	2	5	42.7	
498381	22-Jun-01	Domestic	NW	21	24	2	5	85.3	
498383	14-Jun-01	Domestic	SE	21	24	3	5	28.3	
498384	14-Jun-01	Domestic	SE	21	24	3	5	30.5	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
499238	24-Aug-88	Stock	SW	15	24	4	5	24.4	
499366	17-Nov-01	Domestic	SW	7	24	3	5	61.0	
499367	09-Sep-01	Domestic	NW	14	24	3	5	36.6	
499368	08-Sep-01	Domestic	NW	14	24	3	5	36.6	
499369	07-Sep-01	Domestic	NW	14	24	3	5	36.6	
499370	05-Sep-01	Domestic	NW	14	24	3	5	36.6	
499371	06-Sep-01	Domestic	NW	14	24	3	5	36.6	
499372	10-Sep-01	Domestic	NW	14	24	3	5	48.8	
499373	02-Sep-01	Domestic	NW	22	24	3	5	36.6	
1020001	06-Feb-04	Domestic	NW	6	24	3	5	39.6	
1020214	30-Sep-98	Domestic	1	13	23	5	5	30.5	
1020218	13-Apr-04	Domestic	SE	26	23	5	5	12.2	
1020255	14-Sep-04	Domestic	NE	25	23	5	5	65.5	
1020257	07-Oct-04	Domestic	NW	13	23	5	5	36.6	
1020258	23-Sep-04	Domestic	NW	13	23	5	5	150.9	
1020644	15-Sep-04	Domestic	NW	34	24	4	5	35.1	
1020653	05-Feb-04	Domestic	NW	6	24	3	5	36.6	
1020656	06-May-05	Domestic	SE	25	24	3	5	53.3	
1020658	15-Jul-04	Domestic	SE	25	24	3	5	47.2	
1020661	19-Mar-03	Domestic	SW	26	24	3	5	29.0	
1020664	04-Nov-05	Domestic	NW	27	24	3	5	27.4	
1020666	02-Sep-03	Domestic	NE	27	24	3	5	115.8	
1020668	19-Aug-03	Domestic	NE	27	24	3	5	71.6	
1020672	25-Jun-03	Domestic	SW	28	24	3	5	39.6	
1020673	05-Feb-04	Domestic	SW	28	24	3	5	65.5	
1020689	29-Jun-04	Domestic	NW	15	24	4	5	36.6	
1020693	28-Jun-04	Domestic	NW	15	24	4	5	29.0	
1021011	06-Feb-04	Domestic	NW	6	24	3	5	39.6	
1021013	27-May-05	Other	NW	13	24	3	5	18.3	
1021014	31-Mar-03	Domestic	SW	21	24	3	5	22.9	
1021015	31-May-05	Domestic	NE	23	24	3	5	57.9	
1021185	10-May-06	Domestic	SE	27	24	3	5	65.5	
1021205	07-Mar-06	Domestic	NE	21	24	3	5	22.9	
1021206	11-May-06	Domestic	SE	27	24	3	5	61.0	
1021207	11-May-06	Domestic	SE	27	24	3	5	22.9	
1021210	28-Jun-06	Domestic	NW	17	24	4	5	29.0	
1021376	30-Oct-06	Domestic	SE	19	24	2	5	150.9	
1021377	23-Oct-06	Domestic	SE	19	24	2	5	132.6	
1021428	21-Feb-07	Domestic	SE	25	24	3	5	48.8	
1021615	16-Oct-07	Domestic	NW	16	24	2	5	65.5	
1021654	21-Feb-08	Domestic	NE	15	24	4	5	59.4	
1021790	24-Nov-08	Stock	SE	20	24	4	5	27.4	
1021808	13-Aug-08	Other	SE	34	24	4	5	35.1	
1021869	28-Jan-09	Domestic	NE	23	23	5	5	112.8	
1021894	15-Jun-09	Domestic	5	25	24	3	5	35.1	
1021915	20-Aug-09	Domestic	NE	25	23	5	5	24.4	
1021928	07-Jul-09	Domestic	NW	18	24	2	5	22.9	
1021929	06-Jul-09	Domestic	SW	21	24	2	5	45.7	
1022000		Domestic	7	10	24	2	5	64.6	
1022089	11-Aug-11	Domestic	6	19	24	2	5	67.1	
1022247	15-May-12	Domestic	3	22	24	4	5	47.2	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
1022267	08-Aug-12	Domestic	4	26	24	3	5	22.9	
1022293	22-Nov-12	Domestic	2	21	24	3	5	24.4	
1022347	21-May-13	Domestic	1	17	24	3	5	35.1	
1022404	15-Oct-13	Domestic	7	10	24	3	5	9.1	
1022423	11-Feb-14	Domestic	15	23	24	3	5	29.0	
1022469	06-Jun-06	Domestic	4	21	24	3	5	41.1	
1022483	21-Nov-14	Domestic	1	27	24	3	5	47.2	
1022518	03-Feb-15	Domestic	9	27	23	5	5	47.2	
1022614	11-Nov-15	Domestic	6	26	24	3	5	59.4	
1022748	07-Jun-16	Commercial	8	18	24	2	5	29.0	
1022750	24-May-16	Domestic	9	13	23	5	5	65.5	
1022810	27-Jul-16	Commercial	4	18	24	3	5	29.0	
1022811	29-Jul-16	Commercial	4	18	24	3	5	29.0	
1022880	28-Jul-17	Domestic	9	18	24	2	5	49.7	
1022881	28-Jul-17	Domestic	10	18	24	2	5	29.0	
1022882	28-Jul-17	Domestic	7	18	24	2	5	24.4	
1022883	27-Jul-17	Domestic	9	18	24	2	5	29.0	
1022884	11-Aug-17	Domestic	8	18	24	2	5	29.3	
1022885	11-Aug-17	Domestic	8	18	24	2	5	29.0	
1022886	28-Jul-17	Domestic	8	18	24	2	5	29.0	
1022887	16-Aug-17	Industrial	8	18	24	2	5	35.1	
1022892	21-Jul-17	Domestic	6	27	24	3	5	22.9	
1022935	08-Nov-17	Domestic	6	26	24	3	5	30.5	
1022936	06-Nov-17	Commercial	16	20	24	2	5	96.0	
1022937	20-Nov-17	Commercial	16	20	24	2	5	66.4	
1022964	09-Apr-18	Domestic	5	30	24	2	5	114.3	
1023002	31-May-18	Commercial	9	25	24	4	5	41.1	
1023003	04-Jul-18	Commercial	4	20	24	3	5	40.5	
1023017	31-Jul-18	Domestic	SE	23	24	3	5	47.2	
1023022	10-Aug-18	Commercial	13	15	24	4	5	41.6	
1063104	15-Oct-02	Domestic	NE	10	24	4	5	4.9	
1065155	08-Aug-07	Domestic	2	5	24	2	5	42.7	
1065384	17-Oct-07	Domestic	4	22	24	4	5	24.4	
1065691	20-Nov-08	Domestic	SE	7	24	4	5	85.3	
1065739	28-Apr-09	Domestic	15	20	23	3	5	42.7	
1065768	23-Jan-09	Domestic	6	20	23	4	5	61.0	
1065771	19-Jan-09	Domestic	12	21	23	4	5	42.7	
1065777	28-Apr-09	Domestic	SW	34	23	3	5	54.9	
1065779	30-Apr-09	Domestic	3	23	23	2	5	67.1	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
1065797	11-Jun-09	Domestic	1	29	23	3	5	67.1	
1065802	21-May-09	Domestic	2	34	23	3	5	91.4	
1065868	18-Aug-09	Domestic	12	36	23	4	5	79.2	
1065869	18-Aug-09	Domestic	8	30	23	3	5	54.9	
1065880	20-Jul-09	Domestic	8	23	23	2	5	79.2	
1065887	30-Jun-09	Domestic	8	7	24	4	5	61.0	
1065894	17-Jun-09	Domestic	SE	7	24	4	5	134.1	
1066081	12-Aug-10	Domestic & Stock	15	8	23	3	5	61.0	
1066083	26-Jul-10	Domestic	13	24	23	2	5	42.7	
1066084	27-Jul-10	Domestic	16	14	23	2	5	61.0	
1066085	29-Jul-10	Domestic	10	17	23	3	5	54.9	
1066122	31-May-10	Domestic	SW	23	23	2	5	73.2	
1066183	12-Jul-10	Domestic	16	36	23	4	5	42.7	
1066204	29-Jul-10	Domestic	12	29	23	3	5	54.9	
1066286	19-Oct-10	Domestic	10	20	23	4	5	109.7	
1066299	18-Oct-10	Domestic	12	29	23	3	5	61.0	
1066308	19-Nov-10	Domestic	12	32	23	3	5	67.1	
1066392	20-Jul-11	Domestic	2	26	23	2	5	42.7	
1066393	17-Nov-10	Domestic	NE	23	23	2	5	48.8	
1066425	30-Aug-11	Domestic	6	35	23	4	5	42.7	
1066438	29-Sep-11	Domestic	15	9	23	3	5	85.3	
1066441	30-Sep-11	Domestic	12	20	23	3	5	48.8	
1066444	05-Oct-11	Domestic	SE	27	23	3	5	42.7	
1066478	19-Jul-11	Domestic	2	26	23	2	5	61.0	
1066481	13-Jul-11	Domestic	1	17	23	3	5	79.2	
1066482	12-Jul-11	Domestic	13	17	23	3	5	79.2	
1066483	11-Jul-11	Domestic	6	28	23	3	5	48.8	
1066484	21-Jul-11	Domestic	9	23	23	2	5	42.7	
1066511	17-Oct-11	Domestic	2	22	23	3	5	48.8	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
1066512	18-Oct-11	Domestic	13	26	23	3	5	48.8	
1066541	10-Nov-11	Domestic	5	21	23	4	5	15.8	
1066616	20-Jun-12	Domestic	1	26	23	2	5	42.7	
1115001	16-Sep-03	Domestic	NW	16	24	3	5	32.0	
1115004	06-Nov-03	Domestic	SW	19	24	2	5	103.6	
1115019	23-Jul-04	Domestic	NE	8	24	2	5	32.0	
1115103	13-May-06	Domestic	NE	13	23	5	5	24.4	
1140067	19-Apr-02	Domestic	14	22	24	3	5	18.3	
1140078	17-Aug-01	Domestic	SE	5	24	2	5	35.1	
1140400	16-Apr-09	Domestic	13	23	24	3	5	18.3	
1155015	22-Oct-02	Domestic	SW	2	24	3	5	73.2	
1155016	01-Nov-02	Domestic	SW	2	24	3	5	24.4	
1240029	27-Jul-05	Domestic	SE	27	24	3	5	61.0	
1240030	15-Mar-05	Domestic	6	17	24	2	5	41.1	
1240217	18-Jul-06	Domestic	4	2	24	4	5	18.3	
1245005	19-Jul-04	Domestic	SE	22	24	4	5	42.7	
1245221	14-Nov-06	Other	16	10	24	4	5	48.8	
1245311	23-Feb-08	Domestic	16	23	23	2	5	30.5	
1245319	18-Sep-08	Domestic	13	17	23	3	5	55.5	
1245320	22-Sep-08	Domestic	5	31	23	3	5	30.5	
1245323	27-Oct-08	Domestic	8	32	23	3	5	36.6	
1245324	28-Oct-08	Domestic	14	21	3	23	5	36.6	
1305324	06-Oct-08	Domestic	NE	31	24	3	5	39.6	
1305325	05-Oct-08	Domestic	NE	31	24	3	5	36.6	
1305338	13-Dec-06	Commercial	NE	36	23	2	5	46.0	
1305339	06-Nov-06	Commercial	NE	36	23	2	5	46.3	
1305437	23-May-12	Domestic	16	24	23	5	5	67.1	
1305478	11-Feb-13	Domestic	10	24	23	5	5	36.6	
1465013	06-Sep-03	Domestic	NW	12	24	4	5	36.6	
1465042	28-Sep-10	Domestic	4	2	25	4	5	32.0	
1465050	18-Jun-13	Domestic	8	20	24	3	5	54.9	
1465051	23-Jun-13	Domestic	8	20	24	3	5	48.8	
1465062	03-May-16	Domestic	SW	25	23	4	5	65.5	
1465064	30-May-17	Domestic	NE	25	24	4	5	140.2	
1475288	02-Apr-04	Domestic	12	18	24	2	5	18.3	
1475329	30-Mar-04	Domestic	10	21	24	2	5	67.1	
1475346	17-Oct-03	Industrial	7	34	24	4	5	27.4	
1475642	15-Dec-04	Domestic	8	18	23	3	5	18.3	
1475877	13-Apr-07	Stock	11	3	25	4	5	36.6	
1476960	08-Apr-16	Domestic & Stock	9	4	25	4	5	30.5	
1476961	19-Apr-16	Domestic & Stock	5	2	24	4	5	67.1	
1476963	22-Apr-16	Stock	5	2	24	4	5	13.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
1476966	22-Apr-16	Domestic & Stock	10	4	25	4	5	48.8	
1555410	31-Aug-06	Domestic	NE	21	24	3	5	36.6	
1555412	28-Mar-06	Domestic	NE	27	24	3	5	27.4	
1555505	20-Jul-04	Domestic	SE	10	24	2	5	79.9	
1555506	01-Aug-04	Domestic	SW	16	24	3	5	100.0	
1555573	25-Jul-06	Domestic	NW	22	24	3	5	23.8	
1555784	08-Nov-07	Domestic	NE	29	24	3	5	23.8	
1555796	18-Apr-08	Domestic	SW	22	24	3	5	27.4	
1600057	14-Dec-05	Industrial	2	4	25	3	5	48.8	
1600208	20-Nov-09	Domestic	1	29	24	3	5	17.7	
1600220	24-Sep-10	Domestic	5	2	24	3	5	59.4	
1600235	09-Dec-11	Domestic	16	2	24	3	5	29.0	
1600250	23-Feb-12	Irrigation	2	4	25	3	5	29.3	
1610568	28-Sep-09	Domestic	13	22	24	3	5	37.2	
1610574	22-Sep-09	Other	5	17	24	2	5	37.2	
1610643	10-Aug-10	Domestic	5	4	24	3	5	61.0	
1610657	28-Mar-11	Domestic	5	5	24	3	5	61.0	
1610684	19-Aug-11	Municipal	8	18	24	3	5	7.0	
1610688	24-Aug-11	Municipal	8	18	24	3	5	6.1	
1610804	01-Sep-13	Domestic	5	17	24	2	5	42.7	
1610826	04-Apr-14	Commercial	SW	29	24	2	5	65.5	
1610926	02-Feb-16	Domestic	9	24	23	5	5	67.1	
1610927	04-Feb-16	Domestic	15	24	23	5	5	48.8	
1610928	07-Feb-16	Domestic	NE	24	23	5	5	48.8	
1635010	30-Jun-04	Domestic	SW	24	23	2	5	79.2	
1635032	12-Jul-04	Unknown	SE	30	23	2	5	65.5	
1635033	05-Jul-03	Domestic	SE	3	24	4	5	64.0	
1725010	01-Oct-10	Domestic	6	26	24	3	5	32.0	
2022507	02-May-04	Domestic	6	10	24	3	5	30.5	
2023631	26-Sep-06	Domestic	NW	5	24	3	5	48.8	
2023632	25-Sep-06	Domestic	NE	4	24	2	5	53.3	
2023634	05-Sep-06	Domestic	SW	5	24	3	5	53.3	
2027002	28-Apr-79	Domestic	SE	9	24	2	5	82.6	
2056007	10-Jul-06	Domestic & Stock	SW	5	24	3	5	35.4	
2056009	23-Aug-06	Domestic & Stock	SW	3	24	4	5	20.4	
2056013	13-Jun-06	Domestic	5	5	24	3	5	57.9	
2056018	21-Jun-06	Domestic	SE	15	24	2	5	38.1	
2066005	30-Jun-10	Domestic	SE	19	24	4	5	30.5	
2066082	09-Dec-14	Domestic	SE	6	25	3	5	29.0	
2066204	26-Oct-17	Domestic	5	2	24	3	5	41.1	
2085369	02-May-12	Domestic	11	23	24	3	5	36.6	
2085452	07-Mar-13	Domestic	10	23	24	3	5	42.7	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
2085635	01-Aug-14	Domestic	12	16	24	2	5	91.4	
2085834	24-Nov-15	Domestic	15	24	23	5	5	54.9	
2085835	26-Nov-15	Domestic	NE	24	23	5	5	73.2	
2085836	30-Nov-15	Domestic	NE	24	23	5	5	61.0	
2085837	28-Nov-15	Domestic	NE	24	23	5	5	79.2	
2085976	20-Dec-16	Domestic	12	23	23	5	5	42.7	
2090502	17-Oct-08	Domestic	SE	22	24	4	5	61.6	
2090503	21-Oct-08	Domestic	SE	22	24	4	5	27.4	
2090508	22-Jan-09	Domestic	13	13	23	2	5	33.5	
2092616	19-Dec-79	Industrial	12	1	24	2	5	21.3	
2093209	17-Mar-78	Domestic	11	11	24	4	5	91.4	
2093210	17-Mar-78	Domestic	11	11	24	4	5	30.5	
2093764	31-Oct-35	Domestic & Stock	NW	20	24	2	5	45.7	
2095621		Domestic & Stock	NE	23	24	3	5	38.1	
2095693		Domestic	NE	33	24	4	5		
2095694		Domestic & Stock	NE	33	24	4	5	36.6	
2095787		Domestic	NE	9	24	2	5	70.1	
2096008		Domestic	NE	12	23	5	5	3.7	
2096076		Domestic & Stock	NE	13	23	5	5	4.6	
2096163	01-Aug-73	Domestic	SW	10	24	2	5	39.6	
2096226	12-Aug-78	Domestic & Stock	NE	25	24	3	5		
2096453	01-Jan-91	Domestic	9	9	24	3	5	6.1	
2097500	31-Jul-08	Domestic	6	26	24	3	5	22.9	
9546019	29-Jun-12	Domestic	NE	28	23	4	5	57.9	
9546022	08-Jul-12	Domestic	SW	17	23	3	5	64.0	
9546024	13-Jul-12	Domestic	NE	20	23	3	5	64.0	
9546026	01-Aug-12	Domestic	SE	33	23	3	5	76.2	
9546038	07-Sep-12	Domestic	NE	9	23	3	5	35.1	
9546041	23-Oct-12	Domestic	SW	30	23	3	5	67.1	
9546047	08-May-13	Domestic	NE	17	23	3	5	30.5	
9546057	09-Jul-13	Domestic	NE	8	23	3	5	59.4	
9546060	11-Jul-13	Domestic	SW	28	23	3	5	83.8	
9546061	30-Jul-13	Domestic	SW	19	23	3	5	12.2	
9546066	29-Sep-13	Domestic	NW	17	23	3	5	54.9	
9546069	10-Sep-13	Domestic	NE	23	23	2	5	22.9	
9546076	28-Sep-13	Domestic	NE	23	23	2	5	39.6	
9546087	06-Mar-14	Domestic	3	22	23	3	5	41.1	
9546090	10-Apr-14	Domestic	SW	27	23	3	5	42.7	
9546091	23-May-14	Domestic	NE	20	23	3	5	27.4	
9546093	06-Jun-14	Domestic	SW	17	23	3	5	71.6	
9546104	16-Jul-14	Domestic	NW	12	23	4	5	35.1	
9546119	19-Aug-14	Domestic	NE	16	23	3	5	36.6	
9546128	17-Sep-14	Domestic	NE	24	24	4	5	12.2	
9546133	16-Sep-14	Domestic	SE	17	23	3	5	30.5	
9546134	18-Sep-14	Domestic	NE	23	23	2	5	30.5	
9546135	09-Oct-14	Domestic	6	35	23	4	5	36.6	
9546136	08-Oct-14	Domestic	13	24	23	2	5	27.4	
9546137	07-Oct-14	Domestic	13	24	23	2	5	33.5	
9546138	06-Oct-14	Domestic	7	23	23	2	5	51.8	

GIC Well ID[1]	Drilling Date	Well Use	LSD[2]	Section	Township	Range	Meridian	Depth (m BGL)	Field Verified[3]
9546142	13-Oct-14	Domestic	2	19	23	3	5	51.8	
9546143	28-Oct-14	Domestic	13	24	23	2	5	27.4	
9546144	27-Oct-14	Domestic	13	24	23	2	5	27.4	
9546145	29-Oct-14	Domestic	8	23	23	2	5	61.0	
9546148	29-Nov-14	Domestic	7	23	23	2	5	67.1	
9546154	10-Nov-14	Domestic	SE	32	23	3	5	47.2	
9546161	09-Jan-15	Domestic	2	26	23	2	5	47.2	
9546176	26-May-15	Domestic	5	24	23	2	5	41.1	
9546182	02-Jul-15	Domestic	16	13	23	5	5	22.9	
9546277	13-Jun-15	Domestic & Stock	SW	24	23	2	5	76.2	
9546303	28-Jul-17	Domestic	NW	35	23	2	5	41.1	
9546313	30-Jul-17	Domestic	SE	23	23	2	5	27.4	
9546326	16-Sep-17	Domestic	SE	35	23	4	5	61.0	
9546327	03-Sep-17	Domestic	SE	20	23	3	5	42.7	
9546339	01-Jul-18	Domestic	7	29	23	3	5	35.1	
9546340	02-Jul-18	Domestic	7	29	23	3	5	41.1	
9546342	22-Jun-18	Domestic	SE	17	23	3	5	41.1	
9546349	24-Jun-18	Domestic	NW	8	23	3	5	59.4	
9546353	02-Jul-18	Domestic	NE	22	23	3	5	35.1	
9546355	08-Sep-18	Domestic	SW	20	23	4	5	26.2	
9546356	03-Sep-18	Domestic	NW	21	23	3	5	22.9	
9681070	15-May-15	Domestic	4	20	23	4	5	48.8	
9681071	19-May-15	Domestic	5	20	23	4	5	60.0	
9681266	26-Sep-17	Domestic	7	28	24	3	5	21.3	
9681273	03-Oct-17	Domestic	9	21	24	3	5	30.5	
9906001	16-Aug-17	Domestic	14	24	24	3	5	24.4	
9906054	14-May-18	Commercial	2	2	24	2	5	26.2	
9906055	15-May-18	Commercial	1	2	24	2	5	26.2	
9906056	16-May-18	Commercial	1	2	24	2	5	26.2	
9906057	18-May-18	Commercial	1	2	24	2	5	26.2	

1 - Groundwater Information Centre well identification number

2 - Legal Site Description

3 - Location verfied during the domestic water well testing program

Attachment C GROUNDWATER MONITORING LABORATORY ANALYTICAL RESULTS

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031849

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/03
Report #: R2273769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684017
Received: 2016/09/26, 19:33

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/09/27	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	1	N/A	2016/10/01	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	1	2016/09/27	2016/09/28	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	1	2016/09/27	2016/09/28	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) (1)	1	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	1	N/A	2016/09/27	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	1	2016/09/27	2016/09/28	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/09/29	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	1	2016/09/29	2016/09/29	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	1	2016/09/29	2016/09/29	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	1	N/A	2016/09/28	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	1	N/A	2016/09/28	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/09/29	AB WI-00065	Auto Calc
Ammonia-N (Dissolved)	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	1	N/A	2016/09/28	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2016/09/27	AB SOP-00023	SM 22 4110 B m
pH @25°C	1	N/A	2016/09/27	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	1	N/A	2016/09/28	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	1	2016/09/27	2016/09/29	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/01	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	1	2016/09/30	2016/09/30	AB SOP-00008	EPA 351.1 R1978 m
Phosphorus -P (Total, Dissolved)	1	2016/09/29	2016/09/30	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031849

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/03
Report #: R2273769
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684017
Received: 2016/09/26, 19:33

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	MW16-15-34	RDL	QC Batch
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.10	8411843
Volatiles				
Benzene	mg/L	<0.00040	0.00040	8416232
Toluene	mg/L	<0.00040	0.00040	8416232
Ethylbenzene	mg/L	<0.00040	0.00040	8416232
m & p-Xylene	mg/L	<0.00080	0.00080	8416232
o-Xylene	mg/L	<0.00040	0.00040	8416232
Xylenes (Total)	mg/L	<0.00080	0.00080	8416232
F1 (C6-C10) - BTEX	mg/L	<0.10	0.10	8416232
F1 (C6-C10)	mg/L	<0.10	0.10	8416232
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	108	N/A	8416232
4-Bromofluorobenzene (sur.)	%	106	N/A	8416232
D4-1,2-Dichloroethane (sur.)	%	121	N/A	8416232
O-TERPHENYL (sur.)	%	94	N/A	8411843

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	**MW16-15-34**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	meq/L	11	N/A	8411319
Cation Sum	meq/L	10	N/A	8411319
Hardness (CaCO3)	mg/L	52	0.50	8411317
Ion Balance	N/A	0.95	0.010	8411318
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8411320
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8411321
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8411320
Calculated Total Dissolved Solids	mg/L	610	10	8411322
Misc. Inorganics				
Conductivity	uS/cm	1000	1.0	8412214
pH	pH	8.31	N/A	8412213
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8412208
Alkalinity (Total as CaCO3)	mg/L	350	0.50	8412208
Bicarbonate (HCO3)	mg/L	430	0.50	8412208
Carbonate (CO3)	mg/L	<0.50	0.50	8412208
Hydroxide (OH)	mg/L	<0.50	0.50	8412208
Dissolved Sulphate (SO4)	mg/L	170	1.0	8418346
Dissolved Chloride (Cl)	mg/L	3.4	1.0	8418338
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8412585
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8412585
Elements				
Dissolved Aluminum (Al)	mg/L	0.0040	0.0030	8413830
Dissolved Antimony (Sb)	mg/L	0.0013	0.00060	8413830
Dissolved Arsenic (As)	mg/L	0.0010	0.00020	8413830
Dissolved Barium (Ba)	mg/L	0.013	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8413830
Dissolved Boron (B)	mg/L	0.040	0.020	8414668
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8413830

RDL = Reportable Detection Limit
N/A = Not Applicable

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Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	**MW16-15-34**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	14	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8413830
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8413830
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8413830
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8413830
Dissolved Lithium (Li)	mg/L	0.074	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	4.2	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.028	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.018	0.00020	8413830
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8413830
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	2.4	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00065	0.00020	8413830
Dissolved Silicon (Si)	mg/L	2.6	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8413830
Dissolved Sodium (Na)	mg/L	210	0.50	8414668
Dissolved Strontium (Sr)	mg/L	0.25	0.020	8414668
Dissolved Sulphur (S)	mg/L	51	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8413830
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8413830
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8413830
Dissolved Uranium (U)	mg/L	0.00024	0.00010	8413830
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8413830
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8413830
RDL = Reportable Detection Limit				

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP4727	PP4727		
Sampling Date		2016/09/26 14:38	2016/09/26 14:38		
COC Number		M031849	M031849		
	UNITS	MW16-15-34	MW16-15-34 Lab-Dup	RDL	QC Batch
Misc. Inorganics					
Dissolved Organic Carbon (C)	mg/L	1.7	1.7	0.50	8417244
Microbiological Param.					
E.Coli DST	mpn/100mL	<1.0	N/A	1.0	8412377
Fecal Coliforms	MPN/100mL	<1.0	N/A	1.0	8412376
Heterotrophic Plate Count	CFU/mL	39	45	1.0	8412470
Total Coliforms DST	mpn/100mL	<1.0	N/A	1.0	8412377
Nutrients					
Dissolved Ammonia (N)	mg/L	0.99 (1)	0.95 (1)	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	0.90 (1)	N/A	0.050	8416562
Orthophosphate (P)	mg/L	0.0038	N/A	0.0030	8414603
Dissolved Phosphorus (P)	mg/L	0.0057	0.0057	0.0030	8415469

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Ammonia greater than TKN. Results are within acceptable limits of precision.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PP4727		
Sampling Date		2016/09/26 14:38		
COC Number		M031849		
	UNITS	**MW16-15-34**	**RDL**	**QC Batch**
Low Level Elements				
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8415298
Total Mercury (Hg)	ug/L	<0.10 (1)	0.10	8415274

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	9.7°C

Results relate only to the items tested.

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Maxxam Job #: B684017
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8411843	LSH	Matrix Spike	O-TERPHENYL (sur.)	2016/09/27		91	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27		88	%	50 - 130
8411843	LSH	Spiked Blank	O-TERPHENYL (sur.)	2016/09/27		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27		88	%	70 - 130
8411843	LSH	Method Blank	O-TERPHENYL (sur.)	2016/09/27		93	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/27	<0.10		mg/L	
8411843	LSH	RPD	F2 (C10-C16 Hydrocarbons)	2016/09/28	NC		%	40
8412208	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/27		99	%	80 - 120
8412208	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/27	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/27	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/27	<0.50		mg/L	
			Carbonate (CO3)	2016/09/27	<0.50		mg/L	
			Hydroxide (OH)	2016/09/27	<0.50		mg/L	
8412208	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/27	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/27	6.1		%	20
			Bicarbonate (HCO3)	2016/09/27	6.1		%	20
			Carbonate (CO3)	2016/09/27	NC		%	20
			Hydroxide (OH)	2016/09/27	NC		%	20
8412213	SSO	Spiked Blank	pH	2016/09/27		100	%	97 - 103
8412213	SSO	RPD	pH	2016/09/27	0.17		%	N/A
8412214	SSO	Spiked Blank	Conductivity	2016/09/27		100	%	90 - 110
8412214	SSO	Method Blank	Conductivity	2016/09/27	<1.0		uS/cm	
8412214	SSO	RPD	Conductivity	2016/09/27	0.12		%	20
8412376	AP1	Method Blank	Fecal Coliforms	2016/09/28	<1.0		MPN/10	
8412376	AP1	RPD	Fecal Coliforms	2016/09/28	NC		%	N/A
8412377	AP1	Method Blank	E.Coli DST	2016/09/28	<1.0		mpn/100	
			Total Coliforms DST	2016/09/28	<1.0 (1)		mpn/100	
8412377	AP1	RPD	Total Coliforms DST	2016/09/28	NC		%	N/A
8412470	AP1	Method Blank	Heterotrophic Plate Count	2016/09/29	<1.0		CFU/mL	
8412470	AP1	RPD [PP4727-08]	Heterotrophic Plate Count	2016/09/29	14		%	N/A
8412585	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/27		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/27		103	%	80 - 120
8412585	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/27		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/27		101	%	80 - 120
8412585	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/27	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/27	<0.010		mg/L	
8412585	JLD	RPD	Dissolved Nitrite (N)	2016/09/27	NC		%	20
			Dissolved Nitrate (N)	2016/09/27	NC		%	20
8413830	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/28		NC	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/28		94	%	80 - 120
			Dissolved Arsenic (As)	2016/09/28		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/28		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/28		102	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/28		103	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/28		101	%	80 - 120
			Dissolved Copper (Cu)	2016/09/28		99	%	80 - 120
			Dissolved Lead (Pb)	2016/09/28		103	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/28		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/28		95	%	80 - 120
			Dissolved Selenium (Se)	2016/09/28		100	%	80 - 120
			Dissolved Silver (Ag)	2016/09/28		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/28		105	%	80 - 120

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/09/28		99	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/28		97	%	80 - 120
			Dissolved Uranium (U)	2016/09/28		101	%	80 - 120
			Dissolved Vanadium (V)	2016/09/28		102	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/28		105	%	80 - 120
8413830	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/28		101	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/28		93	%	80 - 120
			Dissolved Arsenic (As)	2016/09/28		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/28		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/28		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/28		99	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/28		97	%	80 - 120
			Dissolved Copper (Cu)	2016/09/28		98	%	80 - 120
			Dissolved Lead (Pb)	2016/09/28		100	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/28		100	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/28		93	%	80 - 120
			Dissolved Selenium (Se)	2016/09/28		100	%	80 - 120
			Dissolved Silver (Ag)	2016/09/28		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/28		102	%	80 - 120
			Dissolved Tin (Sn)	2016/09/28		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/28		93	%	80 - 120
			Dissolved Uranium (U)	2016/09/28		99	%	80 - 120
			Dissolved Vanadium (V)	2016/09/28		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/28		100	%	80 - 120
8413830	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/28	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/28	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/28	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/28	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/28	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/28	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/28	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/28	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/28	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/28	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/28	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/28	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/28	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/28	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/28	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/28	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/28	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/28	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/28	<0.0030		mg/L	
8413830	PC5	RPD	Dissolved Aluminum (Al)	2016/09/28	1.1		%	20
			Dissolved Antimony (Sb)	2016/09/28	NC		%	20
			Dissolved Arsenic (As)	2016/09/28	NC		%	20
			Dissolved Beryllium (Be)	2016/09/28	NC		%	20
			Dissolved Chromium (Cr)	2016/09/28	NC		%	20
			Dissolved Cobalt (Co)	2016/09/28	NC		%	20
			Dissolved Copper (Cu)	2016/09/28	NC		%	20
			Dissolved Lead (Pb)	2016/09/28	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/28	NC		%	20

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2016/09/28	NC		%	20
			Dissolved Selenium (Se)	2016/09/28	NC		%	20
			Dissolved Silver (Ag)	2016/09/28	NC		%	20
			Dissolved Thallium (Tl)	2016/09/28	NC		%	20
			Dissolved Tin (Sn)	2016/09/28	NC		%	20
			Dissolved Titanium (Ti)	2016/09/28	NC		%	20
			Dissolved Uranium (U)	2016/09/28	NC		%	20
			Dissolved Vanadium (V)	2016/09/28	NC		%	20
			Dissolved Zinc (Zn)	2016/09/28	NC		%	20
8414603	MB5	Matrix Spike	Orthophosphate (P)	2016/09/28		95	%	80 - 120
8414603	MB5	Spiked Blank	Orthophosphate (P)	2016/09/28		100	%	80 - 120
8414603	MB5	Method Blank	Orthophosphate (P)	2016/09/28	<0.0030		mg/L	
8414603	MB5	RPD	Orthophosphate (P)	2016/09/28	NC		%	20
8414668	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/28		90	%	80 - 120
			Dissolved Boron (B)	2016/09/28		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		90	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		88	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		96	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		89	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		99	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		91	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		87	%	80 - 120
8414668	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/28		92	%	80 - 120
			Dissolved Boron (B)	2016/09/28		88	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		97	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		91	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		93	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		94	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		95	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		89	%	80 - 120
8414668	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/28	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/28	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/28	<0.20		mg/L	
8414668	JHC	RPD	Dissolved Barium (Ba)	2016/09/28	0.0078		%	20
			Dissolved Boron (B)	2016/09/28	NC		%	20

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Calcium (Ca)	2016/09/28	0.0054		%	20
			Dissolved Iron (Fe)	2016/09/28	NC		%	20
			Dissolved Lithium (Li)	2016/09/28	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/28	0.051		%	20
			Dissolved Manganese (Mn)	2016/09/28	0.054		%	20
			Dissolved Phosphorus (P)	2016/09/28	NC		%	20
			Dissolved Potassium (K)	2016/09/28	1.6		%	20
			Dissolved Silicon (Si)	2016/09/28	0.29		%	20
			Dissolved Sodium (Na)	2016/09/28	0.082		%	20
			Dissolved Strontium (Sr)	2016/09/28	0.0033		%	20
			Dissolved Sulphur (S)	2016/09/28	0.015		%	20
8415274	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/29		111	%	80 - 120
8415274	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/29		95	%	80 - 120
8415274	RK3	Method Blank	Total Mercury (Hg)	2016/09/29	<0.0020		ug/L	
8415274	RK3	RPD	Total Mercury (Hg)	2016/09/29	NC		%	20
8415298	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/29		116	%	80 - 120
8415298	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/29		96	%	80 - 120
8415298	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/29	<0.0020		ug/L	
8415298	RK3	RPD	Dissolved Mercury (Hg)	2016/09/29	NC		%	20
8415469	MB5	Matrix Spike [PP4727-05]	Dissolved Phosphorus (P)	2016/09/30		91	%	80 - 120
8415469	MB5	QC Standard	Dissolved Phosphorus (P)	2016/09/30		96	%	80 - 120
8415469	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/09/30		97	%	80 - 120
8415469	MB5	Method Blank	Dissolved Phosphorus (P)	2016/09/30	<0.0030		mg/L	
8415469	MB5	RPD [PP4727-05]	Dissolved Phosphorus (P)	2016/09/30	NC		%	20
8416232	GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/01		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		119	%	70 - 130
			Benzene	2016/10/01		110	%	70 - 130
			Toluene	2016/10/01		106	%	70 - 130
			Ethylbenzene	2016/10/01		113	%	70 - 130
			m & p-Xylene	2016/10/01		112	%	70 - 130
			o-Xylene	2016/10/01		116	%	70 - 130
			F1 (C6-C10)	2016/10/01		87	%	70 - 130
8416232	GP4	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/01		101	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		116	%	70 - 130
			Benzene	2016/10/01		111	%	70 - 130
			Toluene	2016/10/01		108	%	70 - 130
			Ethylbenzene	2016/10/01		116	%	70 - 130
			m & p-Xylene	2016/10/01		115	%	70 - 130
			o-Xylene	2016/10/01		119	%	70 - 130
			F1 (C6-C10)	2016/10/01		102	%	70 - 130
8416232	GP4	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/01		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/01		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/01		118	%	70 - 130
			Benzene	2016/10/01	<0.00040		mg/L	
			Toluene	2016/10/01	<0.00040		mg/L	
			Ethylbenzene	2016/10/01	<0.00040		mg/L	
			m & p-Xylene	2016/10/01	<0.00080		mg/L	
			o-Xylene	2016/10/01	<0.00040		mg/L	
			Xylenes (Total)	2016/10/01	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/01	<0.10		mg/L	

Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/01	<0.10		mg/L	
8416232	GP4	RPD	Benzene	2016/10/01	NC		%	40
			Toluene	2016/10/01	NC		%	40
			Ethylbenzene	2016/10/01	NC		%	40
			m & p-Xylene	2016/10/01	NC		%	40
			o-Xylene	2016/10/01	NC		%	40
			Xylenes (Total)	2016/10/01	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/01	NC		%	40
			F1 (C6-C10)	2016/10/01	NC		%	40
8416562	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/09/30		88	%	80 - 120
8416562	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/09/30		90	%	80 - 120
8416562	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/09/30		87	%	80 - 120
8416562	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/09/30	<0.050		mg/L	
8416562	MB5	RPD	Total Kjeldahl Nitrogen	2016/09/30	NC		%	20
8417244	MUK	Matrix Spike [PP4727-05]	Dissolved Organic Carbon (C)	2016/09/30		103	%	80 - 120
8417244	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		98	%	80 - 120
8417244	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417244	MUK	RPD [PP4727-05]	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417670	MB5	Matrix Spike [PP4727-05]	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD [PP4727-05]	Dissolved Ammonia (N)	2016/09/30	3.2 (2)		%	20
8418338	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/01		108	%	80 - 120
8418338	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/01		107	%	80 - 120
8418338	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/01	1.2, RDL=1.0		mg/L	
8418338	ZI	RPD	Dissolved Chloride (Cl)	2016/10/01	1.6		%	20
8418346	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/01		119	%	80 - 120
8418346	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/01		101	%	80 - 120
8418346	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/01	<1.0		mg/L	
8418346	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/01	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

(2) Ammonia greater than TKN. Results are within acceptable limits of precision.

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Maxxam Job #: B684017
Report Date: 2016/10/03

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Lisa Thum, C.E.T., QP, Manager, Inorganics

Michael Sheppard, B.Sc., P. Biol., QP, Senior Scientific Specialist, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1137

Maxxam
A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
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maxxam.ca

CHAIN OF CUSTODY RECORD

M 031849

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required
Company:	Stantec Consulting Ltd.	Company:		Quotation #:		☑ 5 - 7 Days Regular (Most analyses)
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	10160 112St, Edmonton	Address:				Rush TAT (Surcharges will be applied)
	AB, ~~[illegible]~~ T5K 2L6			Project #:	110773396	☐ Same Day ☐ 2 Days
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1	☐ 1 Day ☐ 3-4 Days
Email:	Dylan.King@stantec.com	Email:		Site #:		Date Required:
Copies:	Dale.nisbet@stantec.com	Copies:		Sampled By:	D.Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present			Temp	10	9	10
Seal Intact						
Cooling Media						
Seal Present			Temp			
Seal Intact						
Cooling Media						
Seal Present			Temp			
Seal Intact						
Cooling Media						

Depot Reception

Analysis Requested

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Ammonia (DISS)	TKN	DOC	Total coliforms	E. coli	Fecal coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-15-34		2016/09/26	14:38	W	~~13~~ 14	✓		✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- ☑ AT1/CCME
- ☑ Drinking Water
- ☐ Saskatchewan
- ☐ D50 (Drilling Waste)
- ☐ Other:

Special Instructions

Submitted same day as sampled. Filtered and preserved as indicated on bottles. Hold total metals

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/26	19:33	[signature] JASON BIL	20160926	19:33

26-Sep-16 19:33
Wendy Sears
B684017
NB6 INS-0001

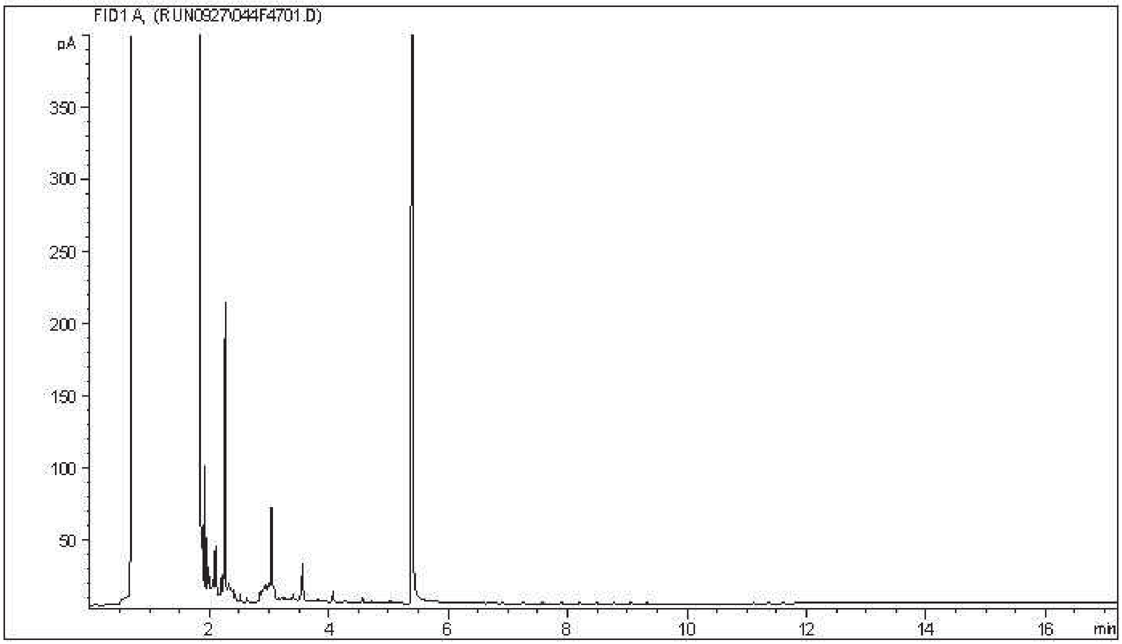
AB FCD-00331/6

Maxxam Job #: B684017
Report Date: 2016/10/03
Maxxam Sample: PP4727

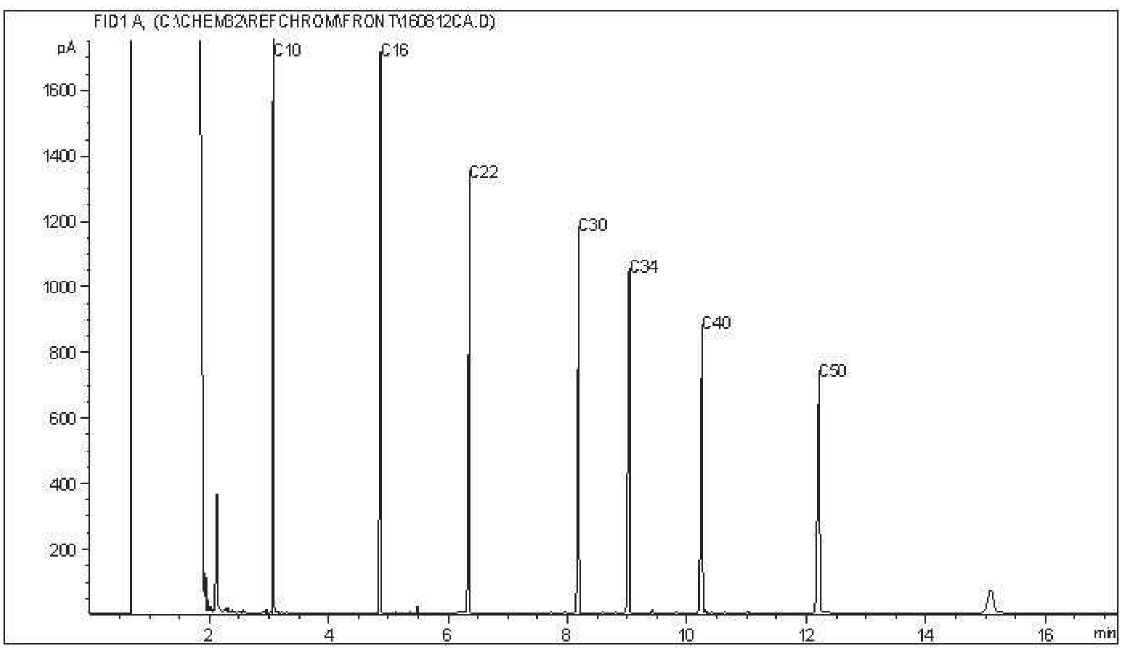
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-15-34

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031856

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/06
Report #: R2276976
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684487
Received: 2016/09/27, 18:56

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	6	N/A	2016/09/28	AB SOP-00005	SM 22 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/10/06	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	2	N/A	2016/10/02	AB SOP-00039	CCME CWS/EPA 8260c m
BTEX/F1 in Water by HS GC/MS/FID	5	N/A	2016/10/03	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	6	N/A	2016/10/02	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	7	2016/09/28	2016/09/29	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	7	2016/09/28	2016/09/29	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	6	N/A	2016/09/30	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	7	N/A	2016/09/28	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	7	2016/09/29	2016/09/30	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	6	N/A	2016/09/29	AB WI-00065	Auto Calc
Hardness	1	N/A	2016/09/30	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	6	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	7	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	6	N/A	2016/09/28	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/06	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	6	N/A	2016/09/29	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/09/29	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	7	N/A	2016/09/29	AB WI-00065	Auto Calc
Sum of cations, anions	6	N/A	2016/09/29	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/09/30	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	6	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	7	N/A	2016/09/30	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	7	N/A	2016/09/30	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	7	N/A	2016/09/28	AB SOP-00023	SM 22 4110 B m

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Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031856

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/06
Report #: R2276976
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B684487
Received: 2016/09/27, 18:56

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
pH @25°C	7	N/A	2016/09/28	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	7	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	1	N/A	2016/10/01	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	6	N/A	2016/10/02	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	7	2016/09/28	2016/09/30	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/01	AB WI-00065	Auto Calc
Total Dissolved Solids (Calculated)	6	N/A	2016/10/02	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	6	2016/09/30	2016/10/01	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	1	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/09/29	2016/09/29	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	6	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP7330	PP7330	PP7331	PP7332	PP7333	PP7334		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17	2016/09/27 10:07	2016/09/27 09:37	2016/09/27 17:50	2016/09/27 13:10		
COC Number		M031856	M031856	M031856	M031856	M031856	M031856		
	UNITS	**MW16-14-33**	**MW16-14-33 Lab-Dup**	**MW16-6-11**	**MW16-6-20**	**MW16-7-5**	**MW16-19-8**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	<0.10	0.10	8414729
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Toluene	mg/L	<0.00040	0.00048	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8417842
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8417842
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8417842
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8417842
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8417842
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	109	109	107	109	110	109	N/A	8417842
4-Bromofluorobenzene (sur.)	%	105	106	106	105	105	106	N/A	8417842
D4-1,2-Dichloroethane (sur.)	%	120	123	123	120	121	120	N/A	8417842
O-TERPHENYL (sur.)	%	86	N/A	84	86	84	86	N/A	8414729

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PP7335	PP7336		
Sampling Date		2016/09/27 13:42	2016/09/27 15:36		
COC Number		M031856	M031856		
	UNITS	**MW16-19-19**	**MW16-20-21**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8414729
Volatiles					
Benzene	mg/L	<0.00040	0.0010	0.00040	8417842
Toluene	mg/L	<0.00040	0.00050	0.00040	8417842
Ethylbenzene	mg/L	<0.00040	<0.00040	0.00040	8417842
m & p-Xylene	mg/L	<0.00080	<0.00080	0.00080	8417842
o-Xylene	mg/L	<0.00040	<0.00040	0.00040	8417842
Xylenes (Total)	mg/L	<0.00080	<0.00080	0.00080	8417842
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8417842
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8417842
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	110	108	N/A	8417842
4-Bromofluorobenzene (sur.)	%	106	106	N/A	8417842
D4-1,2-Dichloroethane (sur.)	%	119	121	N/A	8417842
O-TERPHENYL (sur.)	%	84	82	N/A	8414729

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7331		PP7332	PP7332		
Sampling Date		2016/09/27 10:07		2016/09/27 09:37	2016/09/27 09:37		
COC Number		M031856		M031856	M031856		
	UNITS	**MW16-6-11**	**RDL**	**MW16-6-20**	**MW16-6-20 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	43	N/A	21	N/A	N/A	8413041
Cation Sum	meq/L	41	N/A	21	N/A	N/A	8413041
Hardness ($CaCO_3$)	mg/L	1300	0.50	340	N/A	0.50	8413039
Ion Balance	N/A	0.95	0.010	0.98	N/A	0.010	8413040
Dissolved Nitrate (NO_3)	mg/L	<0.044	0.044	0.086	N/A	0.044	8413042
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	<0.020	N/A	0.020	8413043
Dissolved Nitrite (NO_2)	mg/L	<0.033	0.033	<0.033	N/A	0.033	8413042
Calculated Total Dissolved Solids	mg/L	2700	10	1400	N/A	10	8413044
Misc. Inorganics							
Conductivity	uS/cm	3300	1.0	2000	2000	1.0	8414429
pH	pH	7.53	N/A	7.99	N/A	N/A	8414428
Anions							
Alkalinity (PP as $CaCO_3$)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Alkalinity (Total as $CaCO_3$)	mg/L	330	0.50	260	270	0.50	8414424
Bicarbonate (HCO_3)	mg/L	410	0.50	320	330	0.50	8414424
Carbonate (CO_3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	8414424
Dissolved Sulphate (SO_4)	mg/L	1800 (1)	20	770 (1)	N/A	5.0	8419026
Dissolved Chloride (Cl)	mg/L	4.3	1.0	4.0	N/A	1.0	8419025
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	N/A	0.010	8414214
Dissolved Nitrate (N)	mg/L	<0.010	0.010	0.020	N/A	0.010	8414214
Elements							
Dissolved Aluminum (Al)	mg/L	0.0041	0.0030	0.0067	N/A	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	<0.00060	N/A	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.00050	0.00020	0.00043	N/A	0.00020	8415439
Dissolved Barium (Ba)	mg/L	0.021	0.010	0.031	N/A	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Boron (B)	mg/L	0.13	0.020	0.093	N/A	0.020	8414668

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7331		PP7332	PP7332		
Sampling Date		2016/09/27 10:07		2016/09/27 09:37	2016/09/27 09:37		
COC Number		M031856		M031856	M031856		
	UNITS	MW16-6-11	RDL	MW16-6-20	MW16-6-20 Lab-Dup	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000058	0.000020	<0.000020	N/A	0.000020	8415439
Dissolved Calcium (Ca)	mg/L	310	0.30	76	N/A	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	0.0041	0.00030	0.00056	N/A	0.00030	8415439
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	0.00056	N/A	0.00020	8415439
Dissolved Iron (Fe)	mg/L	0.11	0.060	<0.060	N/A	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.049	0.020	0.044	N/A	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	140	0.20	36	N/A	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.85	0.0040	0.16	N/A	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0014	0.00020	0.0060	N/A	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	0.0064	0.00050	<0.00050	N/A	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	<0.10	N/A	0.10	8414668
Dissolved Potassium (K)	mg/L	8.5	0.30	4.9	N/A	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00044	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Silicon (Si)	mg/L	5.0	0.10	3.4	N/A	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	<0.00010	N/A	0.00010	8415439
Dissolved Sodium (Na)	mg/L	330	0.50	320	N/A	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.4	0.020	0.78	N/A	0.020	8414668
Dissolved Sulphur (S)	mg/L	580 (1)	2.0	250	N/A	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00020	N/A	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.0085	0.00010	0.0021	N/A	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	<0.0010	N/A	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	<0.0030	N/A	0.0030	8415439

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
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(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7333	PP7333			PP7334		
Sampling Date		2016/09/27 17:50	2016/09/27 17:50			2016/09/27 13:10		
COC Number		M031856	M031856			M031856		
	UNITS	**MW16-7-5**	**MW16-7-5 Lab-Dup**	**RDL**	**QC Batch**	**MW16-19-8**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	55	N/A	N/A	8413041	32	N/A	8413041
Cation Sum	meq/L	49	N/A	N/A	8413041	31	N/A	8413041
Hardness (CaCO3)	mg/L	1600	N/A	0.50	8413039	980	0.50	8413039
Ion Balance	N/A	0.90	N/A	0.010	8413040	0.96	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	0.044	8413042	1.8	0.044	8413362
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8413043	0.42	0.020	8413363
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8413042	<0.033	0.033	8413362
Calculated Total Dissolved Solids	mg/L	3400	N/A	10	8413044	2000	10	8413044
Misc. Inorganics								
Conductivity	uS/cm	3900	N/A	1.0	8414429	2500	1.0	8414429
pH	pH	7.57	N/A	N/A	8414428	7.56	N/A	8414428
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Alkalinity (Total as CaCO3)	mg/L	380	N/A	0.50	8414424	420	0.50	8414424
Bicarbonate (HCO3)	mg/L	470	N/A	0.50	8414424	520	0.50	8414424
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8414424	<0.50	0.50	8414424
Dissolved Sulphate (SO4)	mg/L	2200 (1)	N/A	20	8419026	1100 (1)	10	8419026
Dissolved Chloride (Cl)	mg/L	14	N/A	1.0	8419025	1.9	1.0	8419025
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010	8414403	<0.010	0.010	8414403
Dissolved Nitrate (N)	mg/L	<0.010	<0.010	0.010	8414403	0.42	0.010	8414403
Elements								
Dissolved Aluminum (Al)	mg/L	0.0048	N/A	0.0030	8415439	0.0039	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8415439	<0.00060	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.0010	N/A	0.00020	8415439	0.00030	0.00020	8415439
Dissolved Barium (Ba)	mg/L	0.032	N/A	0.010	8414668	0.013	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Boron (B)	mg/L	0.12	N/A	0.020	8414668	0.092	0.020	8414668

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7333	PP7333			PP7334		
Sampling Date		2016/09/27 17:50	2016/09/27 17:50			2016/09/27 13:10		
COC Number		M031856	M031856			M031856		
	UNITS	**MW16-7-5**	**MW16-7-5 Lab-Dup**	**RDL**	**QC Batch**	**MW16-19-8**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	0.00013	N/A	0.000020	8415439	0.000057	0.000020	8415439
Dissolved Calcium (Ca)	mg/L	250	N/A	0.30	8414668	230	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	0.0051	N/A	0.00030	8415439	<0.00030	0.00030	8415439
Dissolved Copper (Cu)	mg/L	0.00097	N/A	0.00020	8415439	0.00059	0.00020	8415439
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8414668	<0.060	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.077	N/A	0.020	8414668	0.029	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	230	N/A	0.20	8414668	99	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.81	N/A	0.0040	8414668	0.071	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0026	N/A	0.00020	8415439	0.00060	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	0.011	N/A	0.00050	8415439	<0.00050	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8414668	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	5.9	N/A	0.30	8414668	5.9	0.30	8414668
Dissolved Selenium (Se)	mg/L	0.00046	N/A	0.00020	8415439	0.056	0.00020	8415439
Dissolved Silicon (Si)	mg/L	5.6	N/A	0.10	8414668	3.6	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8415439	<0.00010	0.00010	8415439
Dissolved Sodium (Na)	mg/L	400	N/A	0.50	8414668	260	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.4	N/A	0.020	8414668	1.4	0.020	8414668
Dissolved Sulphur (S)	mg/L	700 (1)	N/A	2.0	8414668	370	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.020	N/A	0.00010	8415439	0.013	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	0.0030	8415439	<0.0030	0.0030	8415439

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7335			PP7336		
Sampling Date		2016/09/27 13:42			2016/09/27 15:36		
COC Number		M031856			M031856		
	UNITS	**MW16-19-19**	**RDL**	**QC Batch**	**MW16-20-21**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	36	N/A	8413041	25	N/A	8413041
Cation Sum	meq/L	34	N/A	8413041	24	N/A	8413041
Hardness (CaCO3)	mg/L	600	0.50	8413039	740	0.50	8413039
Ion Balance	N/A	0.95	0.010	8413040	0.97	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8413362	0.085	0.044	8413362
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8413363	<0.020	0.020	8413363
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8413362	<0.033	0.033	8413362
Calculated Total Dissolved Solids	mg/L	2200	10	8413044	1500	10	8413044
Misc. Inorganics							
Conductivity	uS/cm	3000	1.0	8414429	2100	1.0	8414429
pH	pH	7.54	N/A	8414428	7.59	N/A	8414428
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Alkalinity (Total as CaCO3)	mg/L	520	0.50	8414424	450	0.50	8414424
Bicarbonate (HCO3)	mg/L	640	0.50	8414424	540	0.50	8414424
Carbonate (CO3)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Hydroxide (OH)	mg/L	<0.50	0.50	8414424	<0.50	0.50	8414424
Dissolved Sulphate (SO4)	mg/L	1200 (1)	10	8418346	760 (1)	5.0	8419026
Dissolved Chloride (Cl)	mg/L	1.7	1.0	8418338	3.3	1.0	8419025
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8414214	<0.010	0.010	8414403
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8414214	0.019	0.010	8414403
Elements							
Dissolved Aluminum (Al)	mg/L	0.0033	0.0030	8415439	0.0040	0.0030	8415439
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8415439	<0.00060	0.00060	8415439
Dissolved Arsenic (As)	mg/L	0.00033	0.00020	8415439	0.00043	0.00020	8415439
Dissolved Barium (Ba)	mg/L	<0.010	0.010	8414668	0.018	0.010	8414668
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Boron (B)	mg/L	0.13	0.020	8414668	0.076	0.020	8414668
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8415439	<0.000020	0.000020	8415439

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7335			PP7336		
Sampling Date		2016/09/27 13:42			2016/09/27 15:36		
COC Number		M031856			M031856		
	UNITS	**MW16-19-19**	**RDL**	**QC Batch**	**MW16-20-21**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	140	0.30	8414668	160	0.30	8414668
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8415439	0.00085	0.00030	8415439
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Iron (Fe)	mg/L	2.6	0.060	8414668	0.69	0.060	8414668
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Lithium (Li)	mg/L	0.056	0.020	8414668	0.053	0.020	8414668
Dissolved Magnesium (Mg)	mg/L	62	0.20	8414668	82	0.20	8414668
Dissolved Manganese (Mn)	mg/L	0.37	0.0040	8414668	0.34	0.0040	8414668
Dissolved Molybdenum (Mo)	mg/L	0.0012	0.00020	8415439	0.0052	0.00020	8415439
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8415439	<0.00050	0.00050	8415439
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8414668	<0.10	0.10	8414668
Dissolved Potassium (K)	mg/L	5.9	0.30	8414668	8.9	0.30	8414668
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8415439	0.00090	0.00020	8415439
Dissolved Silicon (Si)	mg/L	3.4	0.10	8414668	4.0	0.10	8414668
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8415439	<0.00010	0.00010	8415439
Dissolved Sodium (Na)	mg/L	490	0.50	8414668	210	0.50	8414668
Dissolved Strontium (Sr)	mg/L	2.1	0.020	8414668	2.0	0.020	8414668
Dissolved Sulphur (S)	mg/L	370	0.20	8414668	240	0.20	8414668
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8415439	<0.00020	0.00020	8415439
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Uranium (U)	mg/L	0.00092	0.00010	8415439	0.0032	0.00010	8415439
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8415439	<0.0010	0.0010	8415439
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8415439	<0.0030	0.0030	8415439
RDL = Reportable Detection Limit							

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7330	PP7330		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17		
COC Number		M031856	M031856		
	UNITS	**MW16-14-33**	**MW16-14-33 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters					
Anion Sum	meq/L	45	N/A	N/A	8413041
Cation Sum	meq/L	160	N/A	N/A	8413041
Hardness (CaCO3)	mg/L	6700	N/A	0.50	8413039
Ion Balance	N/A	3.4	N/A	0.010	8413040
Dissolved Nitrate (NO3)	mg/L	0.072	N/A	0.044	8413042
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8413043
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8413042
Calculated Total Dissolved Solids	mg/L	4700	N/A	10	8413044
Misc. Inorganics					
Conductivity	uS/cm	2000	N/A	1.0	8414429
pH	pH	7.80	N/A	N/A	8414428
Anions					
Alkalinity (PP as CaCO3)	mg/L	81	N/A	5.0	8424014
Alkalinity (Total as CaCO3)	mg/L	1500	N/A	5.0	8424014
Bicarbonate (HCO3)	mg/L	1600	N/A	5.0	8424014
Carbonate (CO3)	mg/L	97	N/A	5.0	8424014
Hydroxide (OH)	mg/L	<5.0	N/A	5.0	8424014
Dissolved Sulphate (SO4)	mg/L	730 (1)	N/A	5.0	8419026
Dissolved Chloride (Cl)	mg/L	25	N/A	1.0	8419025
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8414214
Dissolved Nitrate (N)	mg/L	0.016	N/A	0.010	8414214
Lab Filtered Elements					
Dissolved Aluminum (Al)	mg/L	0.016 (2)	0.012	0.0030	8415465
Dissolved Antimony (Sb)	mg/L	0.0021	0.0021	0.00060	8415465

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

(2) Duplicate exceeds acceptance criteria due to sample non homogeneity.
Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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Report Date: 2016/10/06

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Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PP7330	PP7330		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17		
COC Number		M031856	M031856		
	UNITS	**MW16-14-33**	**MW16-14-33 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Arsenic (As)	mg/L	0.0017	0.0019	0.00020	8415465
Dissolved Barium (Ba)	mg/L	3.8	N/A	1.0	8421809
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Boron (B)	mg/L	<2.0	N/A	2.0	8421809
Dissolved Cadmium (Cd)	mg/L	0.000024	0.000023	0.000020	8415465
Dissolved Calcium (Ca)	mg/L	2300	N/A	30	8421809
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Cobalt (Co)	mg/L	0.00065	0.00057	0.00030	8415465
Dissolved Copper (Cu)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Iron (Fe)	mg/L	68	N/A	6.0	8421809
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Lithium (Li)	mg/L	<2.0	N/A	2.0	8421809
Dissolved Magnesium (Mg)	mg/L	190	N/A	20	8421809
Dissolved Manganese (Mn)	mg/L	14	N/A	0.40	8421809
Dissolved Molybdenum (Mo)	mg/L	0.028	0.028	0.00020	8415465
Dissolved Nickel (Ni)	mg/L	0.0036	0.0033	0.00050	8415465
Dissolved Phosphorus (P)	mg/L	49	N/A	10	8421809
Dissolved Potassium (K)	mg/L	53	N/A	30	8421809
Dissolved Selenium (Se)	mg/L	0.0011	0.0010	0.00020	8415465
Dissolved Silicon (Si)	mg/L	25	N/A	10	8421809
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	8415465
Dissolved Sodium (Na)	mg/L	410	N/A	50	8421809
Dissolved Strontium (Sr)	mg/L	9.7	N/A	2.0	8421809
Dissolved Sulphur (S)	mg/L	220	N/A	20	8421809
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	8415465
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Titanium (Ti)	mg/L	0.0020	0.0012	0.0010	8415465
Dissolved Uranium (U)	mg/L	0.012	0.012	0.00010	8415465
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	8415465
Dissolved Zinc (Zn)	mg/L	0.0036	<0.0030	0.0030	8415465

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Report Date: 2016/10/06

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Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7330	PP7330			PP7331	PP7331		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17			2016/09/27 10:07	2016/09/27 10:07		
COC Number		M031856	M031856			M031856	M031856		
	UNITS	**MW16-14-33**	**MW16-14-33 Lab-Dup**	**RDL**	**QC Batch**	**MW16-6-11**	**MW16-6-11 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	8417244	4.3	N/A	0.50	8417244
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	3.9	N/A	0.50	8417248	N/A	N/A	0.50	8417248
Microbiological Param.									
E.Coli DST	mpn/100mL	<20	N/A	20	8413792	<100	N/A	100	8413792
Fecal Coliforms	MPN/100mL	<20 (1)	N/A	20	8413790	<100 (1)	N/A	100	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1.0	8413793	56000 (2)	56000	100	8413793
Total Coliforms DST	mpn/100mL	2300	N/A	20	8413792	9300	N/A	100	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	N/A	N/A	N/A	8417670	0.37	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	38 (3)	N/A	2.5	8417434	6.5 (2)	N/A	0.50	8417434
Orthophosphate (P)	mg/L	0.0039	N/A	0.0030	8417135	<0.0030	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	N/A	N/A	N/A	<0.0030	N/A	0.0030	8416951
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	1.5	N/A	0.050	8417688	N/A	N/A	N/A	N/A
Dissolved Phosphorus (P)	mg/L	0.0073	0.0064	0.0030	8415475	N/A	N/A	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7332	PP7332			PP7333	PP7333		
Sampling Date		2016/09/27 09:37	2016/09/27 09:37			2016/09/27 17:50	2016/09/27 17:50		
COC Number		M031856	M031856			M031856	M031856		
	UNITS	**MW16-6-20**	**MW16-6-20 Lab-Dup**	**RDL**	**QC Batch**	**MW16-7-5**	**MW16-7-5 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.1	N/A	0.50	8417244	9.2	N/A	0.50	8417244
Microbiological Param.									
E.Coli DST	mpn/100mL	<1.0	<1.0	1.0	8413792	<10	N/A	10	8413792
Fecal Coliforms	MPN/100mL	<1.0	<1.0	1.0	8413790	<10 (1)	N/A	10	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1.0	8413793	920	1100	1.0	8413793
Total Coliforms DST	mpn/100mL	>2400	>2400	1.0	8413792	1700	N/A	10	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	0.49	N/A	0.050	8417670	0.16	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8417434	0.62	N/A	0.050	8419040
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8417394	0.012 (2)	N/A	0.0030	8417135
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8416951	0.0065	N/A	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Orthophopshate greater than dissolved phosphate. Results within acceptable limits of precision.

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Report Date: 2016/10/06

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Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PP7334	PP7334	PP7335	PP7335		PP7336		
Sampling Date		2016/09/27 13:10	2016/09/27 13:10	2016/09/27 13:42	2016/09/27 13:42		2016/09/27 15:36		
COC Number		M031856	M031856	M031856	M031856		M031856		
	UNITS	**MW16-19-8**	**MW16-19-8 Lab-Dup**	**MW16-19-19**	**MW16-19-19 Lab-Dup**	**RDL**	**MW16-20-21**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	6.3	N/A	3.9	N/A	0.50	3.8	0.50	8417244
Microbiological Param.									
E.Coli DST	mpn/100mL	63	N/A	<10	N/A	10	<100	100	8413792
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	<10 (1)	N/A	10	<100 (1)	100	8413790
Heterotrophic Plate Count	CFU/mL	>6000	>6000	1700	1700	1.0	17000 (2)	100	8413793
Total Coliforms DST	mpn/100mL	280	N/A	10	N/A	10	750	100	8413792
Nutrients									
Dissolved Ammonia (N)	mg/L	0.070	N/A	1.1	N/A	0.050	0.57	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	0.70 (2)	N/A	1.5 (2)	N/A	0.50	11 (2)	0.50	8417434
Orthophosphate (P)	mg/L	<0.0030	N/A	<0.0030	N/A	0.0030	<0.0030	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	0.0037	N/A	<0.0030	N/A	0.0030	<0.0030	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PP7336		
Sampling Date		2016/09/27 15:36		
COC Number		M031856		
	UNITS	**MW16-20-21 Lab-Dup**	**RDL**	**QC Batch**
Microbiological Param.				
Heterotrophic Plate Count	CFU/mL	15000	100	8413793

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PP7330	PP7330	PP7331		PP7332		PP7333		
Sampling Date		2016/09/27 17:17	2016/09/27 17:17	2016/09/27 10:07		2016/09/27 09:37		2016/09/27 17:50		
COC Number		M031856	M031856	M031856		M031856		M031856		
	UNITS	**MW16-14-33**	**MW16-14-33 Lab-Dup**	**MW16-6-11**	**RDL**	**MW16-6-20**	**RDL**	**MW16-7-5**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	<0.0020	0.0020	0.0020	0.0020	8417239
Total Mercury (Hg)	ug/L	<20 (1)	N/A	<20 (1)	20	<0.20 (1)	0.20	<2.0 (1)	2.0	8417247
Lab Filtered Elements-Low										
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	N/A	0.0020	N/A	N/A	N/A	N/A	8417235

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PP7334		PP7335		PP7336		
Sampling Date		2016/09/27 13:10		2016/09/27 13:42		2016/09/27 15:36		
COC Number		M031856		M031856		M031856		
	UNITS	**MW16-19-8**	**RDL**	**MW16-19-19**	**RDL**	**MW16-20-21**	**RDL**	**QC Batch**
Low Level Elements								
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	<0.0020	0.0020	<0.0020	0.0020	8417239
Total Mercury (Hg)	ug/L	<2.0 (1)	2.0	<0.20 (1)	0.20	<6.0 (1)	6.0	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
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Site Location: SPRINGBANK SR1
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	10.0°C
Package 2	10.3°C

Sample PP7330-01 : Cation - Anion balance exceeds normal acceptance limits. Major ions were reanalyzed due to possible matrix interference.

ROUTINE WATER & DISS. REGULATED METALS (WATER) Comments

Sample PP7330-01 Alkalinity @25C (pp, total), CO3,HCO3,OH: Detection limits raised due to sample matrix.

Sample PP7330-01 Elements by ICP-Dissolved-Lab Filtered: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8413790	RP0	Method Blank	Fecal Coliforms	2016/09/29	<1.0		MPN/10	
8413790	RP0	RPD [PP7332-09]	Fecal Coliforms	2016/09/29	NC		%	N/A
8413792	AP1	Method Blank	E.Coli DST	2016/09/29	<1.0		mpn/100	
			Total Coliforms DST	2016/09/29	<1.0		mpn/100	
8413792	AP1	RPD [PP7332-09]	E.Coli DST	2016/09/29	NC		%	N/A
			Total Coliforms DST	2016/09/29	NC		%	N/A
8413792	AP1	RPD	E.Coli DST	2016/09/29	NC		%	N/A
			Total Coliforms DST	2016/09/29	NC		%	N/A
8413793	AP1	Method Blank	Heterotrophic Plate Count	2016/09/30	<1.0		CFU/mL	
8413793	AP1	RPD [PP7330-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7331-09]	Heterotrophic Plate Count	2016/09/30	0.72		%	N/A
8413793	AP1	RPD [PP7332-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7333-09]	Heterotrophic Plate Count	2016/09/30	18		%	N/A
8413793	AP1	RPD [PP7334-09]	Heterotrophic Plate Count	2016/09/30	NC		%	N/A
8413793	AP1	RPD [PP7335-09]	Heterotrophic Plate Count	2016/09/30	2.4		%	N/A
8413793	AP1	RPD [PP7336-09]	Heterotrophic Plate Count	2016/09/30	6.9		%	N/A
8414214	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/28		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		NC	%	80 - 120
8414214	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/28		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		101	%	80 - 120
8414214	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/28	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/28	<0.010		mg/L	
8414214	JLD	RPD	Dissolved Nitrite (N)	2016/09/28	0.31		%	20
			Dissolved Nitrate (N)	2016/09/28	2.5		%	20
8414403	JLD	Matrix Spike [PP7333-01]	Dissolved Nitrite (N)	2016/09/28		102	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		103	%	80 - 120
8414403	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/28		100	%	80 - 120
			Dissolved Nitrate (N)	2016/09/28		101	%	80 - 120
8414403	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/28	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/28	<0.010		mg/L	
8414403	JLD	RPD [PP7333-01]	Dissolved Nitrite (N)	2016/09/28	NC		%	20
			Dissolved Nitrate (N)	2016/09/28	NC		%	20
8414424	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/28		94	%	80 - 120
8414424	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/28	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/28	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/28	<0.50		mg/L	
			Carbonate (CO3)	2016/09/28	<0.50		mg/L	
			Hydroxide (OH)	2016/09/28	<0.50		mg/L	
8414424	SSO	RPD [PP7332-01]	Alkalinity (PP as CaCO3)	2016/09/28	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/28	5.2		%	20
			Bicarbonate (HCO3)	2016/09/28	5.2		%	20
			Carbonate (CO3)	2016/09/28	NC		%	20
			Hydroxide (OH)	2016/09/28	NC		%	20
8414428	SSO	Spiked Blank	pH	2016/09/28		100	%	97 - 103
8414428	SSO	RPD	pH	2016/09/28	1.0		%	N/A
8414429	SSO	Spiked Blank	Conductivity	2016/09/28		101	%	90 - 110
8414429	SSO	Method Blank	Conductivity	2016/09/28	<1.0		uS/cm	
8414429	SSO	RPD [PP7332-01]	Conductivity	2016/09/28	0.25		%	20
8414668	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/28		90	%	80 - 120
			Dissolved Boron (B)	2016/09/28		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		90	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		88	%	80 - 120

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lithium (Li)	2016/09/28		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		96	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		89	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		99	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		91	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		87	%	80 - 120
8414668	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/28		92	%	80 - 120
			Dissolved Boron (B)	2016/09/28		88	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/28		97	%	80 - 120
			Dissolved Iron (Fe)	2016/09/28		91	%	80 - 120
			Dissolved Lithium (Li)	2016/09/28		93	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/28		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/28		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/28		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/28		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/28		94	%	80 - 120
			Dissolved Sodium (Na)	2016/09/28		95	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/28		89	%	80 - 120
8414668	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/28	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/28	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/28	<0.20		mg/L	
8414668	JHC	RPD	Dissolved Barium (Ba)	2016/09/28	0.0078		%	20
			Dissolved Boron (B)	2016/09/28	NC		%	20
			Dissolved Calcium (Ca)	2016/09/28	0.0054		%	20
			Dissolved Iron (Fe)	2016/09/28	NC		%	20
			Dissolved Lithium (Li)	2016/09/28	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/28	0.051		%	20
			Dissolved Manganese (Mn)	2016/09/28	0.054		%	20
			Dissolved Phosphorus (P)	2016/09/28	NC		%	20
			Dissolved Potassium (K)	2016/09/28	1.6		%	20
			Dissolved Silicon (Si)	2016/09/28	0.29		%	20
			Dissolved Sodium (Na)	2016/09/28	0.082		%	20
			Dissolved Strontium (Sr)	2016/09/28	0.0033		%	20
			Dissolved Sulphur (S)	2016/09/28	0.015		%	20
8414729	VP4	Matrix Spike [PP7330-07]	O-TERPHENYL (sur.)	2016/09/30		90	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30		88	%	50 - 130
8414729	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/09/30		87	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30		89	%	70 - 130
8414729	VP4	Method Blank	O-TERPHENYL (sur.)	2016/09/30		84	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/30	<0.10		mg/L	

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
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Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8414729	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/09/30	43 (1)		%	40
8415439	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/29		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		94	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		91	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/29		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		87	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		93	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		99	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		98	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		88	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		95	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		NC	%	80 - 120
8415439	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/29		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		90	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		93	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		93	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		92	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/29		95	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		87	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		101	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		92	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		86	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		88	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		94	%	80 - 120
8415439	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/29	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/29	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/29	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/29	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/29	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/29	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/29	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/29	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/29	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/29	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/29	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/29	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/29	<0.00010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Thallium (Tl)	2016/09/29	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/29	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/29	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/29	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/29	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/29	<0.0030		mg/L	
8415439	PC5	RPD	Dissolved Aluminum (Al)	2016/09/29	NC		%	20
			Dissolved Antimony (Sb)	2016/09/29	NC		%	20
			Dissolved Arsenic (As)	2016/09/29	10		%	20
			Dissolved Beryllium (Be)	2016/09/29	NC		%	20
			Dissolved Chromium (Cr)	2016/09/29	NC		%	20
			Dissolved Cobalt (Co)	2016/09/29	NC		%	20
			Dissolved Copper (Cu)	2016/09/29	NC		%	20
			Dissolved Lead (Pb)	2016/09/29	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/29	NC		%	20
			Dissolved Nickel (Ni)	2016/09/29	NC		%	20
			Dissolved Selenium (Se)	2016/09/29	NC		%	20
			Dissolved Silver (Ag)	2016/09/29	NC		%	20
			Dissolved Thallium (Tl)	2016/09/29	NC		%	20
			Dissolved Tin (Sn)	2016/09/29	NC		%	20
			Dissolved Titanium (Ti)	2016/09/29	NC		%	20
			Dissolved Uranium (U)	2016/09/29	NC		%	20
			Dissolved Vanadium (V)	2016/09/29	NC		%	20
			Dissolved Zinc (Zn)	2016/09/29	1.5		%	20
8415465	PC5	Matrix Spike [PP7330-01]	Dissolved Aluminum (Al)	2016/09/30		144 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		97	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		97	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		91	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		93	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		91	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		88	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		NC	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		95	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		93	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		90	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		103	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		106	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		85	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		85	%	80 - 120
8415465	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/29		99	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/29		93	%	80 - 120
			Dissolved Arsenic (As)	2016/09/29		91	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/29		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/29		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/29		94	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/29		92	%	80 - 120
			Dissolved Copper (Cu)	2016/09/29		91	%	80 - 120
			Dissolved Lead (Pb)	2016/09/29		92	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Molybdenum (Mo)	2016/09/29		92	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/29		85	%	80 - 120
			Dissolved Selenium (Se)	2016/09/29		97	%	80 - 120
			Dissolved Silver (Ag)	2016/09/29		94	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/29		93	%	80 - 120
			Dissolved Tin (Sn)	2016/09/29		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/29		90	%	80 - 120
			Dissolved Uranium (U)	2016/09/29		87	%	80 - 120
			Dissolved Vanadium (V)	2016/09/29		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/29		92	%	80 - 120
8415465	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/29	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/29	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/29	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/29	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/29	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/29	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/29	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/29	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/29	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/29	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/29	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/29	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/29	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/29	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/29	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/29	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/29	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/29	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/29	<0.0030		mg/L	
8415465	PC5	RPD [PP7330-01]	Dissolved Aluminum (Al)	2016/09/29	NC		%	20
			Dissolved Antimony (Sb)	2016/09/29	NC		%	20
			Dissolved Arsenic (As)	2016/09/29	14		%	20
			Dissolved Beryllium (Be)	2016/09/29	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/29	NC		%	20
			Dissolved Chromium (Cr)	2016/09/29	NC		%	20
			Dissolved Cobalt (Co)	2016/09/29	NC		%	20
			Dissolved Copper (Cu)	2016/09/29	NC		%	20
			Dissolved Lead (Pb)	2016/09/29	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/29	1.5		%	20
			Dissolved Nickel (Ni)	2016/09/29	8.0		%	20
			Dissolved Selenium (Se)	2016/09/29	9.1		%	20
			Dissolved Silver (Ag)	2016/09/29	NC		%	20
			Dissolved Thallium (Tl)	2016/09/29	NC		%	20
			Dissolved Tin (Sn)	2016/09/29	NC		%	20
			Dissolved Titanium (Ti)	2016/09/29	NC		%	20
			Dissolved Uranium (U)	2016/09/29	0.20		%	20
			Dissolved Vanadium (V)	2016/09/29	NC		%	20
			Dissolved Zinc (Zn)	2016/09/29	NC		%	20
8415475	MB5	Matrix Spike [PP7330-01]	Dissolved Phosphorus (P)	2016/09/29		99	%	80 - 120
8415475	MB5	QC Standard	Dissolved Phosphorus (P)	2016/09/29		97	%	80 - 120
8415475	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/09/29		97	%	80 - 120
8415475	MB5	Method Blank	Dissolved Phosphorus (P)	2016/09/29	<0.0030		mg/L	

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8415475	MB5	RPD [PP7330-01]	Dissolved Phosphorus (P)	2016/09/29	NC		%	20
8416951	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		103	%	80 - 120
8416951	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		104	%	80 - 120
8416951	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		100	%	80 - 120
8416951	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	0.0037, RDL=0.0030		mg/L	
8416951	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	NC		%	20
8417135	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		90	%	80 - 120
8417135	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		91	%	80 - 120
8417135	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417135	MB5	RPD	Orthophosphate (P)	2016/09/30	NC		%	20
8417235	RK3	Matrix Spike [PP7330-06]	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417235	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		114	%	80 - 120
8417235	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417235	RK3	RPD [PP7330-06]	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417239	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/30		107	%	80 - 120
8417239	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417239	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417239	RK3	RPD	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417244	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/09/30		103	%	80 - 120
8417244	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		98	%	80 - 120
8417244	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417244	MUK	RPD	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417247	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/30		109	%	80 - 120
8417247	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/30		104	%	80 - 120
8417247	RK3	Method Blank	Total Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417247	RK3	RPD	Total Mercury (Hg)	2016/09/30	NC		%	20
8417248	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/09/30		107	%	80 - 120
8417248	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/09/30		101	%	80 - 120
8417248	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/09/30	<0.50		mg/L	
8417248	MUK	RPD	Dissolved Organic Carbon (C)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417434	RM9	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/01		NC	%	80 - 120
8417434	RM9	QC Standard	Total Kjeldahl Nitrogen	2016/10/01		111	%	80 - 120
8417434	RM9	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/01		108	%	80 - 120
8417434	RM9	Method Blank	Total Kjeldahl Nitrogen	2016/10/01	<0.050		mg/L	
8417434	RM9	RPD	Total Kjeldahl Nitrogen	2016/10/01	1.1		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417688	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417688	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		97	%	80 - 120
8417688	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417688	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	1.3		%	20
8417842	MZ	Matrix Spike [PP7331-08]	1,4-Difluorobenzene (sur.)	2016/10/02		105	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		108	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		128	%	70 - 130
			Benzene	2016/10/02		111	%	70 - 130

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Toluene	2016/10/02		108	%	70 - 130
			Ethylbenzene	2016/10/02		114	%	70 - 130
			m & p-Xylene	2016/10/02		117	%	70 - 130
			o-Xylene	2016/10/02		119	%	70 - 130
			F1 (C6-C10)	2016/10/02		70	%	70 - 130
8417842	MZ	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/02		107	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		118	%	70 - 130
			Benzene	2016/10/02		98	%	70 - 130
			Toluene	2016/10/02		98	%	70 - 130
			Ethylbenzene	2016/10/02		104	%	70 - 130
			m & p-Xylene	2016/10/02		105	%	70 - 130
			o-Xylene	2016/10/02		107	%	70 - 130
			F1 (C6-C10)	2016/10/02		98	%	70 - 130
8417842	MZ	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/02		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/02		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/02		120	%	70 - 130
			Benzene	2016/10/02	<0.00040		mg/L	
			Toluene	2016/10/02	<0.00040		mg/L	
			Ethylbenzene	2016/10/02	<0.00040		mg/L	
			m & p-Xylene	2016/10/02	<0.00080		mg/L	
			o-Xylene	2016/10/02	<0.00040		mg/L	
			Xylenes (Total)	2016/10/02	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/02	<0.10		mg/L	
			F1 (C6-C10)	2016/10/02	<0.10		mg/L	
8417842	MZ	RPD [PP7330-08]	Benzene	2016/10/02	NC		%	40
			Toluene	2016/10/02	NC		%	40
			Ethylbenzene	2016/10/02	NC		%	40
			m & p-Xylene	2016/10/02	NC		%	40
			o-Xylene	2016/10/02	NC		%	40
			Xylenes (Total)	2016/10/02	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/02	NC		%	40
			F1 (C6-C10)	2016/10/02	NC		%	40
8418338	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/01		108	%	80 - 120
8418338	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/01		107	%	80 - 120
8418338	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/01	1.2, RDL=1.0		mg/L	
8418338	ZI	RPD	Dissolved Chloride (Cl)	2016/10/01	1.6		%	20
8418346	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/01		119	%	80 - 120
8418346	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/01		101	%	80 - 120
8418346	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/01	<1.0		mg/L	
8418346	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/01	NC		%	20
8419025	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419025	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		107	%	80 - 120
8419025	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419025	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	0.44		%	20
8419026	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		111	%	80 - 120
8419026	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		103	%	80 - 120
8419026	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419026	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	NC		%	20
8419040	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419040	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		88	%	80 - 120

Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419040	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		109	%	80 - 120
8419040	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419040	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8421809	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		104	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		95	%	80 - 120
8421809	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		103	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421809	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421809	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20

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Maxxam Job #: B684487
Report Date: 2016/10/06

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8424014	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/06		92	%	80 - 120
8424014	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/06	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/06	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/06	<0.50		mg/L	
			Carbonate (CO3)	2016/10/06	<0.50		mg/L	
			Hydroxide (OH)	2016/10/06	<0.50		mg/L	
8424014	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/06	3.1		%	20
			Alkalinity (Total as CaCO3)	2016/10/06	0.30		%	20
			Bicarbonate (HCO3)	2016/10/06	0.22		%	20
			Carbonate (CO3)	2016/10/06	3.1		%	20
			Hydroxide (OH)	2016/10/06	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics

Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1200

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
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CHAIN OF CUSTODY RECORD

M 031856

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information	
Company:	Stantec Consulting Ltd.	Company:		Quotation #:	
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:	
Address:	10160 112 st, Edmonton AB, T5K 2L6	Address:		Project #:	110773396
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1
Email:	Dylan.King@stantec.com	Email:		Site #:	
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet

Turnaround Time (TAT) Required

- [x] 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

- [ ] Same Day
- [ ] 2 Days
- [ ] 1 Day
- [ ] 3-4 Days

Date Required:

Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID				
Seal Present		✓					
Seal Intact		✓	Temp	8	10	12	
Cooling Media	✓						
Seal Present		✓					
Seal Intact		✓	Temp	8	11	12	
Cooling Media	✓						
Seal Present							
Seal Intact			Temp				
Cooling Media							

Depot Reception

Analysis Requested

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorus	Phosphate	Dissolved ammonia	TKN	DOC	Total coliforms	E.coli	Fecal coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-14-33		2016/09/27	17:17	W	13		✓		✓	✓	✓		8	10	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-6-11			10:07										8	9	9										
3	MW16-6-20			9:37										10	10	10										
4	MW16-7-5			17:50										9	9	10										
5	MW16-19-8			13:10										8	10	11										
6	MW16-19-19			13:42										8	9	9										
7	MW16-20-21			15:36										9	11	11										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- [x] AT1/CCME
- [x] Drinking Water
- [ ] Saskatchewan
- [ ] D50 (Drilling Waste)
- [ ] Other:

Special Instructions

MW16-14-33 dissolved parameters not field filtered or preserved due to turbidity and low water volume

Submitted same day as sampled

Unused metals bottles present in same sample bags

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/27	18:51	[signature] GURJEET GREWAL	2016/09/27	18:56

27-Sep-16 18:56
Wendy Sears
B684487

NB6 INS-0001

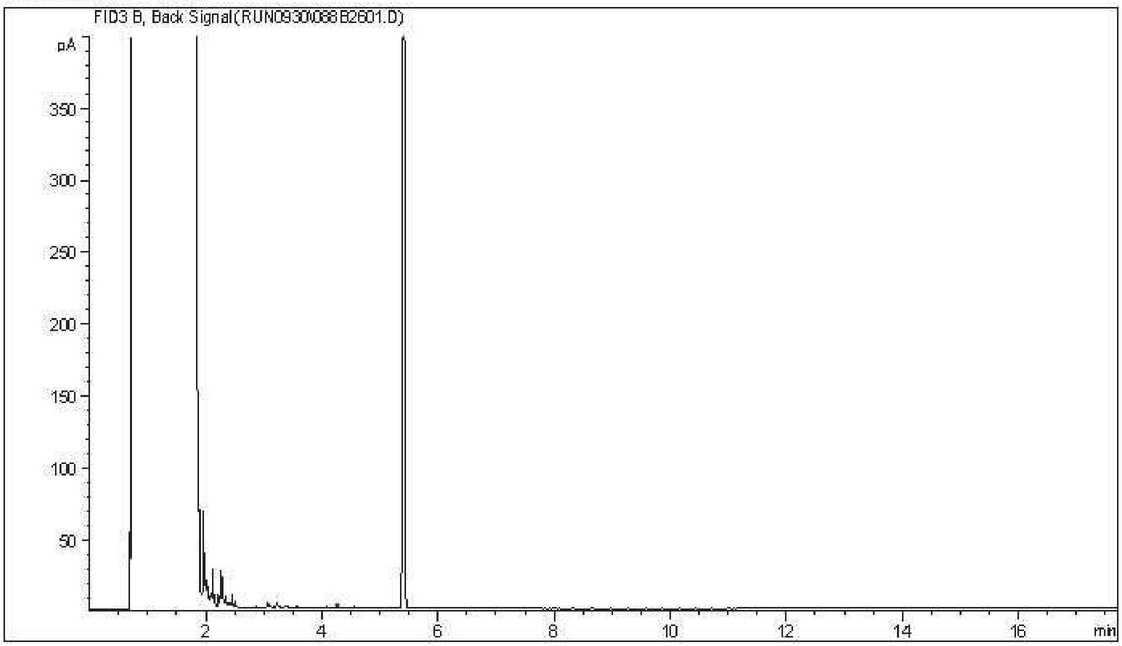
AB FCD-00331/6

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7330

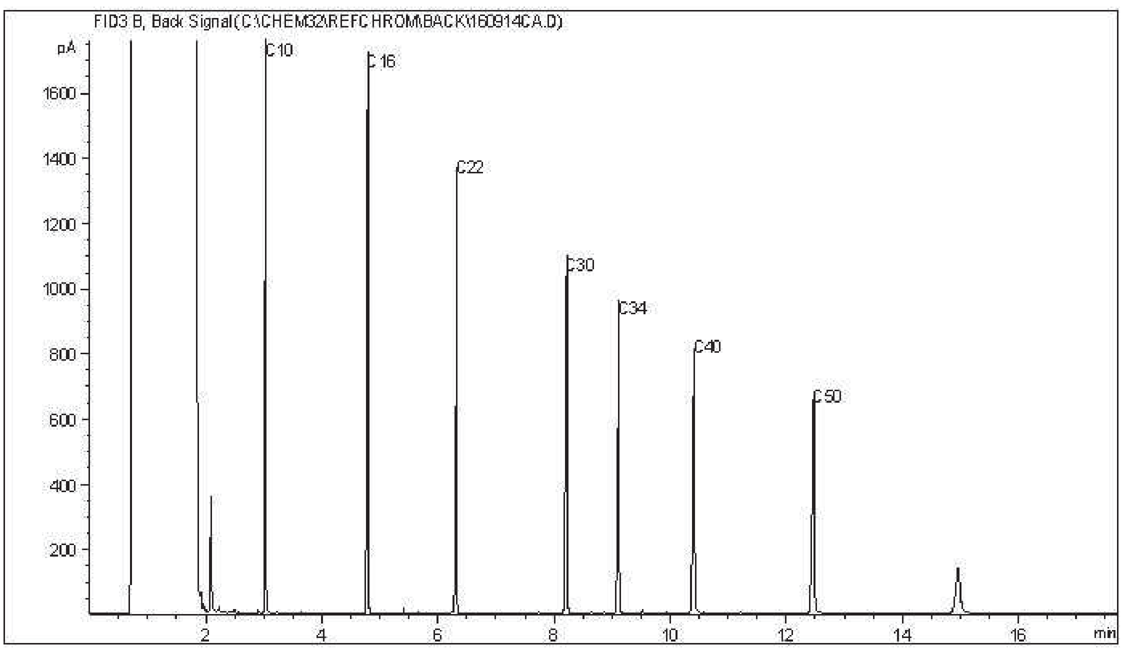
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-14-33

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

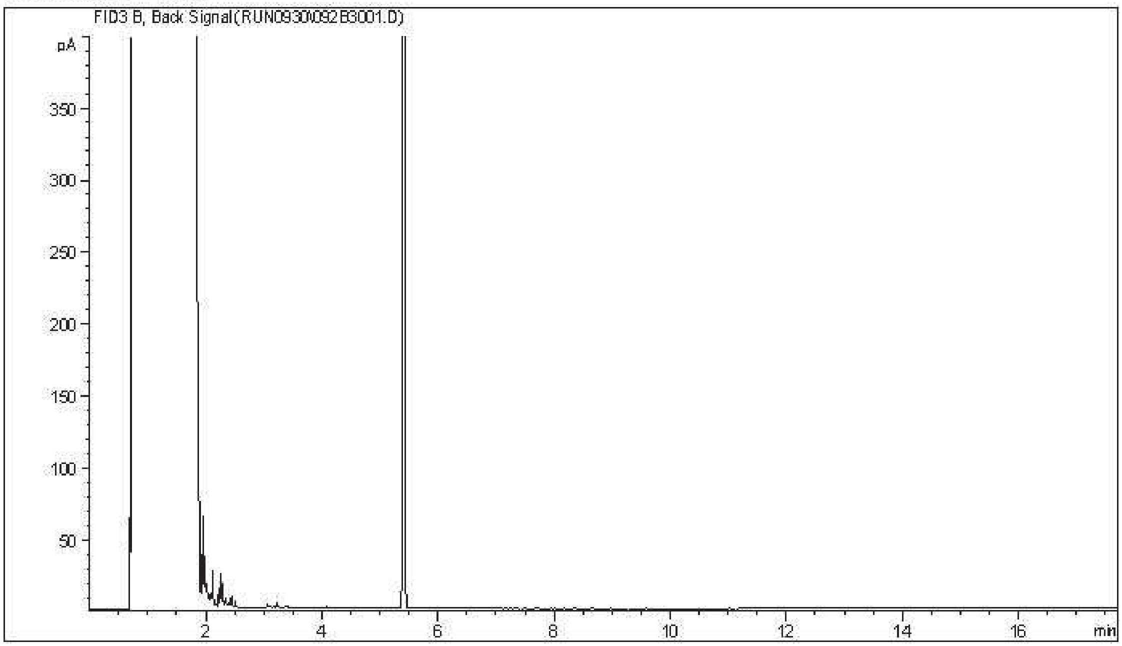
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7331

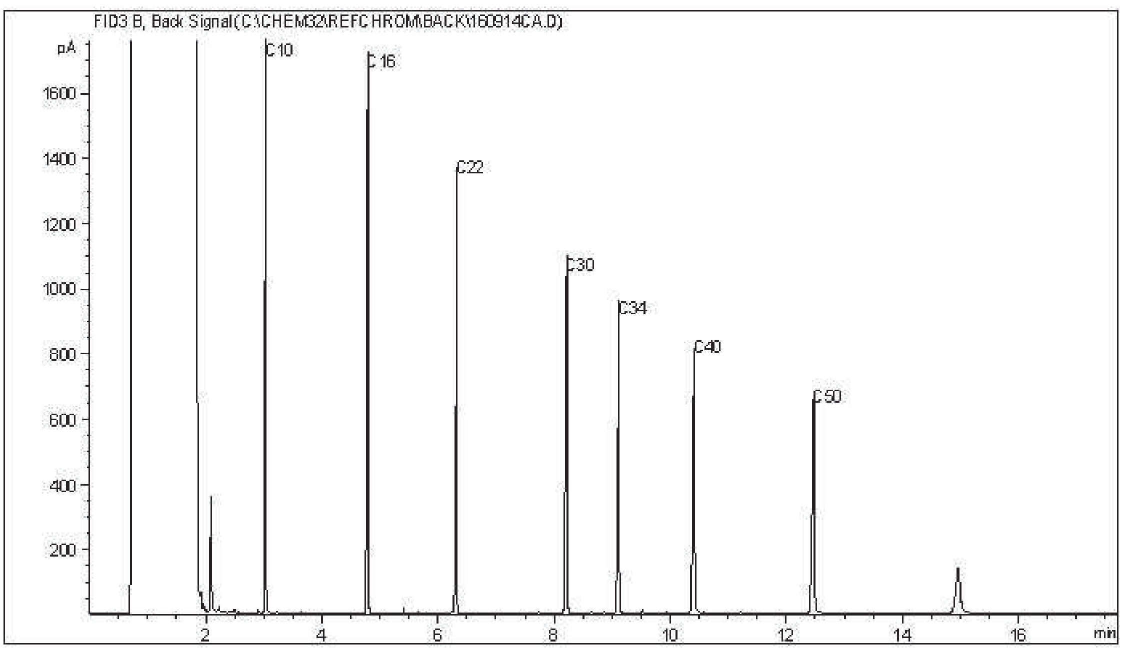
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-6-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

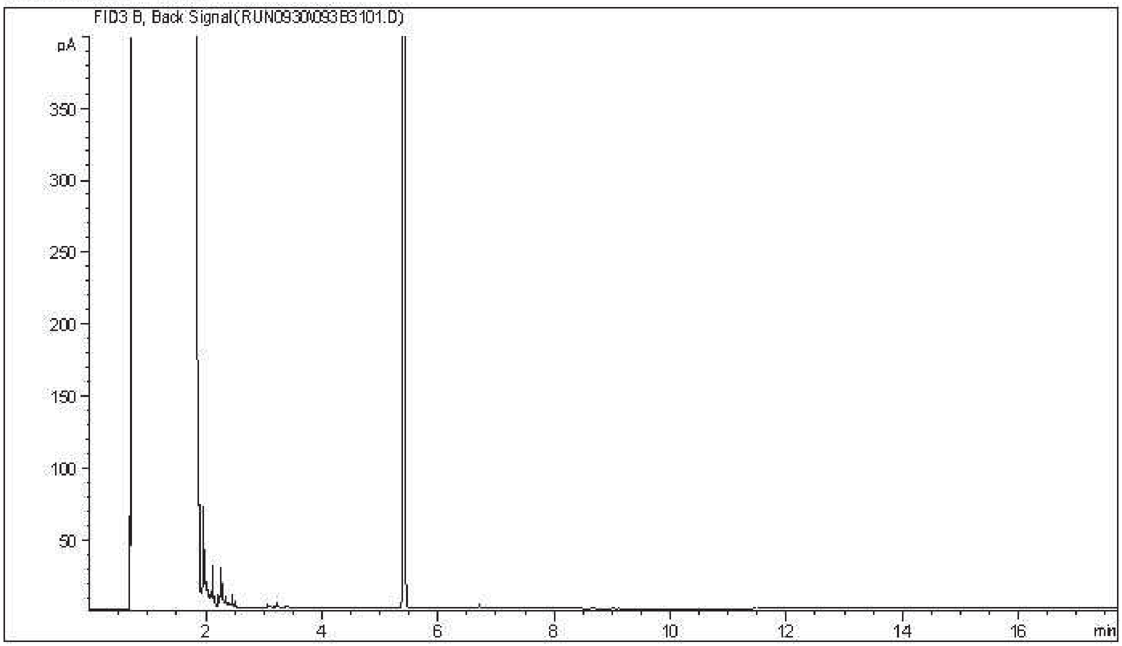
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7332

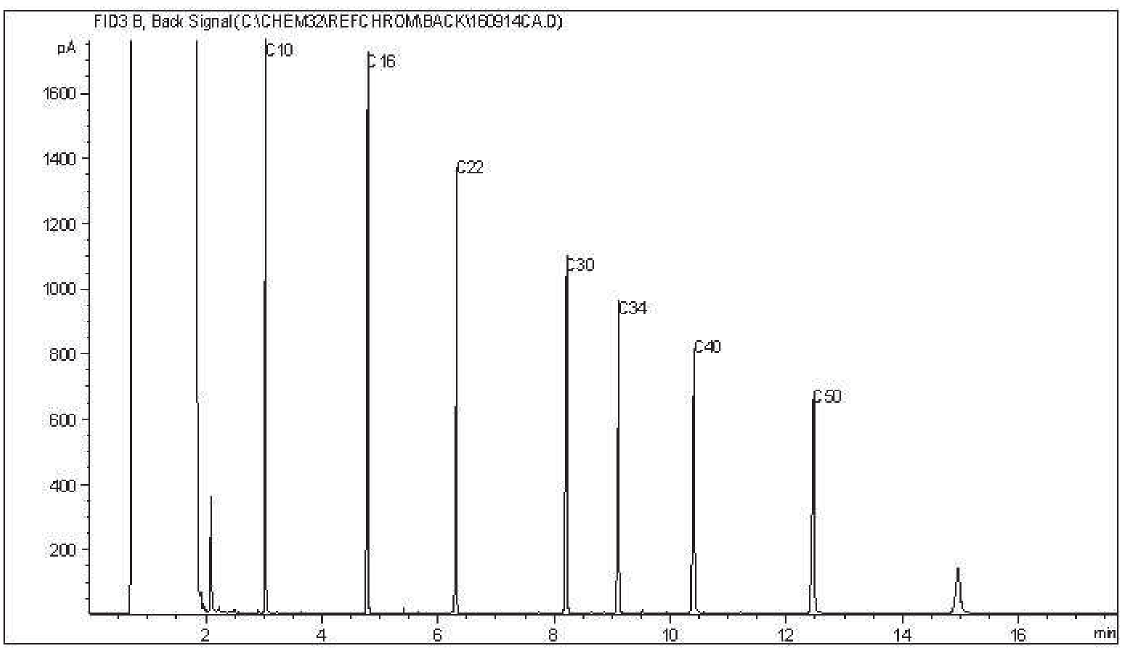
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-6-20

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

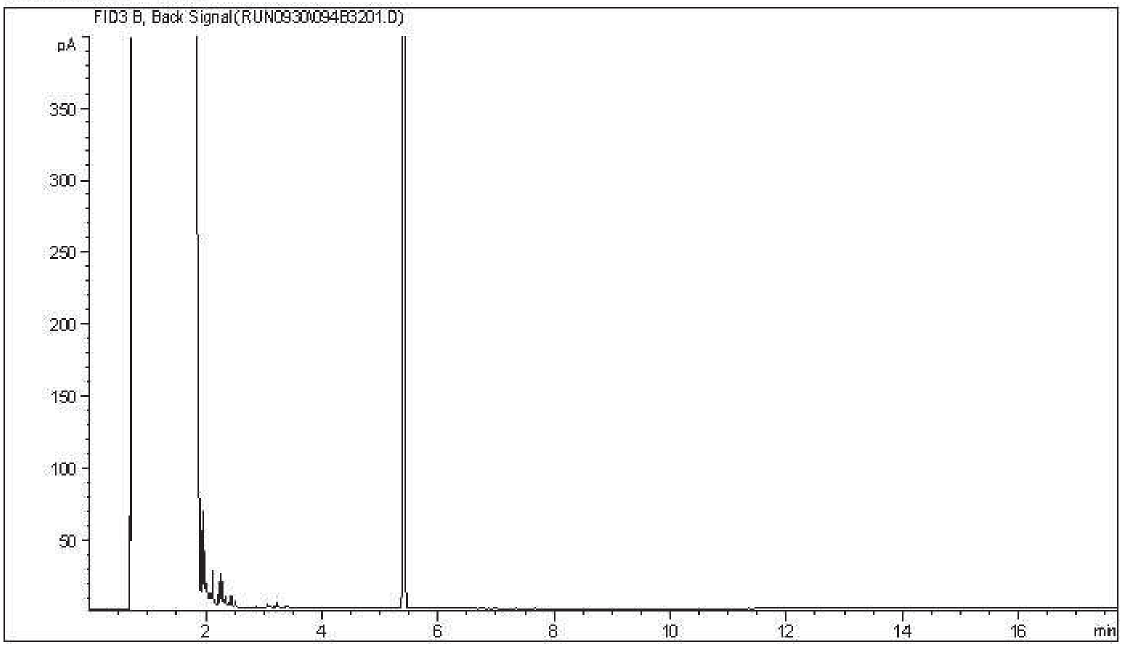
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7333

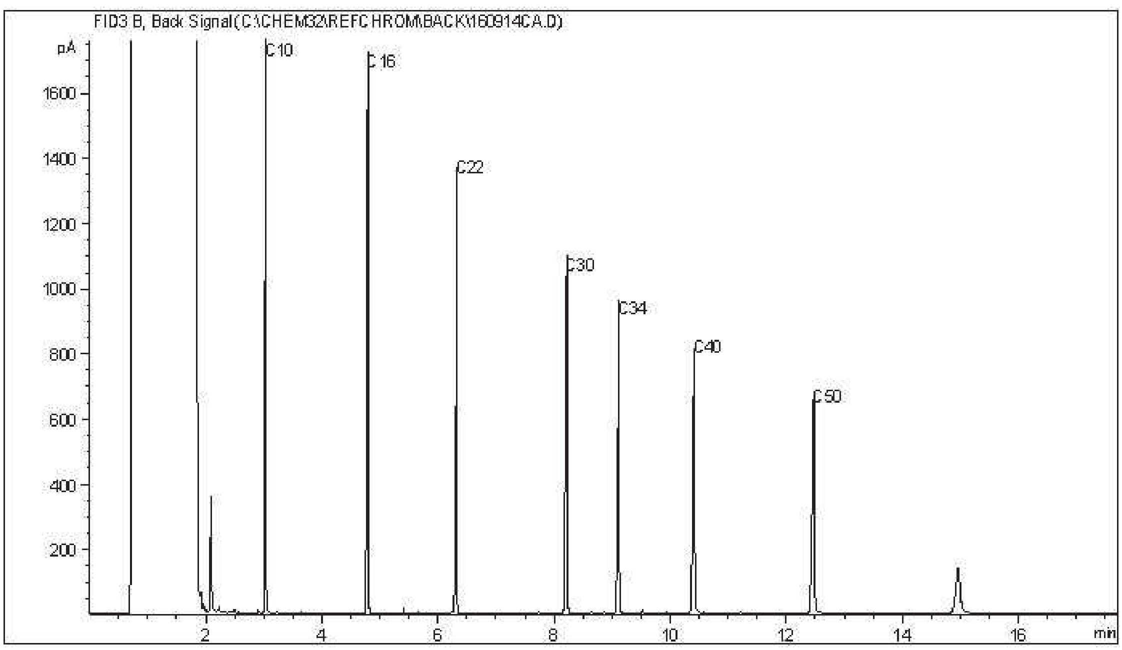
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-7-5

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



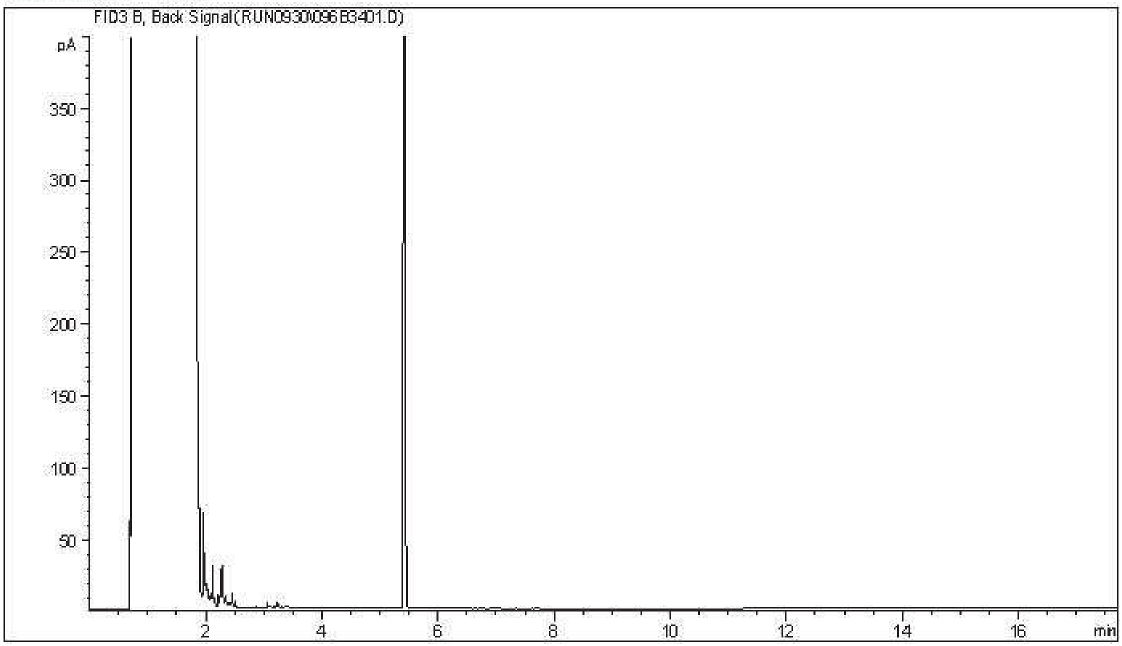
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

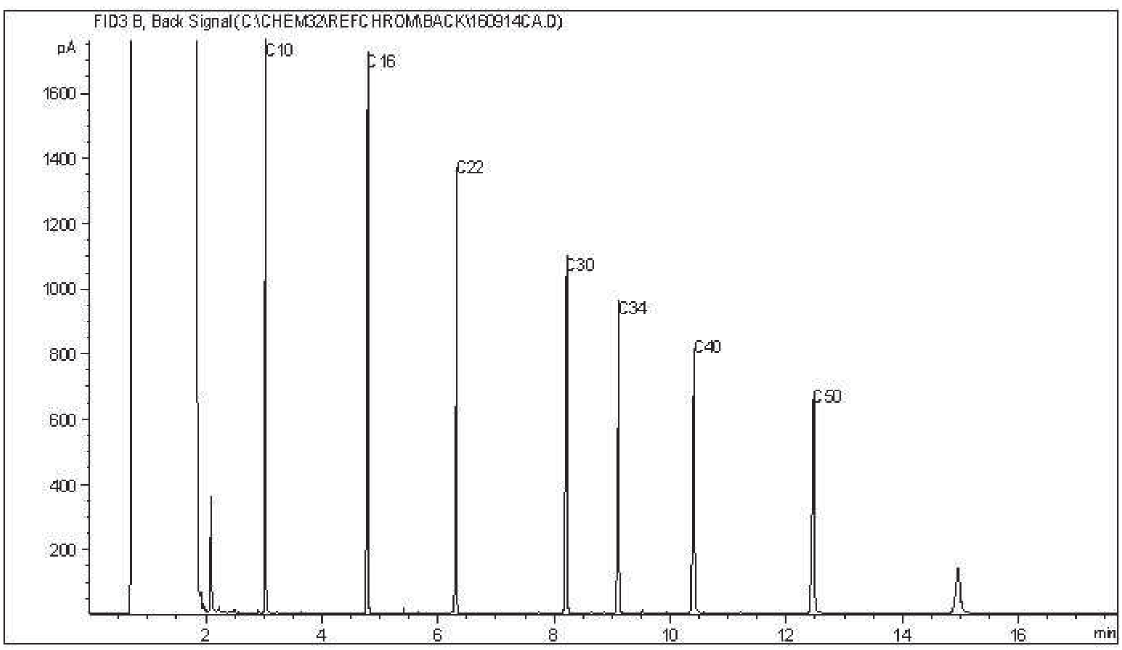
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

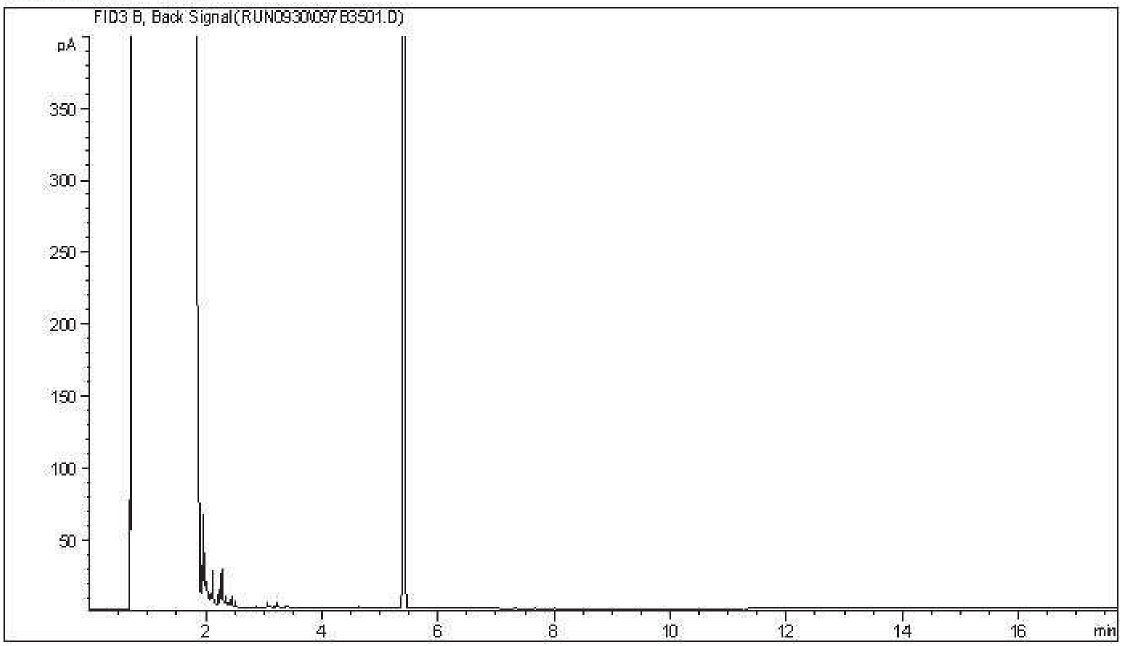
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7335

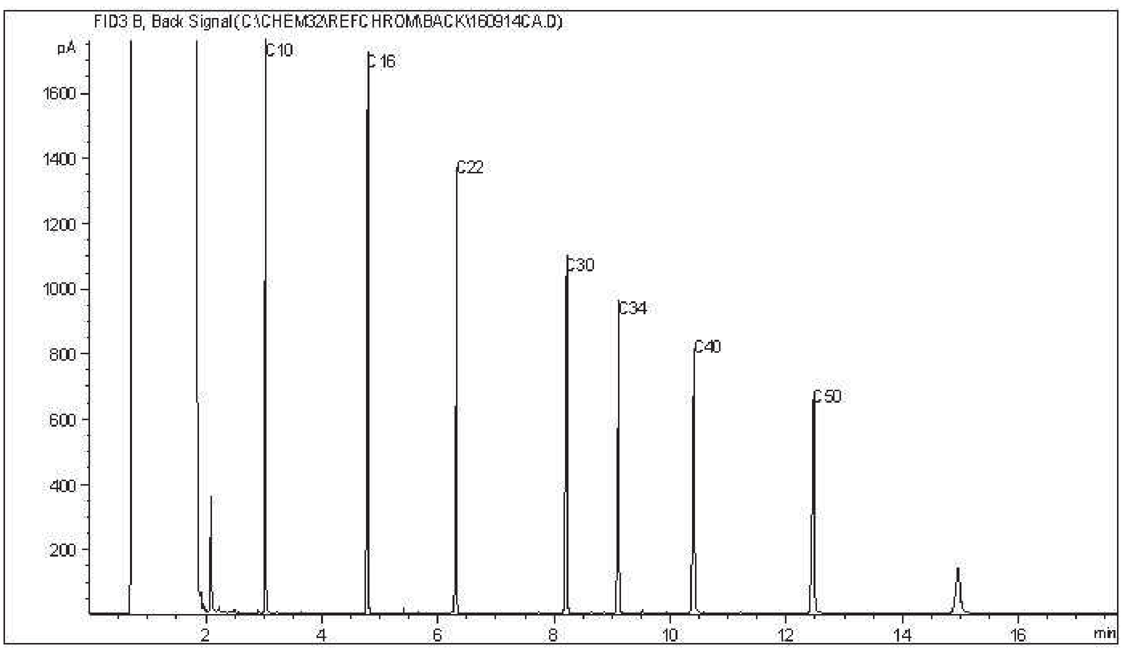
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-19-19

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

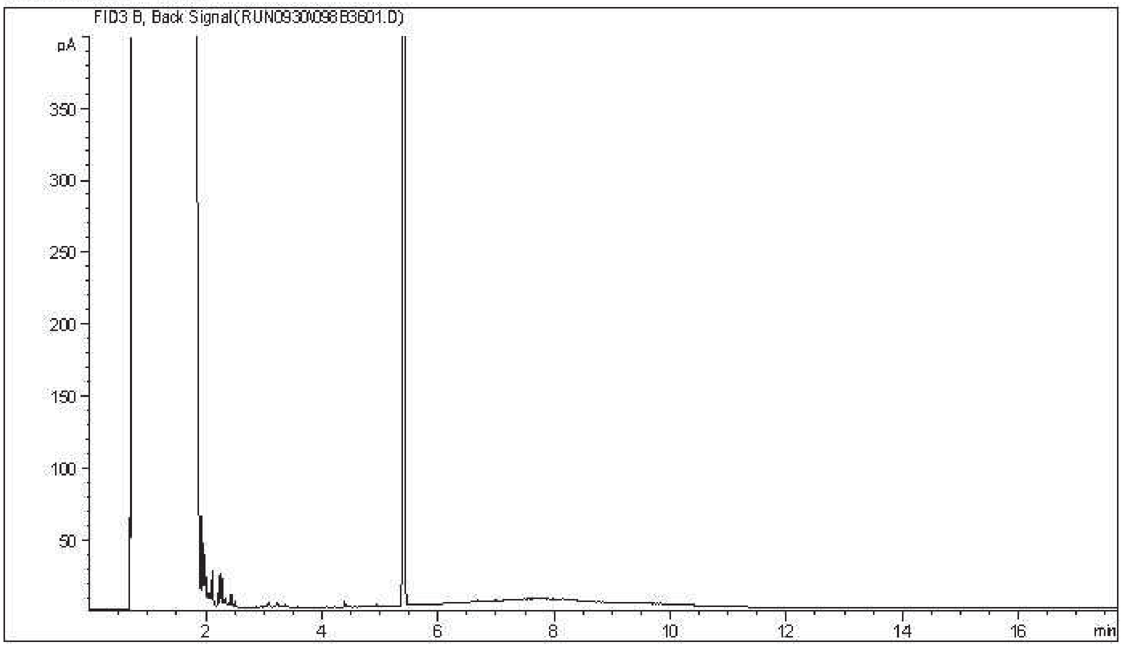
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B684487
Report Date: 2016/10/06
Maxxam Sample: PP7336

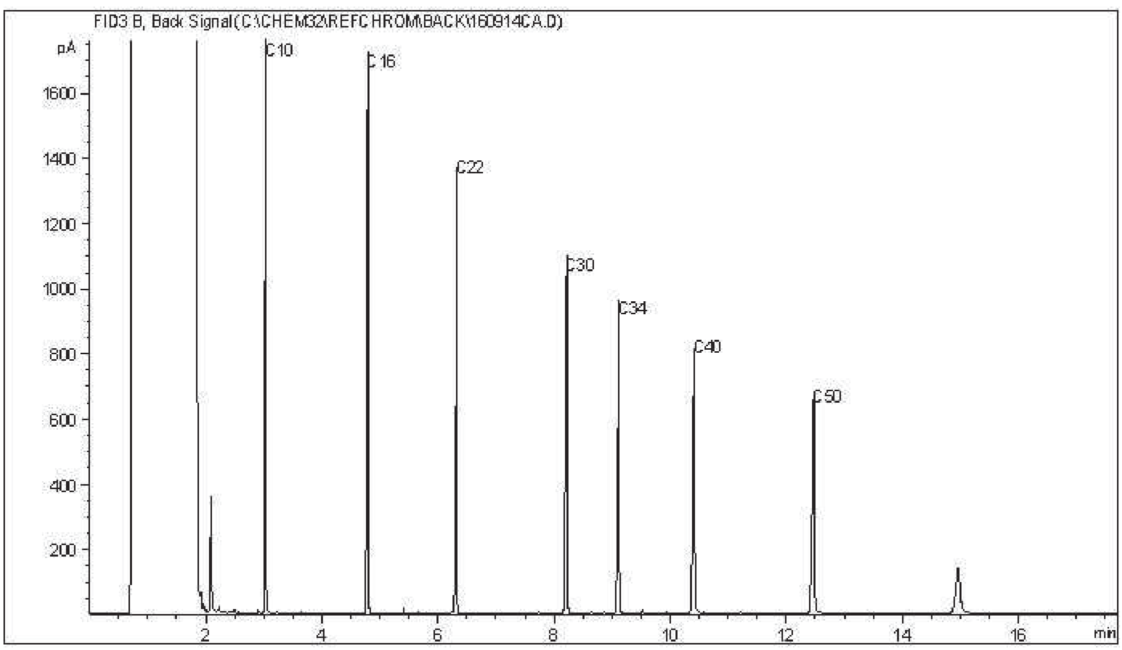
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-20-21

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031857

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/07
Report #: R2278053
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B685593
Received: 2016/09/29, 19:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	3	N/A	2016/09/30	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	3	N/A	2016/10/06	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	3	N/A	2016/10/03	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	3	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	3	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	2	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	1	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	3	N/A	2016/09/30	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	3	2016/09/30	2016/10/02	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	3	N/A	2016/10/04	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	2	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	3	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	2	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	2	N/A	2016/09/30	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	3	N/A	2016/09/30	AB WI-00065	Auto Calc
Sum of cations, anions	3	N/A	2016/10/04	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	2	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	1	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	3	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	3	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	3	N/A	2016/10/01	AB SOP-00023	SM 22 4110 B m
pH @25°C	3	N/A	2016/09/30	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	3	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	3	N/A	2016/10/03	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	3	2016/09/30	2016/10/02	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	3	N/A	2016/10/04	AB WI-00065	Auto Calc

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031857

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/07
Report #: R2278053
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B685593
Received: 2016/09/29, 19:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Kjeldahl Nitrogen	1	2016/09/30	2016/10/01	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	2	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	2	2016/10/02	2016/10/04	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	1	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ3527	PQ3527	PQ3528	PQ3529	PQ3529		
Sampling Date		2016/09/29 09:52	2016/09/29 09:52	2016/09/29 16:56	2016/09/29 17:32	2016/09/29 17:32		
COC Number		M031857	M031857	M031857	M031857	M031857		
	UNITS	**MW16-21-11**	**MW16-21-11 Lab-Dup**	**MW16-23-36**	**MW16-23-14**	**MW16-23-14 Lab-Dup**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	0.10	8416876
Volatiles								
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	N/A	0.00040	8421839
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	N/A	0.00040	8421839
Ethylbenzene	mg/L	0.00059	0.00058	<0.00040	<0.00040	N/A	0.00040	8421839
m & p-Xylene	mg/L	0.00090	0.00093	<0.00080	<0.00080	N/A	0.00080	8421839
o-Xylene	mg/L	0.0010	0.0010	<0.00040	<0.00040	N/A	0.00040	8421839
Xylenes (Total)	mg/L	0.0019	0.0019	<0.00080	<0.00080	N/A	0.00080	8421839
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	N/A	0.10	8421839
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	N/A	0.10	8421839
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	110	112	106	112	N/A	N/A	8421839
4-Bromofluorobenzene (sur.)	%	105	105	107	104	N/A	N/A	8421839
D4-1,2-Dichloroethane (sur.)	%	104	109	121	105	N/A	N/A	8421839
O-TERPHENYL (sur.)	%	93	N/A	94	92	90	N/A	8416876

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3527		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 17:32		
COC Number		M031857		M031857		
	UNITS	MW16-21-11	QC Batch	MW16-23-14	RDL	QC Batch
Calculated Parameters						
Anion Sum	meq/L	9.2	8416540	13	N/A	8416540
Cation Sum	meq/L	9.9	8416540	14	N/A	8416540
Hardness (CaCO3)	mg/L	440	8416386	540	0.50	8416386
Ion Balance	N/A	1.1	8416402	1.0	0.010	8416402
Dissolved Nitrate (NO3)	mg/L	21	8416387	<0.044	0.044	8416387
Nitrate plus Nitrite (N)	mg/L	4.8	8416388	<0.020	0.020	8416388
Dissolved Nitrite (NO2)	mg/L	<0.033	8416387	<0.033	0.033	8416387
Calculated Total Dissolved Solids	mg/L	480	8416403	680	10	8416403
Misc. Inorganics						
Conductivity	uS/cm	800	8417189	1100	1.0	8417175
pH	pH	7.96	8417188	7.94	N/A	8417173
Anions						
Alkalinity (PP as CaCO3)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Alkalinity (Total as CaCO3)	mg/L	390	8417181	600	0.50	8417160
Bicarbonate (HCO3)	mg/L	470	8417181	730	0.50	8417160
Carbonate (CO3)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Hydroxide (OH)	mg/L	<0.50	8417181	<0.50	0.50	8417160
Dissolved Sulphate (SO4)	mg/L	50	8419569	70	1.0	8419569
Dissolved Chloride (Cl)	mg/L	4.6	8419564	3.5	1.0	8419564
Nutrients						
Dissolved Nitrite (N)	mg/L	<0.010	8417625	<0.010	0.010	8417633
Dissolved Nitrate (N)	mg/L	4.8	8417625	<0.010	0.010	8417633
Elements						
Dissolved Aluminum (Al)	mg/L	0.0033	8417228	<0.0030	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00045	8417228	0.0056	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.087	8417829	0.12	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.061	8417829	0.13	0.020	8417829
Dissolved Cadmium (Cd)	mg/L	0.000073	8417228	0.000033	0.000020	8417228

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3527		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 17:32		
COC Number		M031857		M031857		
	UNITS	**MW16-21-11**	**QC Batch**	**MW16-23-14**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	86	8417829	130	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.00062	8417228	0.0020	0.00030	8417228
Dissolved Copper (Cu)	mg/L	0.0013	8417228	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.078	8417829	0.50	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.028	8417829	0.032	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	54	8417829	53	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.17	8417829	0.75	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0010	8417228	0.0053	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.0016	8417228	0.0053	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	7.6	8417829	6.5	0.30	8417829
Dissolved Selenium (Se)	mg/L	0.0019	8417228	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	4.7	8417829	6.5	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	21	8417829	59	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.1	8417829	1.1	0.020	8417829
Dissolved Sulphur (S)	mg/L	19	8417829	25	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.0067	8417228	0.0052	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	8417228	<0.0030	0.0030	8417228
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3528		
Sampling Date		2016/09/29 16:56		
COC Number		M031857		
	UNITS	**MW16-23-36**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	meq/L	14	N/A	8416540
Cation Sum	meq/L	14	N/A	8416540
Hardness (CaCO3)	mg/L	180	0.50	8416386
Ion Balance	N/A	0.99	0.010	8416402
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8416387
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8416388
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8416387
Calculated Total Dissolved Solids	mg/L	850	10	8416403
Misc. Inorganics				
Conductivity	uS/cm	1300	1.0	8417175
pH	pH	8.22	N/A	8417173
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8417160
Alkalinity (Total as CaCO3)	mg/L	290	0.50	8417160
Bicarbonate (HCO3)	mg/L	350	0.50	8417160
Carbonate (CO3)	mg/L	<0.50	0.50	8417160
Hydroxide (OH)	mg/L	<0.50	0.50	8417160
Dissolved Sulphate (SO4)	mg/L	380 (1)	2.0	8419569
Dissolved Chloride (Cl)	mg/L	3.2	1.0	8419564
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8417633
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8417633
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.0074	0.0030	8419977
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8419977
Dissolved Arsenic (As)	mg/L	0.00035	0.00020	8419977
Dissolved Barium (Ba)	mg/L	0.030	0.010	8417669
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8419977
Dissolved Boron (B)	mg/L	0.086	0.020	8417669

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ3528		
Sampling Date		2016/09/29 16:56		
COC Number		M031857		
	UNITS	**MW16-23-36**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8419977
Dissolved Calcium (Ca)	mg/L	50	0.30	8417669
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8419977
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8419977
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8419977
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8417669
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8419977
Dissolved Lithium (Li)	mg/L	0.066	0.020	8417669
Dissolved Magnesium (Mg)	mg/L	14	0.20	8417669
Dissolved Manganese (Mn)	mg/L	0.083	0.0040	8417669
Dissolved Molybdenum (Mo)	mg/L	0.0023	0.00020	8419977
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8419977
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417669
Dissolved Potassium (K)	mg/L	4.2	0.30	8417669
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8419977
Dissolved Silicon (Si)	mg/L	3.8	0.10	8417669
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8419977
Dissolved Sodium (Na)	mg/L	230	0.50	8417669
Dissolved Strontium (Sr)	mg/L	0.77	0.020	8417669
Dissolved Sulphur (S)	mg/L	120	0.20	8417669
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8419977
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8419977
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8419977
Dissolved Uranium (U)	mg/L	0.00010	0.00010	8419977
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8419977
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8419977
RDL = Reportable Detection Limit				

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ3527	PQ3527			PQ3528	PQ3528		
Sampling Date		2016/09/29 09:52	2016/09/29 09:52			2016/09/29 16:56	2016/09/29 16:56		
COC Number		M031857	M031857			M031857	M031857		
	UNITS	**MW16-21-11**	**MW16-21-11 Lab-Dup**	**RDL**	**QC Batch**	**MW16-23-36**	**MW16-23-36 Lab-Dup**	**RDL**	**QC Batch**
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.8	N/A	0.50	8418324	2.9	3.1	0.50	8418324
Microbiological Param.									
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8416950	11	N/A	1.0	8416950
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8416953	5.1	N/A	1.0	8416953
Heterotrophic Plate Count	CFU/mL	3200 (2)	3100	10	8416947	400	430	1.0	8416947
Total Coliforms DST	mpn/100mL	20 (1)	N/A	10	8416950	520	N/A	1.0	8416950
Nutrients									
Total Kjeldahl Nitrogen	mg/L	3.3 (1)	N/A	0.50	8417434	1.3	N/A	0.050	8419036
Orthophosphate (P)	mg/L	0.0041 (3)	N/A	0.0030	8417394	0.0040 (3)	N/A	0.0030	8417394
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8417688	0.83	0.82	0.050	8417688
Dissolved Phosphorus (P)	mg/L	0.013	N/A	0.0030	8418959	0.013	N/A	0.0030	8418959

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(3) Orthophosphate greater than total phosphate. Results within acceptable limits of precision.

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ3529	PQ3529		
Sampling Date		2016/09/29 17:32	2016/09/29 17:32		
COC Number		M031857	M031857		
	UNITS	**MW16-23-14**	**MW16-23-14 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics					
Dissolved Organic Carbon (C)	mg/L	4.1	N/A	0.50	8418321
Microbiological Param.					
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8416950
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8416953
Heterotrophic Plate Count	CFU/mL	20000 (2)	20000	10	8416947
Total Coliforms DST	mpn/100mL	>2400 (1)	N/A	10	8416950
Nutrients					
Dissolved Ammonia (N)	mg/L	0.14	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	2.8 (3)	N/A	0.25	8419031
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8416975

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ3527		PQ3528		PQ3529		
Sampling Date		2016/09/29 09:52		2016/09/29 16:56		2016/09/29 17:32		
COC Number		M031857		M031857		M031857		
	UNITS	**MW16-21-11**	**RDL**	**MW16-23-36**	**RDL**	**MW16-23-14**	**RDL**	**QC Batch**
Low Level Elements								
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	N/A	0.0020	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<20 (1)	20	<0.20 (1)	0.20	<20 (1)	20	8419734
Lab Filtered Elements-Low								
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	N/A	N/A	8417235

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
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Sampler Initials: DN

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	12.0°C

Results relate only to the items tested.

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8416876	MHF	Matrix Spike	O-TERPHENYL (sur.)	2016/10/02		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02		94	%	50 - 130
8416876	MHF	Spiked Blank	O-TERPHENYL (sur.)	2016/10/02		95	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02		94	%	70 - 130
8416876	MHF	Method Blank	O-TERPHENYL (sur.)	2016/10/02		93	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/02	<0.10		mg/L	
8416876	MHF	RPD [PQ3529-06]	F2 (C10-C16 Hydrocarbons)	2016/10/02	NC		%	40
8416947	GK1	Method Blank	Heterotrophic Plate Count	2016/10/02	<1.0		CFU/mL	
8416947	GK1	RPD [PQ3527-08]	Heterotrophic Plate Count	2016/10/02	3.5		%	N/A
8416947	GK1	RPD [PQ3528-08]	Heterotrophic Plate Count	2016/10/02	6.8		%	N/A
8416947	GK1	RPD [PQ3529-08]	Heterotrophic Plate Count	2016/10/02	0.60		%	N/A
8416947	GK1	RPD	Heterotrophic Plate Count	2016/10/02	2.2		%	N/A
			Heterotrophic Plate Count	2016/10/02	5.4		%	N/A
			Heterotrophic Plate Count	2016/10/02	4.3		%	N/A
			Heterotrophic Plate Count	2016/10/02	1.5		%	N/A
			Heterotrophic Plate Count	2016/10/02	NC		%	N/A
8416950	GK1	Method Blank	E.Coli DST	2016/10/01	<1.0		mpn/100	
			Total Coliforms DST	2016/10/01	<1.0		mpn/100	
8416950	GK1	RPD	Total Coliforms DST	2016/10/01	NC		%	N/A
8416953	GK1	Method Blank	Fecal Coliforms	2016/10/01	<1.0		MPN/10	
8416953	GK1	RPD	Fecal Coliforms	2016/10/01	NC		%	N/A
8416975	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		98	%	80 - 120
8416975	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		0.0	%	N/A
8416975	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		102	%	80 - 120
8416975	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	<0.0030		mg/L	
8416975	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	3.0		%	20
8417160	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		97	%	80 - 120
8417160	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8417160	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	0.14		%	20
			Bicarbonate (HCO3)	2016/09/30	0.14		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20
			Hydroxide (OH)	2016/09/30	NC		%	20
8417173	SSO	Spiked Blank	pH	2016/09/30		101	%	97 - 103
8417173	SSO	RPD	pH	2016/09/30	0.19		%	N/A
8417175	SSO	Spiked Blank	Conductivity	2016/09/30		100	%	90 - 110
8417175	SSO	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8417175	SSO	RPD	Conductivity	2016/09/30	0.12		%	20
8417181	SSO	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		97	%	80 - 120
8417181	SSO	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8417181	SSO	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	0.47		%	20
			Bicarbonate (HCO3)	2016/09/30	0.47		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Hydroxide (OH)	2016/09/30	NC		%	20
8417188	SSO	Spiked Blank	pH	2016/09/30		101	%	97 - 103
8417188	SSO	RPD	pH	2016/09/30	0.23		%	N/A
8417189	SSO	Spiked Blank	Conductivity	2016/09/30		99	%	90 - 110
8417189	SSO	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8417189	SSO	RPD	Conductivity	2016/09/30	0.13		%	20
8417228	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/09/30		104	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		87	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		94	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		88	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		89	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		96	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		94	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		91	%	80 - 120
8417228	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/30		105	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		93	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		88	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		95	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		100	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		89	%	80 - 120
8417228	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/30	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/30	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/30	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/30	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/30	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/30	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/30	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/30	<0.00020		mg/L	

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lead (Pb)	2016/09/30	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/30	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/30	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/30	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/30	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/30	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/30	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/30	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/30	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/30	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/30	<0.0030		mg/L	
8417228	PC5	RPD	Dissolved Aluminum (Al)	2016/09/30	NC		%	20
			Dissolved Antimony (Sb)	2016/09/30	NC		%	20
			Dissolved Arsenic (As)	2016/09/30	2.8		%	20
			Dissolved Beryllium (Be)	2016/09/30	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/30	NC		%	20
			Dissolved Chromium (Cr)	2016/09/30	NC		%	20
			Dissolved Cobalt (Co)	2016/09/30	NC		%	20
			Dissolved Copper (Cu)	2016/09/30	NC		%	20
			Dissolved Lead (Pb)	2016/09/30	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/30	6.0		%	20
			Dissolved Nickel (Ni)	2016/09/30	NC		%	20
			Dissolved Selenium (Se)	2016/09/30	NC		%	20
			Dissolved Silver (Ag)	2016/09/30	NC		%	20
			Dissolved Thallium (Tl)	2016/09/30	NC		%	20
			Dissolved Tin (Sn)	2016/09/30	NC		%	20
			Dissolved Titanium (Ti)	2016/09/30	NC		%	20
			Dissolved Uranium (U)	2016/09/30	NC		%	20
			Dissolved Vanadium (V)	2016/09/30	NC		%	20
			Dissolved Zinc (Zn)	2016/09/30	NC		%	20
8417235	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/09/30		112	%	80 - 120
8417235	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/09/30		114	%	80 - 120
8417235	RK3	Method Blank	Dissolved Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417235	RK3	RPD	Dissolved Mercury (Hg)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417434	RM9	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/01		NC	%	80 - 120
8417434	RM9	QC Standard	Total Kjeldahl Nitrogen	2016/10/01		111	%	80 - 120
8417434	RM9	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/01		108	%	80 - 120
8417434	RM9	Method Blank	Total Kjeldahl Nitrogen	2016/10/01	<0.050		mg/L	
8417434	RM9	RPD	Total Kjeldahl Nitrogen	2016/10/01	1.1		%	20
8417625	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/09/30		101	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		NC	%	80 - 120
8417625	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/30		99	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		102	%	80 - 120
8417625	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/30	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/30	<0.010		mg/L	
8417625	JLD	RPD	Dissolved Nitrite (N)	2016/09/30	NC		%	20
			Dissolved Nitrate (N)	2016/09/30	0.57		%	20
8417633	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/10/01		102	%	80 - 120

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Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nitrate (N)	2016/10/01		103	%	80 - 120
8417633	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/10/01		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/01		102	%	80 - 120
8417633	JLD	Method Blank	Dissolved Nitrite (N)	2016/10/01	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/01	<0.010		mg/L	
8417633	JLD	RPD	Dissolved Nitrite (N)	2016/10/01	NC		%	20
			Dissolved Nitrate (N)	2016/10/01	0.73		%	20
8417669	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/09/30		97	%	80 - 120
			Dissolved Boron (B)	2016/09/30		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/30		99	%	80 - 120
			Dissolved Iron (Fe)	2016/09/30		99	%	80 - 120
			Dissolved Lithium (Li)	2016/09/30		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/30		98	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/30		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/30		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/30		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/30		97	%	80 - 120
			Dissolved Sodium (Na)	2016/09/30		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/30		97	%	80 - 120
8417669	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/09/30		99	%	80 - 120
			Dissolved Boron (B)	2016/09/30		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/09/30		104	%	80 - 120
			Dissolved Iron (Fe)	2016/09/30		101	%	80 - 120
			Dissolved Lithium (Li)	2016/09/30		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/30		99	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/30		102	%	80 - 120
			Dissolved Phosphorus (P)	2016/09/30		98	%	80 - 120
			Dissolved Potassium (K)	2016/09/30		101	%	80 - 120
			Dissolved Silicon (Si)	2016/09/30		98	%	80 - 120
			Dissolved Sodium (Na)	2016/09/30		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/09/30		99	%	80 - 120
8417669	JHC	Method Blank	Dissolved Barium (Ba)	2016/09/30	<0.010		mg/L	
			Dissolved Boron (B)	2016/09/30	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/09/30	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/30	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/09/30	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/09/30	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/30	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/09/30	<0.10		mg/L	
			Dissolved Potassium (K)	2016/09/30	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/09/30	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/09/30	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/09/30	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/09/30	<0.20		mg/L	
8417669	JHC	RPD	Dissolved Calcium (Ca)	2016/09/30	1.0		%	20
			Dissolved Iron (Fe)	2016/09/30	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/30	0.94		%	20
			Dissolved Manganese (Mn)	2016/09/30	NC		%	20
			Dissolved Potassium (K)	2016/09/30	NC		%	20
			Dissolved Sodium (Na)	2016/09/30	0.12		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417688	MB5	Matrix Spike [PQ3528-01]	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417688	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		97	%	80 - 120
8417688	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417688	MB5	RPD [PQ3528-01]	Dissolved Ammonia (N)	2016/09/30	1.3		%	20
8417829	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/01		112	%	80 - 120
			Dissolved Boron (B)	2016/10/01		104	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		111	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		114	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		106	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		105	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		118	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		115	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		111	%	80 - 120
8417829	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/01		105	%	80 - 120
			Dissolved Boron (B)	2016/10/01		97	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		106	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		107	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		103	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		100	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		109	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		105	%	80 - 120
8417829	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/01	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/01	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/01	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/01	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/01	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/01	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/01	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/01	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/01	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/01	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/01	0.50, RDL=0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/01	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/01	<0.20		mg/L	
8417829	JHC	RPD	Dissolved Barium (Ba)	2016/10/01	0.047		%	20
			Dissolved Boron (B)	2016/10/01	0.55		%	20
			Dissolved Calcium (Ca)	2016/10/01	0.15		%	20
			Dissolved Iron (Fe)	2016/10/01	1.3		%	20
			Dissolved Lithium (Li)	2016/10/01	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/01	0.13		%	20
			Dissolved Manganese (Mn)	2016/10/01	0.044		%	20
			Dissolved Phosphorus (P)	2016/10/01	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Potassium (K)	2016/10/01	0.21		%	20
			Dissolved Silicon (Si)	2016/10/01	0.18		%	20
			Dissolved Sodium (Na)	2016/10/01	0.084		%	20
			Dissolved Strontium (Sr)	2016/10/01	0.045		%	20
			Dissolved Sulphur (S)	2016/10/01	0.25		%	20
8418321	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/01		109	%	80 - 120
8418321	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		97	%	80 - 120
8418321	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418321	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/01	NC		%	20
8418324	MUK	Matrix Spike [PQ3528-01]	Dissolved Organic Carbon (C)	2016/10/01		103	%	80 - 120
8418324	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		93	%	80 - 120
8418324	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418324	MUK	RPD [PQ3528-01]	Dissolved Organic Carbon (C)	2016/10/01	5.3		%	20
8418959	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8418959	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/04		100	%	N/A
8418959	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8418959	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/04	0.0052, RDL=0.0030		mg/L	
8418959	MB5	RPD	Dissolved Phosphorus (P)	2016/10/04	NC		%	20
8419031	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419031	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		95	%	80 - 120
8419031	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		106	%	80 - 120
8419031	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419031	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8419036	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		106	%	80 - 120
8419036	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		99	%	80 - 120
8419036	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		99	%	80 - 120
8419036	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419036	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	NC		%	20
8419564	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/03		102	%	80 - 120
8419564	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/03		108	%	80 - 120
8419564	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/03	2.0, RDL=1.0		mg/L	
8419564	KP9	RPD	Dissolved Chloride (Cl)	2016/10/03	NC		%	20
8419569	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/03		130 (1)	%	80 - 120
8419569	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/03		106	%	80 - 120
8419569	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/03	<1.0		mg/L	
8419569	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/03	NC		%	20
8419725	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/03		93	%	80 - 120
8419725	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/03		91	%	80 - 120
8419725	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/03	<0.0020		ug/L	
8419725	RK3	RPD	Dissolved Mercury (Hg)	2016/10/03	NC		%	20
8419734	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/03		101	%	80 - 120
8419734	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/03		109	%	80 - 120
8419734	RK3	Method Blank	Total Mercury (Hg)	2016/10/03	<0.0020		ug/L	
8419734	RK3	RPD	Total Mercury (Hg)	2016/10/03	NC		%	20
8419977	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		100	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		106	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		92	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		102	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		101	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		112	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		99	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		108	%	80 - 120
8419977	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		114	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		99	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		101	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		98	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		101	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		99	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		97	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		98	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		104	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		97	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		102	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		110	%	80 - 120
8419977	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/04	0.0031, RDL=0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Zinc (Zn)	2016/10/04	0.0030, RDL=0.0030		mg/L	
8419977	PC5	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
8421839	RSA	Matrix Spike [PQ3528-07]	1,4-Difluorobenzene (sur.)	2016/10/07		107	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		115	%	70 - 130
			Benzene	2016/10/07		91	%	70 - 130
			Toluene	2016/10/07		94	%	70 - 130
			Ethylbenzene	2016/10/07		99	%	70 - 130
			m & p-Xylene	2016/10/07		98	%	70 - 130
			o-Xylene	2016/10/07		99	%	70 - 130
			F1 (C6-C10)	2016/10/07		81	%	70 - 130
8421839	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/06		106	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/06		107	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/06		101	%	70 - 130
			Benzene	2016/10/06		91	%	70 - 130
			Toluene	2016/10/06		94	%	70 - 130
			Ethylbenzene	2016/10/06		99	%	70 - 130
			m & p-Xylene	2016/10/06		98	%	70 - 130
			o-Xylene	2016/10/06		98	%	70 - 130
			F1 (C6-C10)	2016/10/06		96	%	70 - 130
8421839	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/06		114	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/06		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/06		105	%	70 - 130
			Benzene	2016/10/06	<0.00040		mg/L	
			Toluene	2016/10/06	<0.00040		mg/L	
			Ethylbenzene	2016/10/06	<0.00040		mg/L	
			m & p-Xylene	2016/10/06	<0.00080		mg/L	
			o-Xylene	2016/10/06	<0.00040		mg/L	
			Xylenes (Total)	2016/10/06	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/06	<0.10		mg/L	
			F1 (C6-C10)	2016/10/06	<0.10		mg/L	
8421839	RSA	RPD [PQ3527-07]	Benzene	2016/10/06	NC		%	40
			Toluene	2016/10/06	NC		%	40
			Ethylbenzene	2016/10/06	NC		%	40
			m & p-Xylene	2016/10/06	NC		%	40
			o-Xylene	2016/10/06	NC		%	40
			Xylenes (Total)	2016/10/06	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/06	NC		%	40

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/06	NC		%	40

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B685593
Report Date: 2016/10/07

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Janet Gao, B.Sc., QP, Supervisor, Organics

Lisa Thum, C.E.T., QP, Manager, Inorganics

Maxxam
A Bureau Veritas Group Company

Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD

M 031857

Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd	Company:	Quotation #:	☑ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112 St, Edmonton, AB, T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied): ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	Date Required:
Email: Dylan.King@stantec.com	Email:	Site #:	Rush Confirmation #:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D. Nisbet	

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	11	11	14
Cooling Media	✓					
Seal Present			Cooler ID			
Seal Intact			Temp			
Cooling Media						
Seal Present			Cooler ID			
Seal Intact			Temp			
Cooling Media						

Depot Reception

Regulatory Criteria

- ☑ AT1/CCME
- ☑ Drinking Water
- ☐ Saskatchewan
- ☐ D50 (Drilling Waste)
- ☐ Other:

Analysis Requested

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved Phosphorus	Phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-21-11		2016/09/29	9:52		12		✓		✓	✓	✓		14	15	15	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-23-36		↓	16:56		13		✓		✓	✓	✓		10	10	9	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	MW16-23-14		↓	17:32		13		✓		✓	✓	✓		9	9	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4																										
5																										
6																										
7																										
8																										
9																										
10																										

Please Indicate Filtered, Preserved or Both (F, P, F/P) →

Special Instructions

Due to low sample volume please take DOC from routine Bottle for MW16-21-11

Due to turbidity please filter and preserve dissolved metals dissolved mercury and DOC for MW16-23-36

Submitted same day as sampled

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
D. Nisbet / Dale Nisbet	2016/09/29	19:29	ARDRIN VILLAMAYOR	2016/09/29	19:30

29-Sep-16 19:30
Wendy Sears
B685593
AV2 INS-0160

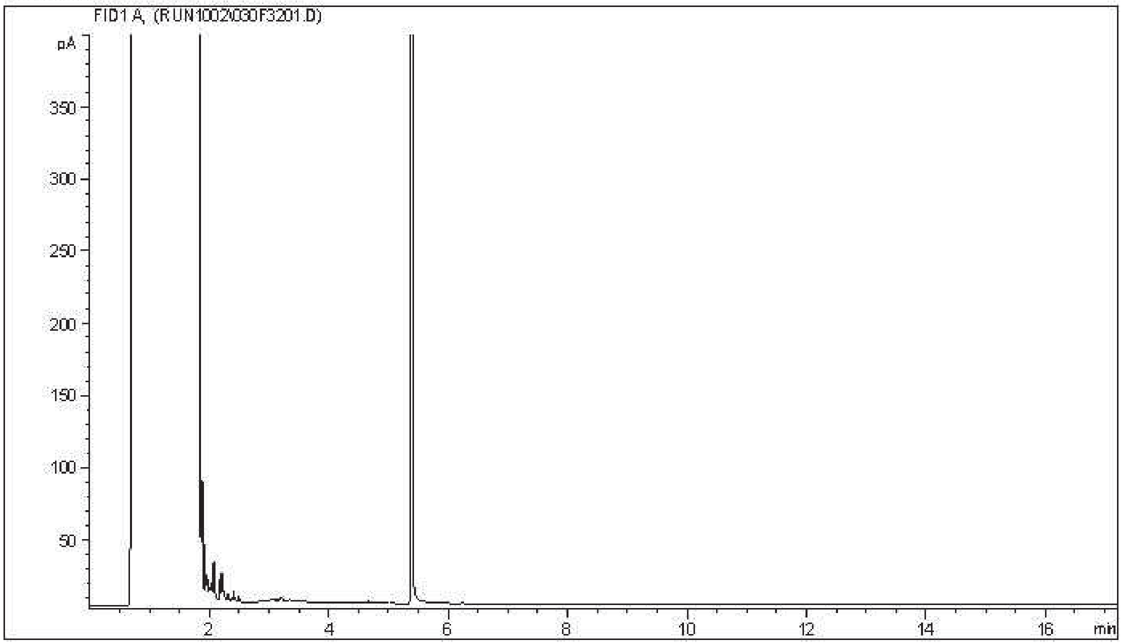
AB FCD-00331/6

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3527

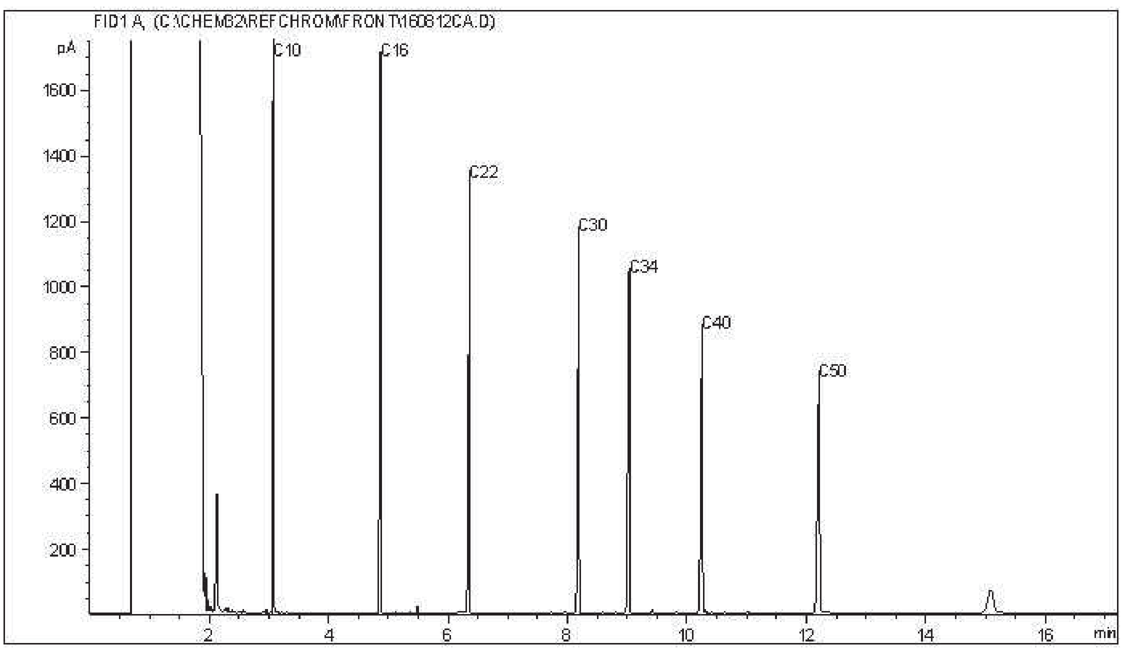
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-21-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

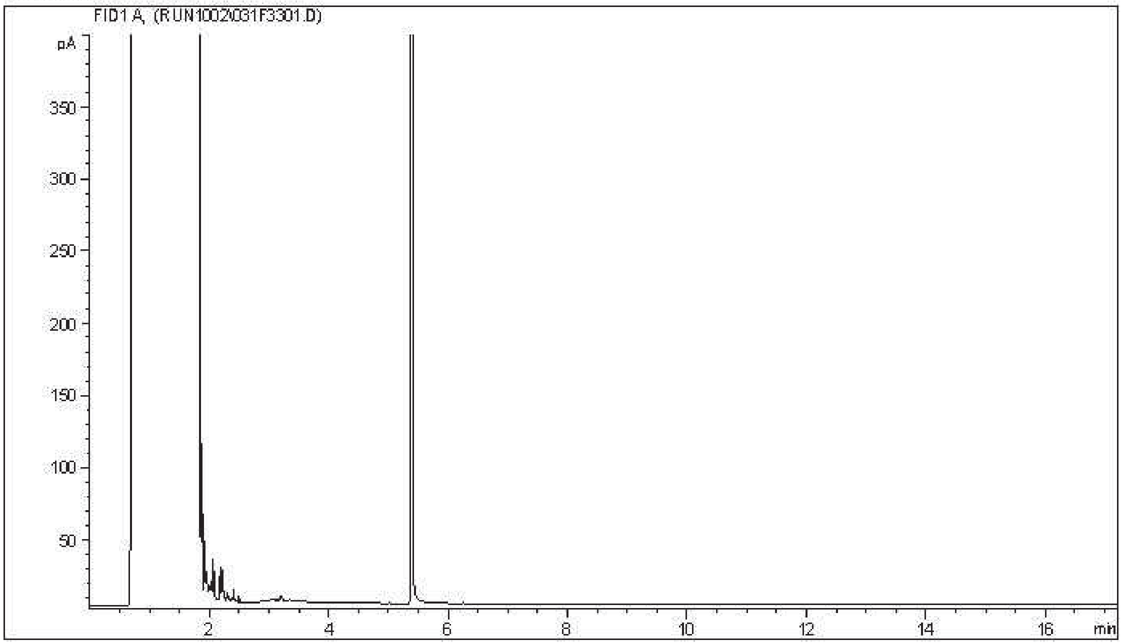
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3528

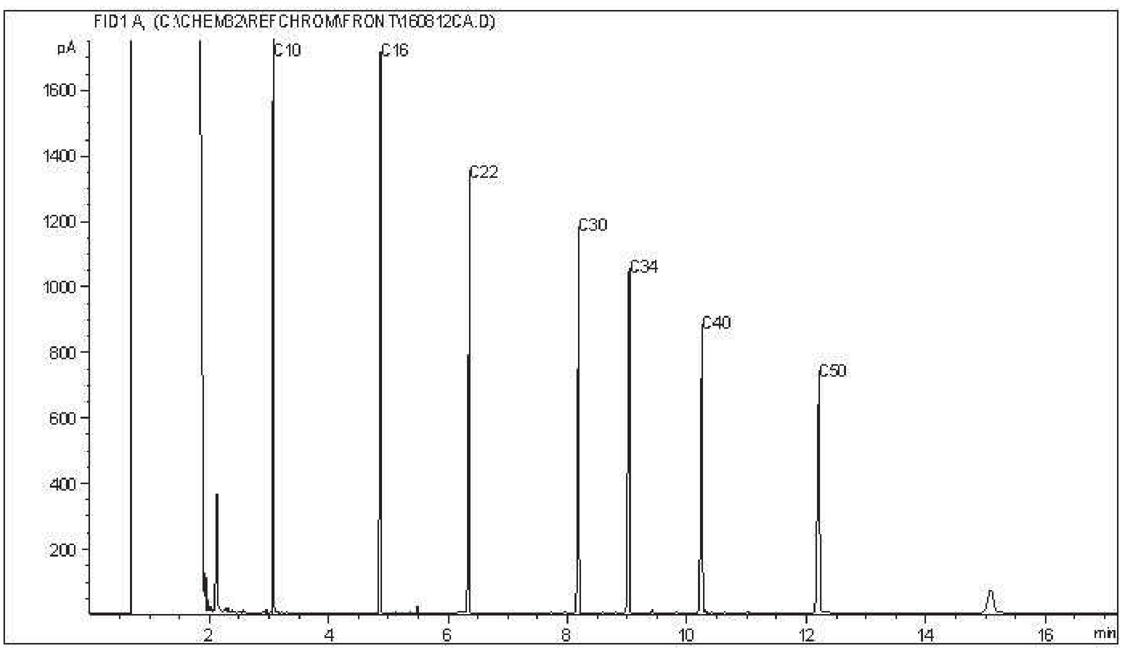
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-23-36

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

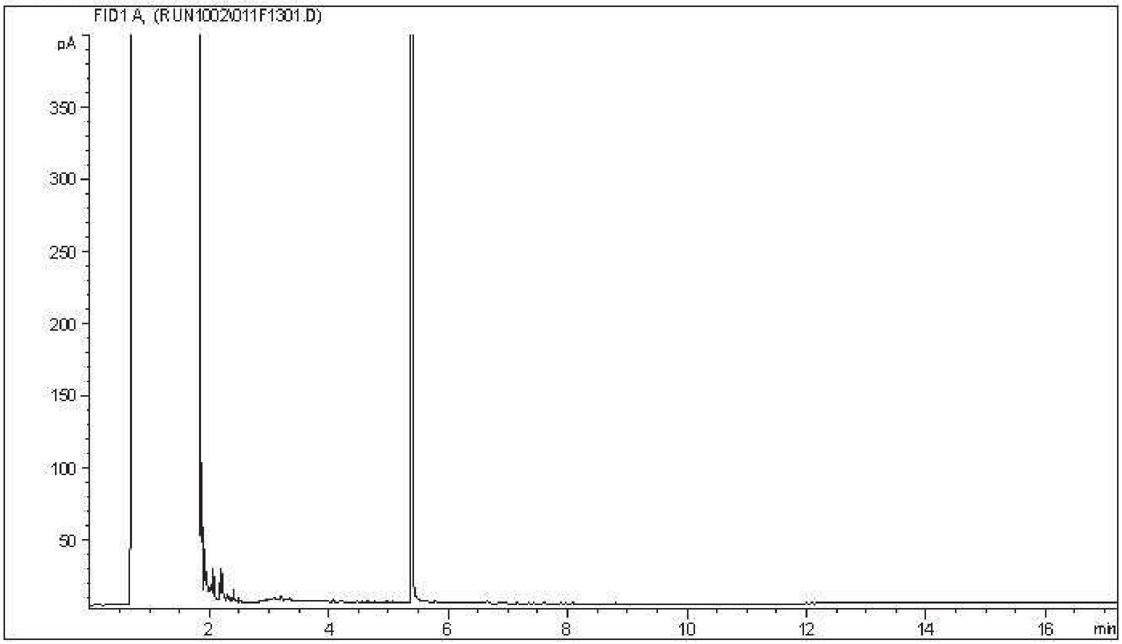
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3529

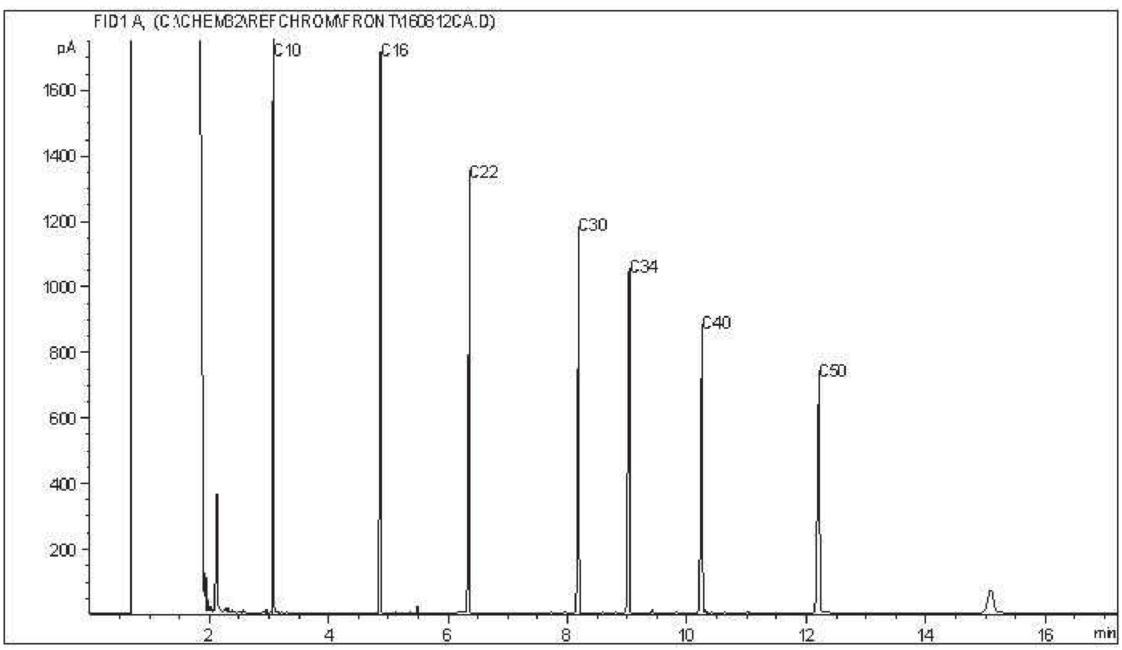
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-23-14

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

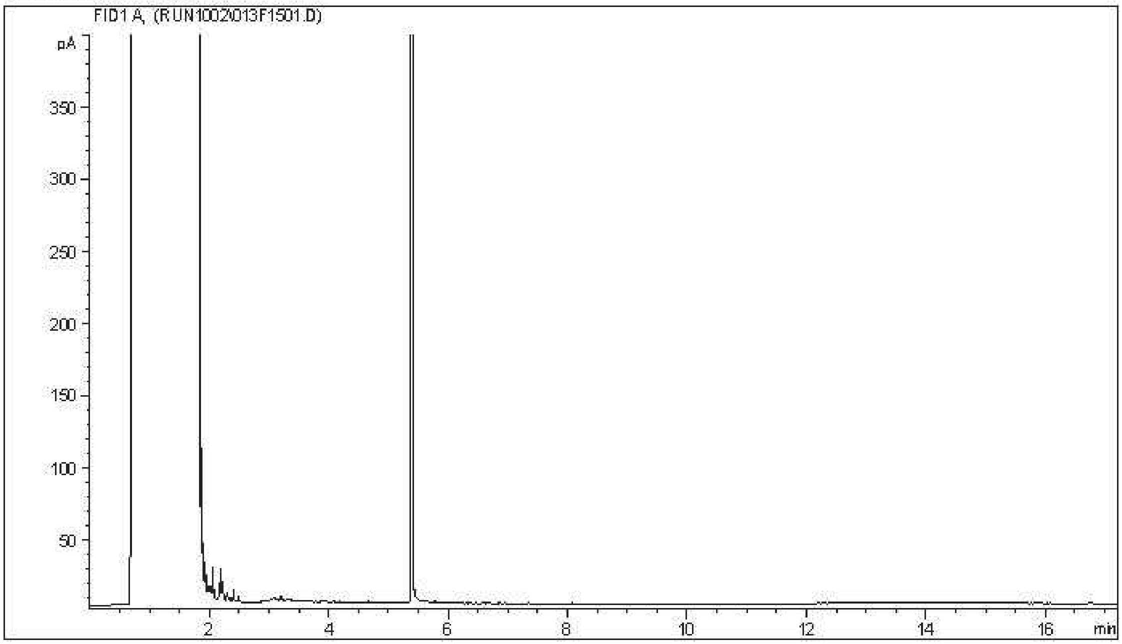
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685593
Report Date: 2016/10/07
Maxxam Sample: PQ3529 Lab-Dup

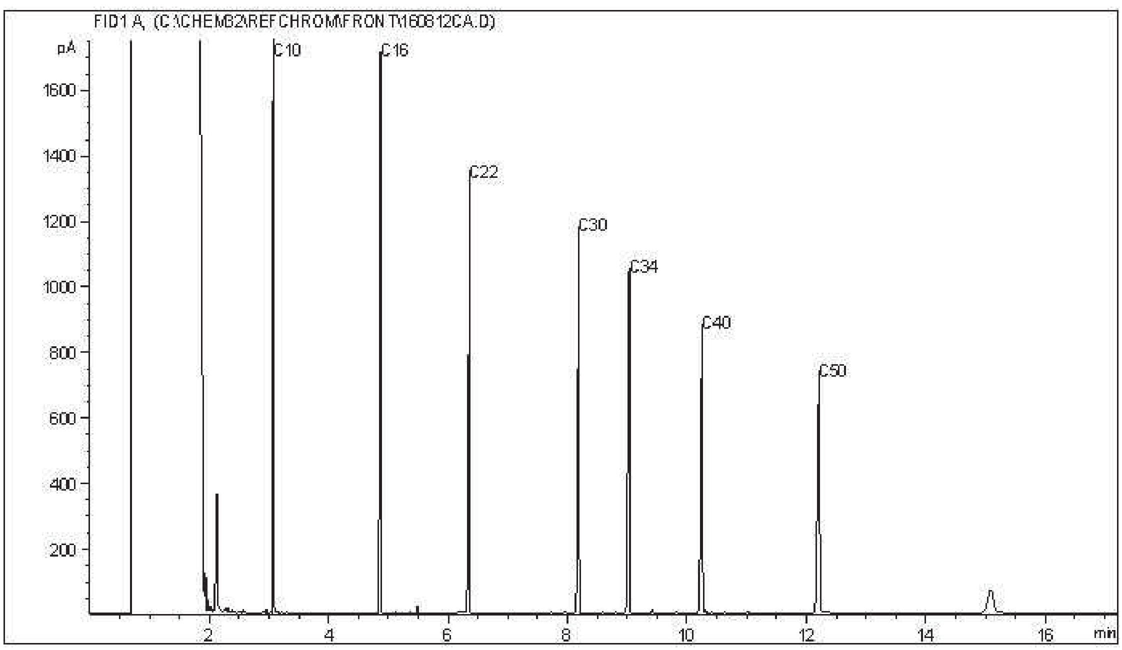
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-23-14

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC7



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031906

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/11
Report #: R2279234
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686123
Received: 2016/09/30, 15:57

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	4	N/A	2016/10/03	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	4	N/A	2016/10/08	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	3	N/A	2016/10/06	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	1	N/A	2016/10/07	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	4	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	4	2016/09/30	2016/10/01	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/05	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	3	N/A	2016/10/05	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	4	N/A	2016/10/03	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	4	2016/10/03	2016/10/04	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Hardness	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	3	2016/10/07	2016/10/07	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	4	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	3	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	3	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/04	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	4	N/A	2016/10/01	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Sum of cations, anions	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	3	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	4	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	4	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	4	N/A	2016/10/03	AB SOP-00023	SM 22 4110 B m
pH @25°C	4	N/A	2016/10/03	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	4	N/A	2016/10/03	AB SOP-00025	SM 22 4500-P A,F m

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Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031906

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/11
Report #: R2279234
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686123
Received: 2016/09/30, 15:57

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sulphate by Automated Colourimetry	3	N/A	2016/10/06	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	1	N/A	2016/10/07	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	4	2016/09/30	2016/10/02	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Total Dissolved Solids (Calculated)	3	N/A	2016/10/08	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	4	2016/10/04	2016/10/05	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/05	2016/10/05	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	3	2016/10/03	2016/10/04	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ7066	PQ7066	PQ7067	PQ7068	PQ7069		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22	2016/09/30 11:21	2016/09/30 14:02	2016/09/30 13:01		
COC Number		M031906	M031906	M031906	M031906	M031906		
	UNITS	**MW16-9-6**	**MW16-9-6 Lab-Dup**	**MW16-25-9**	**MW16-11-15**	**MW16-2-6**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	0.47	0.10	8419208
Volatiles								
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	0.00044	0.00040	8424673
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8424673
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8424673
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8424673
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8424673
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8424673
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	111	111	111	112	111	N/A	8424673
4-Bromofluorobenzene (sur.)	%	104	105	104	105	105	N/A	8424673
D4-1,2-Dichloroethane (sur.)	%	106	107	107	108	108	N/A	8424673
O-TERPHENYL (sur.)	%	94	N/A	91	94	90	N/A	8419208

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7066	PQ7066			PQ7067		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22			2016/09/30 11:21		
COC Number		M031906	M031906			M031906		
	UNITS	**MW16-9-6**	**MW16-9-6 Lab-Dup**	**RDL**	**QC Batch**	**MW16-25-9**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	21	N/A	N/A	8417613	13	N/A	8418022
Cation Sum	meq/L	22	N/A	N/A	8417613	14	N/A	8418022
Hardness (CaCO3)	mg/L	930	N/A	0.50	8418724	590	0.50	8418724
Ion Balance	N/A	1.1	N/A	0.010	8417612	1.1	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	0.065	N/A	0.044	8418013	0.064	0.044	8418013
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8418014	<0.020	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8418013	<0.033	0.033	8418013
Calculated Total Dissolved Solids	mg/L	1200	N/A	10	8417617	680	10	8418023
Misc. Inorganics								
Conductivity	uS/cm	1700	N/A	1.0	8419207	1100	1.0	8419207
pH	pH	7.88	N/A	N/A	8419206	8.11	N/A	8419206
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	510	N/A	0.50	8419203	470	0.50	8419203
Bicarbonate (HCO3)	mg/L	630	N/A	0.50	8419203	580	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8419203	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	490 (1)	N/A	5.0	8425289	150	1.0	8425254
Dissolved Chloride (Cl)	mg/L	1.6	N/A	1.0	8425265	8.2	1.0	8425251
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010	8419271	<0.010	0.010	8419271
Dissolved Nitrate (N)	mg/L	0.015	0.016	0.010	8419271	0.015	0.010	8419271
Elements								
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	0.0030	8419986	0.028	0.0030	8419986
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8419986	<0.00060	0.00060	8419986
Dissolved Arsenic (As)	mg/L	0.00093	N/A	0.00020	8419986	0.00078	0.00020	8419986
Dissolved Barium (Ba)	mg/L	0.039	N/A	0.010	8424941	0.053	0.010	8424941
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Boron (B)	mg/L	0.14	N/A	0.020	8424941	0.099	0.020	8424941

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7066	PQ7066			PQ7067		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22			2016/09/30 11:21		
COC Number		M031906	M031906			M031906		
	UNITS	MW16-9-6	MW16-9-6 Lab-Dup	RDL	QC Batch	MW16-25-9	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	0.000073	N/A	0.000020	8419986	0.000065	0.000020	8419986
Dissolved Calcium (Ca)	mg/L	220	N/A	0.30	8424941	140	0.30	8424941
Dissolved Chromium (Cr)	mg/L	0.0043	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Cobalt (Co)	mg/L	0.0037	N/A	0.00030	8419986	0.0020	0.00030	8419986
Dissolved Copper (Cu)	mg/L	0.00064	N/A	0.00020	8419986	0.0011	0.00020	8419986
Dissolved Iron (Fe)	mg/L	0.13	N/A	0.060	8424941	0.16	0.060	8424941
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8419986	<0.00020	0.00020	8419986
Dissolved Lithium (Li)	mg/L	0.030	N/A	0.020	8424941	0.034	0.020	8424941
Dissolved Magnesium (Mg)	mg/L	94	N/A	0.20	8424941	59	0.20	8424941
Dissolved Manganese (Mn)	mg/L	0.93	N/A	0.0040	8424941	0.23	0.0040	8424941
Dissolved Molybdenum (Mo)	mg/L	0.00082	N/A	0.00020	8419986	0.0036	0.00020	8419986
Dissolved Nickel (Ni)	mg/L	0.0071	N/A	0.00050	8419986	0.0067	0.00050	8419986
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8424941	<0.10	0.10	8424941
Dissolved Potassium (K)	mg/L	5.6	N/A	0.30	8424941	6.6	0.30	8424941
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	0.00020	8419986	0.0014	0.00020	8419986
Dissolved Silicon (Si)	mg/L	5.5	N/A	0.10	8424941	7.0	0.10	8424941
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8419986	<0.00010	0.00010	8419986
Dissolved Sodium (Na)	mg/L	71	N/A	0.50	8424941	34	0.50	8424941
Dissolved Strontium (Sr)	mg/L	1.4	N/A	0.020	8424941	0.74	0.020	8424941
Dissolved Sulphur (S)	mg/L	180	N/A	0.20	8424941	49	0.20	8424941
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8419986	<0.00020	0.00020	8419986
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8419986	<0.0010	0.0010	8419986
Dissolved Uranium (U)	mg/L	0.0086	N/A	0.00010	8419986	0.014	0.00010	8419986
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8419986	0.0011	0.0010	8419986
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	0.0030	8419986	<0.0030	0.0030	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7068	PQ7068		
Sampling Date		2016/09/30 14:02	2016/09/30 14:02		
COC Number		M031906	M031906		
	UNITS	**MW16-11-15**	**MW16-11-15 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters					
Anion Sum	meq/L	39	N/A	N/A	8418022
Cation Sum	meq/L	38	N/A	N/A	8418022
Hardness (CaCO3)	mg/L	1200	N/A	0.50	8418724
Ion Balance	N/A	0.98	N/A	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	0.044	8418013
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8418013
Calculated Total Dissolved Solids	mg/L	2400	N/A	10	8418023
Misc. Inorganics					
Conductivity	uS/cm	3100	3100	1.0	8419207
pH	pH	7.99	7.98	N/A	8419206
Anions					
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	410	410	0.50	8419203
Bicarbonate (HCO3)	mg/L	500	500	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	1500 (1)	N/A	10	8425254
Dissolved Chloride (Cl)	mg/L	1.7	N/A	1.0	8425251
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8419271
Dissolved Nitrate (N)	mg/L	<0.010	N/A	0.010	8419271
Elements					
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	0.0030	8419986
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	0.00060	8419986
Dissolved Arsenic (As)	mg/L	0.0012	N/A	0.00020	8419986
Dissolved Barium (Ba)	mg/L	0.016	N/A	0.010	8424941
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7068	PQ7068		
Sampling Date		2016/09/30 14:02	2016/09/30 14:02		
COC Number		M031906	M031906		
	UNITS	**MW16-11-15**	**MW16-11-15 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Boron (B)	mg/L	0.10	N/A	0.020	8424941
Dissolved Cadmium (Cd)	mg/L	0.000043	N/A	0.000020	8419986
Dissolved Calcium (Ca)	mg/L	290	N/A	0.30	8424941
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Cobalt (Co)	mg/L	0.0016	N/A	0.00030	8419986
Dissolved Copper (Cu)	mg/L	0.00029	N/A	0.00020	8419986
Dissolved Iron (Fe)	mg/L	0.37	N/A	0.060	8424941
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Lithium (Li)	mg/L	0.050	N/A	0.020	8424941
Dissolved Magnesium (Mg)	mg/L	110	N/A	0.20	8424941
Dissolved Manganese (Mn)	mg/L	0.77	N/A	0.0040	8424941
Dissolved Molybdenum (Mo)	mg/L	0.0015	N/A	0.00020	8419986
Dissolved Nickel (Ni)	mg/L	0.0027	N/A	0.00050	8419986
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8424941
Dissolved Potassium (K)	mg/L	6.0	N/A	0.30	8424941
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Silicon (Si)	mg/L	4.8	N/A	0.10	8424941
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8419986
Dissolved Sodium (Na)	mg/L	320	N/A	0.50	8424941
Dissolved Strontium (Sr)	mg/L	2.6	N/A	0.020	8424941
Dissolved Sulphur (S)	mg/L	480	N/A	0.20	8424941
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8419986
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Uranium (U)	mg/L	0.0071	N/A	0.00010	8419986
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8419986
Dissolved Zinc (Zn)	mg/L	0.0053	N/A	0.0030	8419986

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7069		
Sampling Date		2016/09/30 13:01		
COC Number		M031906		
	UNITS	MW16-2-6	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	83	N/A	8418022
Cation Sum	meq/L	83	N/A	8418022
Hardness (CaCO3)	mg/L	2600	0.50	8418020
Ion Balance	N/A	1.0	0.010	8418021
Dissolved Nitrate (NO3)	mg/L	<0.22	0.22	8418013
Nitrate plus Nitrite (N)	mg/L	0.024	0.020	8418014
Dissolved Nitrite (NO2)	mg/L	0.078	0.033	8418013
Calculated Total Dissolved Solids	mg/L	5300	10	8418023
Misc. Inorganics				
Conductivity	uS/cm	5900	1.0	8419207
pH	pH	7.95	N/A	8419206
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8419203
Alkalinity (Total as CaCO3)	mg/L	520	0.50	8419203
Bicarbonate (HCO3)	mg/L	630	0.50	8419203
Carbonate (CO3)	mg/L	<0.50	0.50	8419203
Hydroxide (OH)	mg/L	<0.50	0.50	8419203
Dissolved Sulphate (SO4)	mg/L	3500 (1)	25	8426427
Dissolved Chloride (Cl)	mg/L	6.0	1.0	8426417
Nutrients				
Dissolved Nitrite (N)	mg/L	0.024	0.010	8419271
Dissolved Nitrate (N)	mg/L	<0.050 (2)	0.050	8419271
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.016	0.0030	8419977
Dissolved Antimony (Sb)	mg/L	0.00073	0.00060	8419977
Dissolved Arsenic (As)	mg/L	0.0044	0.00020	8419977
Dissolved Barium (Ba)	mg/L	0.018	0.010	8421827
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8419977

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ7069		
Sampling Date		2016/09/30 13:01		
COC Number		M031906		
	UNITS	**MW16-2-6**	**RDL**	**QC Batch**
Dissolved Boron (B)	mg/L	0.11	0.020	8421827
Dissolved Cadmium (Cd)	mg/L	0.000092	0.000020	8419977
Dissolved Calcium (Ca)	mg/L	390	0.30	8421827
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8419977
Dissolved Cobalt (Co)	mg/L	0.0060	0.00030	8419977
Dissolved Copper (Cu)	mg/L	0.00084	0.00020	8419977
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8421827
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8419977
Dissolved Lithium (Li)	mg/L	0.11	0.020	8421827
Dissolved Magnesium (Mg)	mg/L	400	0.20	8421827
Dissolved Manganese (Mn)	mg/L	1.5	0.0040	8421827
Dissolved Molybdenum (Mo)	mg/L	0.0071	0.00020	8419977
Dissolved Nickel (Ni)	mg/L	0.016	0.00050	8419977
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8421827
Dissolved Potassium (K)	mg/L	9.4	0.30	8421827
Dissolved Selenium (Se)	mg/L	0.0013	0.00020	8419977
Dissolved Silicon (Si)	mg/L	5.9	0.10	8421827
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8419977
Dissolved Sodium (Na)	mg/L	690 (1)	5.0	8421827
Dissolved Strontium (Sr)	mg/L	4.6	0.020	8421827
Dissolved Sulphur (S)	mg/L	1200 (1)	2.0	8421827
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8419977
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8419977
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8419977
Dissolved Uranium (U)	mg/L	0.040	0.00010	8419977
Dissolved Vanadium (V)	mg/L	0.0016	0.0010	8419977
Dissolved Zinc (Zn)	mg/L	0.016	0.0030	8419977

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ7066	PQ7066		PQ7067	PQ7067		PQ7068		
Sampling Date		2016/09/30 12:22	2016/09/30 12:22		2016/09/30 11:21	2016/09/30 11:21		2016/09/30 14:02		
COC Number		M031906	M031906		M031906	M031906		M031906		
	UNITS	**MW16-9-6**	**MW16-9-6 Lab-Dup**	**RDL**	**MW16-25-9**	**MW16-25-9 Lab-Dup**	**RDL**	**MW16-11-15**	**RDL**	**QC Batch**
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	4.7	N/A	0.50	5.6	N/A	0.50	3.1	0.50	8422700
Microbiological Param.										
E.Coli DST	mpn/100mL	<1.0	N/A	1.0	<10 (1)	N/A	10	<100 (1)	100	8416950
Fecal Coliforms	MPN/100mL	<1.0	N/A	1.0	<10 (1)	N/A	10	<100 (1)	100	8416953
Heterotrophic Plate Count	CFU/mL	1100	1100	1.0	7900 (2)	8300	10	23000 (3)	100	8416947
Total Coliforms DST	mpn/100mL	390	N/A	1.0	>2400 (1)	N/A	10	100 (1)	100	8416950
Nutrients										
Dissolved Ammonia (N)	mg/L	0.16	0.16	0.050	0.12	N/A	0.050	0.49	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	0.20	N/A	0.050	0.54 (1)	N/A	0.25	3.7 (1)	0.25	8421122
Orthophosphate (P)	mg/L	0.0036	N/A	0.0030	0.0086	N/A	0.0030	<0.0030	0.0030	8419663
Dissolved Phosphorus (P)	mg/L	0.0059	0.0062	0.0030	0.016	N/A	0.0030	0.0033	0.0030	8419539

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
Spreader colonies were present in the Petri dish. Presence of spreader colonies may obscure other colonies, possibly biasing results.

(3) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

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Maxxam Job #: B686123
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ7068	PQ7069	PQ7069		
Sampling Date		2016/09/30 14:02	2016/09/30 13:01	2016/09/30 13:01		
COC Number		M031906	M031906	M031906		
	UNITS	**MW16-11-15 Lab-Dup**	**MW16-2-6**	**MW16-2-6 Lab-Dup**	**RDL**	**QC Batch**
Lab Filtered Inorganics						
Dissolved Organic Carbon (C)	mg/L	N/A	6.2	6.5	0.50	8422695
Microbiological Param.						
E.Coli DST	mpn/100mL	N/A	<100 (1)	N/A	100	8416950
Fecal Coliforms	MPN/100mL	N/A	<100 (1)	N/A	100	8416953
Heterotrophic Plate Count	CFU/mL	24000	49000 (2)	48000	100	8416947
Total Coliforms DST	mpn/100mL	N/A	<100 (1)	N/A	100	8416950
Nutrients						
Total Kjeldahl Nitrogen	mg/L	N/A	5.1 (1)	N/A	0.25	8421122
Orthophosphate (P)	mg/L	N/A	0.0041	N/A	0.0030	8419663
Lab Filtered Nutrients						
Dissolved Ammonia (N)	mg/L	N/A	0.27	0.24	0.050	8423178
Dissolved Phosphorus (P)	mg/L	N/A	0.0094	0.0090	0.0030	8422263

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ7066		PQ7067		PQ7068	PQ7069		
Sampling Date		2016/09/30 12:22		2016/09/30 11:21		2016/09/30 14:02	2016/09/30 13:01		
COC Number		M031906		M031906		M031906	M031906		
	UNITS	**MW16-9-6**	**RDL**	**MW16-25-9**	**RDL**	**MW16-11-15**	**MW16-2-6**	**RDL**	**QC Batch**
Low Level Elements									
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	0.0035	0.0020	0.0036	N/A	0.0020	8426284
Total Mercury (Hg)	ug/L	<0.020 (1)	0.020	<2.0 (1)	2.0	<6.0 (1)	<6.0 (1)	6.0	8421406
Lab Filtered Elements-Low									
Dissolved Mercury (Hg)	ug/L	N/A	N/A	N/A	N/A	N/A	<0.0020	0.0020	8421467

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.3°C

Results relate only to the items tested.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8416947	GK1	Method Blank	Heterotrophic Plate Count	2016/10/02	<1.0		CFU/mL	
8416947	GK1	RPD	Heterotrophic Plate Count	2016/10/02	3.5		%	N/A
			Heterotrophic Plate Count	2016/10/02	6.8		%	N/A
			Heterotrophic Plate Count	2016/10/02	0.60		%	N/A
			Heterotrophic Plate Count	2016/10/02	NC		%	N/A
8416947	GK1	RPD [PQ7066-09]	Heterotrophic Plate Count	2016/10/02	2.2		%	N/A
8416947	GK1	RPD [PQ7067-09]	Heterotrophic Plate Count	2016/10/02	5.4		%	N/A
8416947	GK1	RPD [PQ7068-09]	Heterotrophic Plate Count	2016/10/02	4.3		%	N/A
8416947	GK1	RPD [PQ7069-09]	Heterotrophic Plate Count	2016/10/02	1.5		%	N/A
8416950	GK1	Method Blank	E.Coli DST	2016/10/01	<1.0		mpn/100	
			Total Coliforms DST	2016/10/01	<1.0		mpn/100	
8416950	GK1	RPD	Total Coliforms DST	2016/10/01	NC		%	N/A
8416953	GK1	Method Blank	Fecal Coliforms	2016/10/01	<1.0		MPN/10	
8416953	GK1	RPD	Fecal Coliforms	2016/10/01	NC		%	N/A
8419203	LQ1	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/03		100	%	80 - 120
8419203	LQ1	Method Blank	Alkalinity (PP as CaCO3)	2016/10/03	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/03	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/03	<0.50		mg/L	
			Carbonate (CO3)	2016/10/03	<0.50		mg/L	
			Hydroxide (OH)	2016/10/03	<0.50		mg/L	
8419203	LQ1	RPD [PQ7068-01]	Alkalinity (PP as CaCO3)	2016/10/03	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/03	0.49		%	20
			Bicarbonate (HCO3)	2016/10/03	0.49		%	20
			Carbonate (CO3)	2016/10/03	NC		%	20
			Hydroxide (OH)	2016/10/03	NC		%	20
8419206	LQ1	Spiked Blank	pH	2016/10/03		100	%	97 - 103
8419206	LQ1	RPD [PQ7068-01]	pH	2016/10/03	0.054		%	N/A
8419207	LQ1	Spiked Blank	Conductivity	2016/10/03		102	%	90 - 110
8419207	LQ1	Method Blank	Conductivity	2016/10/03	<1.0		uS/cm	
8419207	LQ1	RPD [PQ7068-01]	Conductivity	2016/10/03	0.33		%	20
8419208	LSH	Matrix Spike	O-TERPHENYL (sur.)	2016/10/03		101	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03		100	%	50 - 130
8419208	LSH	Spiked Blank	O-TERPHENYL (sur.)	2016/10/03		97	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03		96	%	70 - 130
8419208	LSH	Method Blank	O-TERPHENYL (sur.)	2016/10/03		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/03	<0.10		mg/L	
8419208	LSH	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/03	NC		%	40
8419271	LQ1	Matrix Spike [PQ7066-01]	Dissolved Nitrite (N)	2016/10/03		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/03		103	%	80 - 120
8419271	LQ1	Spiked Blank	Dissolved Nitrite (N)	2016/10/03		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/03		102	%	80 - 120
8419271	LQ1	Method Blank	Dissolved Nitrite (N)	2016/10/03	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/03	<0.010		mg/L	
8419271	LQ1	RPD [PQ7066-01]	Dissolved Nitrite (N)	2016/10/03	NC		%	20
			Dissolved Nitrate (N)	2016/10/03	NC		%	20
8419539	MB5	Matrix Spike [PQ7066-03]	Dissolved Phosphorus (P)	2016/10/04		97	%	80 - 120
8419539	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/04		99	%	80 - 120
8419539	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/04		102	%	80 - 120
8419539	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/04	<0.0030		mg/L	
8419539	MB5	RPD [PQ7066-03]	Dissolved Phosphorus (P)	2016/10/04	NC		%	20
8419663	MB5	Matrix Spike	Orthophosphate (P)	2016/10/03		96	%	80 - 120
8419663	MB5	Spiked Blank	Orthophosphate (P)	2016/10/03		101	%	80 - 120

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Maxxam Job #: B686123
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419663	MB5	Method Blank	Orthophosphate (P)	2016/10/03	<0.0030		mg/L	
8419663	MB5	RPD	Orthophosphate (P)	2016/10/03	NC		%	20
8419977	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		100	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		102	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		106	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		99	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		92	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		102	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		101	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		112	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		99	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		108	%	80 - 120
8419977	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		114	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		99	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		101	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		98	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		101	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		99	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		97	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		98	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		104	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		98	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		97	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		102	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		110	%	80 - 120
8419977	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/04	0.0031, RDL=0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/04	0.0030, RDL=0.0030		mg/L	
8419977	PC5	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
8419986	STI	Matrix Spike	Dissolved Aluminum (Al)	2016/10/04		120	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		91	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		104	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		89	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		94	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		93	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		105	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		97	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		94	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		95	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		97	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		86	%	80 - 120
8419986	STI	Spiked Blank	Dissolved Aluminum (Al)	2016/10/04		123 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/04		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/04		94	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/04		108	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/04		96	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/04		97	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/04		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/04		95	%	80 - 120
			Dissolved Lead (Pb)	2016/10/04		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/04		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/04		94	%	80 - 120
			Dissolved Selenium (Se)	2016/10/04		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/04		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/04		95	%	80 - 120
			Dissolved Tin (Sn)	2016/10/04		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/04		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/04		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/04		98	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/04		95	%	80 - 120
8419986	STI	Method Blank	Dissolved Aluminum (Al)	2016/10/04	<0.0030		mg/L	

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Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Antimony (Sb)	2016/10/04	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/04	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/04	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/04	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/04	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/04	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/04	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/04	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/04	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/04	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/04	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/04	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/04	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/04	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/04	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/04	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/04	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/04	<0.0030		mg/L	
8419986	STI	RPD	Dissolved Aluminum (Al)	2016/10/04	NC		%	20
			Dissolved Antimony (Sb)	2016/10/04	NC		%	20
			Dissolved Arsenic (As)	2016/10/04	NC		%	20
			Dissolved Beryllium (Be)	2016/10/04	NC		%	20
			Dissolved Chromium (Cr)	2016/10/04	NC		%	20
			Dissolved Cobalt (Co)	2016/10/04	NC		%	20
			Dissolved Copper (Cu)	2016/10/04	NC		%	20
			Dissolved Lead (Pb)	2016/10/04	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/04	0.86		%	20
			Dissolved Nickel (Ni)	2016/10/04	NC		%	20
			Dissolved Selenium (Se)	2016/10/04	1.9		%	20
			Dissolved Silver (Ag)	2016/10/04	NC		%	20
			Dissolved Thallium (Tl)	2016/10/04	NC		%	20
			Dissolved Tin (Sn)	2016/10/04	NC		%	20
			Dissolved Titanium (Ti)	2016/10/04	NC		%	20
			Dissolved Uranium (U)	2016/10/04	1.1		%	20
			Dissolved Vanadium (V)	2016/10/04	NC		%	20
			Dissolved Zinc (Zn)	2016/10/04	NC		%	20
8421122	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/05		NC	%	80 - 120
8421122	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/05		94	%	80 - 120
8421122	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/05		92	%	80 - 120
8421122	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/05	<0.050		mg/L	
8421122	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/05	12		%	20
8421406	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/04		105	%	80 - 120
8421406	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/04		97	%	80 - 120
8421406	RK3	Method Blank	Total Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421406	RK3	RPD	Total Mercury (Hg)	2016/10/04	NC		%	20
8421467	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/04		105	%	80 - 120
8421467	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/04		104	%	80 - 120
8421467	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421467	RK3	RPD	Dissolved Mercury (Hg)	2016/10/04	NC		%	20
8421827	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		94	%	80 - 120
			Dissolved Boron (B)	2016/10/05		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		94	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		98	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		94	%	80 - 120
8421827	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		94	%	80 - 120
			Dissolved Boron (B)	2016/10/05		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		95	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		101	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		100	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		97	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421827	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421827	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8422263	MB5	Matrix Spike [PQ7069-01]	Dissolved Phosphorus (P)	2016/10/05		94	%	80 - 120
8422263	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
8422263	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/05		103	%	80 - 120
8422263	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/05	<0.0030		mg/L	
8422263	MB5	RPD [PQ7069-01]	Dissolved Phosphorus (P)	2016/10/05	NC		%	20

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422695	MUK	Matrix Spike [PQ7069-01]	Dissolved Organic Carbon (C)	2016/10/05		NC	%	80 - 120
8422695	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/05		104	%	80 - 120
8422695	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/05	<0.50		mg/L	
8422695	MUK	RPD [PQ7069-01]	Dissolved Organic Carbon (C)	2016/10/05	3.6		%	20
8422700	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/05		NC	%	80 - 120
8422700	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/05		95	%	80 - 120
8422700	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/05	<0.50		mg/L	
8422700	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/05	3.0		%	20
8423168	MB5	Matrix Spike [PQ7066-03]	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD [PQ7066-03]	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423178	MB5	Matrix Spike [PQ7069-01]	Dissolved Ammonia (N)	2016/10/06		83	%	80 - 120
8423178	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		97	%	80 - 120
8423178	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423178	MB5	RPD [PQ7069-01]	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8424673	RSA	Matrix Spike [PQ7067-08]	1,4-Difluorobenzene (sur.)	2016/10/07		103	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		114	%	70 - 130
			Benzene	2016/10/07		89	%	70 - 130
			Toluene	2016/10/07		89	%	70 - 130
			Ethylbenzene	2016/10/07		91	%	70 - 130
			m & p-Xylene	2016/10/07		90	%	70 - 130
			o-Xylene	2016/10/07		91	%	70 - 130
			F1 (C6-C10)	2016/10/07		84	%	70 - 130
8424673	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/07		104	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/07		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/07		112	%	70 - 130
			Benzene	2016/10/07		88	%	70 - 130
			Toluene	2016/10/07		89	%	70 - 130
			Ethylbenzene	2016/10/07		92	%	70 - 130
			m & p-Xylene	2016/10/07		91	%	70 - 130
			o-Xylene	2016/10/07		91	%	70 - 130
			F1 (C6-C10)	2016/10/07		87	%	70 - 130
8424673	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/08		112	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		105	%	70 - 130
			Benzene	2016/10/08	<0.00040		mg/L	
			Toluene	2016/10/08	<0.00040		mg/L	
			Ethylbenzene	2016/10/08	<0.00040		mg/L	
			m & p-Xylene	2016/10/08	<0.00080		mg/L	
			o-Xylene	2016/10/08	<0.00040		mg/L	
			Xylenes (Total)	2016/10/08	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/08	<0.10		mg/L	
			F1 (C6-C10)	2016/10/08	<0.10		mg/L	
8424673	RSA	RPD [PQ7066-08]	Benzene	2016/10/08	NC		%	40
			Toluene	2016/10/08	NC		%	40
			Ethylbenzene	2016/10/08	NC		%	40
			m & p-Xylene	2016/10/08	NC		%	40
			o-Xylene	2016/10/08	NC		%	40
			Xylenes (Total)	2016/10/08	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/08	NC		%	40

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/08	NC		%	40
8424941	MAP	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		99	%	80 - 120
			Dissolved Boron (B)	2016/10/08		95	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		97	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		108	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		103	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		112	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		NC	%	80 - 120
8424941	MAP	Spiked Blank	Dissolved Barium (Ba)	2016/10/07		95	%	80 - 120
			Dissolved Boron (B)	2016/10/07		90	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/07		104	%	80 - 120
			Dissolved Iron (Fe)	2016/10/07		101	%	80 - 120
			Dissolved Lithium (Li)	2016/10/07		95	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/07		100	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/07		98	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/07		97	%	80 - 120
			Dissolved Potassium (K)	2016/10/07		95	%	80 - 120
			Dissolved Silicon (Si)	2016/10/07		97	%	80 - 120
			Dissolved Sodium (Na)	2016/10/07		97	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/07		96	%	80 - 120
8424941	MAP	Method Blank	Dissolved Barium (Ba)	2016/10/07	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/07	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/07	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/07	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/07	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/07	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/07	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/07	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/07	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/07	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/07	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/07	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/07	<0.20		mg/L	
8424941	MAP	RPD	Dissolved Barium (Ba)	2016/10/07	NC		%	20
			Dissolved Boron (B)	2016/10/07	0.58		%	20
			Dissolved Calcium (Ca)	2016/10/07	0.041		%	20
			Dissolved Iron (Fe)	2016/10/07	2.2		%	20
			Dissolved Lithium (Li)	2016/10/07	1.6		%	20
			Dissolved Magnesium (Mg)	2016/10/07	10		%	20
			Dissolved Manganese (Mn)	2016/10/07	2.5		%	20
			Dissolved Phosphorus (P)	2016/10/07	NC		%	20
			Dissolved Potassium (K)	2016/10/07	0.27		%	20
			Dissolved Silicon (Si)	2016/10/07	0.27		%	20
			Dissolved Sodium (Na)	2016/10/07	11		%	20
			Dissolved Strontium (Sr)	2016/10/07	0.080		%	20
			Dissolved Sulphur (S)	2016/10/07	9.8		%	20
8425251	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/06		NC	%	80 - 120

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8425251	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/06		107	%	80 - 120
8425251	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/06	<1.0		mg/L	
8425251	KP9	RPD	Dissolved Chloride (Cl)	2016/10/06	0.071		%	20
8425254	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/06		NC	%	80 - 120
8425254	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/06		104	%	80 - 120
8425254	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/06	<1.0		mg/L	
8425254	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/06	0.53		%	20
8425265	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/06		108	%	80 - 120
8425265	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/06		106	%	80 - 120
8425265	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/06	<1.0		mg/L	
8425265	KP9	RPD	Dissolved Chloride (Cl)	2016/10/06	NC		%	20
8425289	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/06		112	%	80 - 120
8425289	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/06		102	%	80 - 120
8425289	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/06	<1.0		mg/L	
8425289	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/06	NC		%	20
8426284	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/07		102	%	80 - 120
8426284	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/07		90	%	80 - 120
8426284	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/07	<0.0020		ug/L	
8426284	RK3	RPD	Dissolved Mercury (Hg)	2016/10/07	NC		%	20
8426417	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426417	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		102	%	80 - 120
8426417	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	1.0, RDL=1.0		mg/L	
8426417	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	4.0		%	20
8426427	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426427	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		102	%	80 - 120
8426427	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426427	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.59		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Maxxam Job #: B686123
Report Date: 2016/10/11

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics

Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1203

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CHAIN OF CUSTODY RECORD

M 031906

Page 1 of 1

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd.	Company:	Quotation #:	✓ 5 - 7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112 St, Edmonton AB, T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied): ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	
Email: Dylan.King@stantec.com	Email:	Site #:	Date Required:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D.Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	13	13	8
Cooling Media	✓					
Seal Present						
Seal Intact			Temp			
Cooling Media						
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved phosphorous	Phosphate	Dissolved Ammonia	TKN	DOC	Total coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-9-6		2016/09/30	12:22	W	13		✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-25-9		↓	11:21	↓	↓		↓		↓	↓	↓					↓	↓	↓	↓	↓	↓	↓	↓	↓	
3	MW16-11-15		↓	14:02	↓	↓		↓		↓	↓	↓					↓	↓	↓	↓	↓	↓	↓	↓	↓	
4	MW16-2-6		↓	13:01	↓	↓		↓		↓	↓	↓					↓	↓	↓	↓	↓	↓	↓	↓	↓	
5																										
6																										
7																										
8																										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

☑ AT1/CCME
☑ Drinking Water
☐ Saskatchewan
☐ D50 (Drilling Waste)
☐ Other:

Special Instructions

13 Please filter and
13 preserve dissolved
8 parameters for
20 MW16-2-6.
TOO turbid to field filter

Submitted same day as sampled

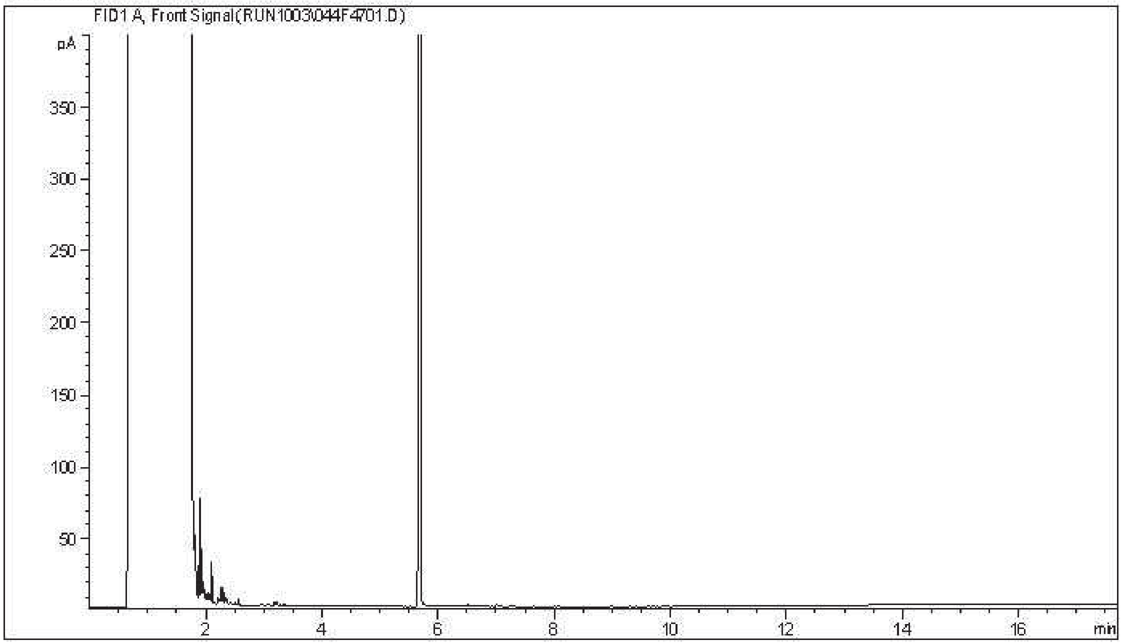
Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
D. Nisbet	2016/09/30	15:56	Josh Kingss	2016/09/30	1557

30-Sep-16 15:57
Wendy Sears
B686123
DN7 INS-0167

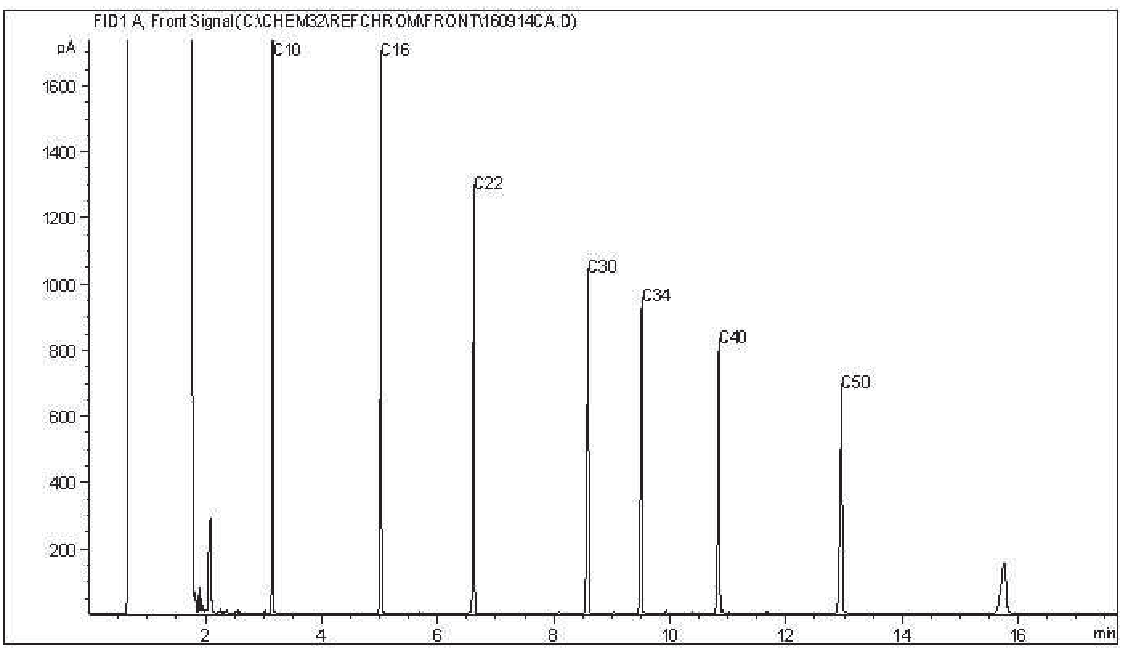
AB FCD-00331/6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

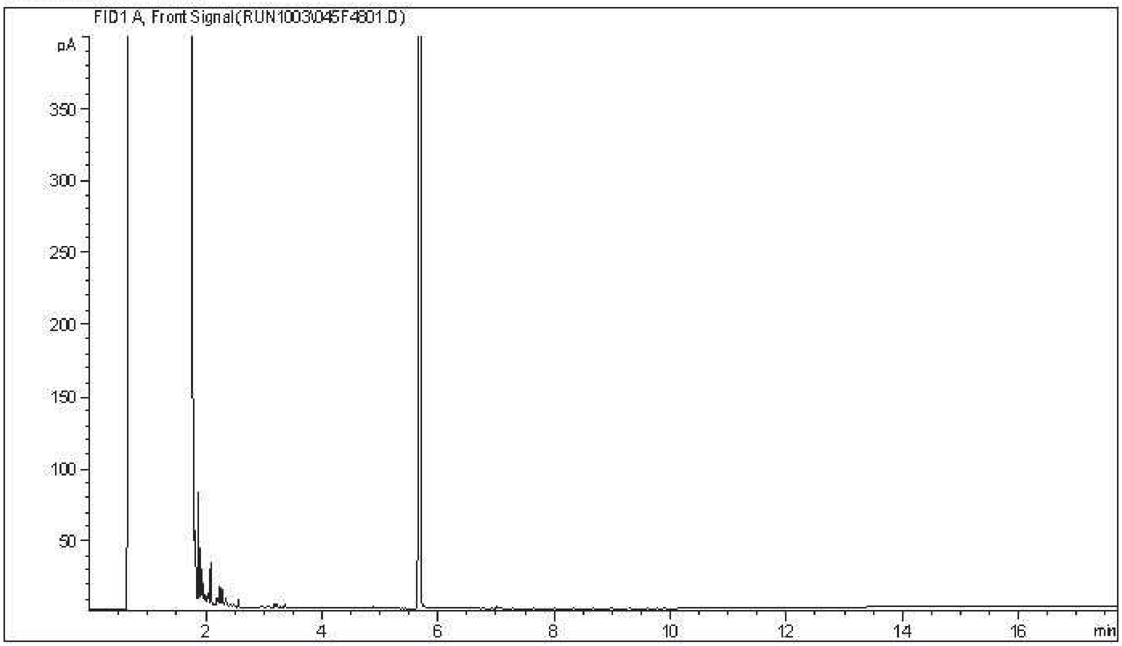
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7067

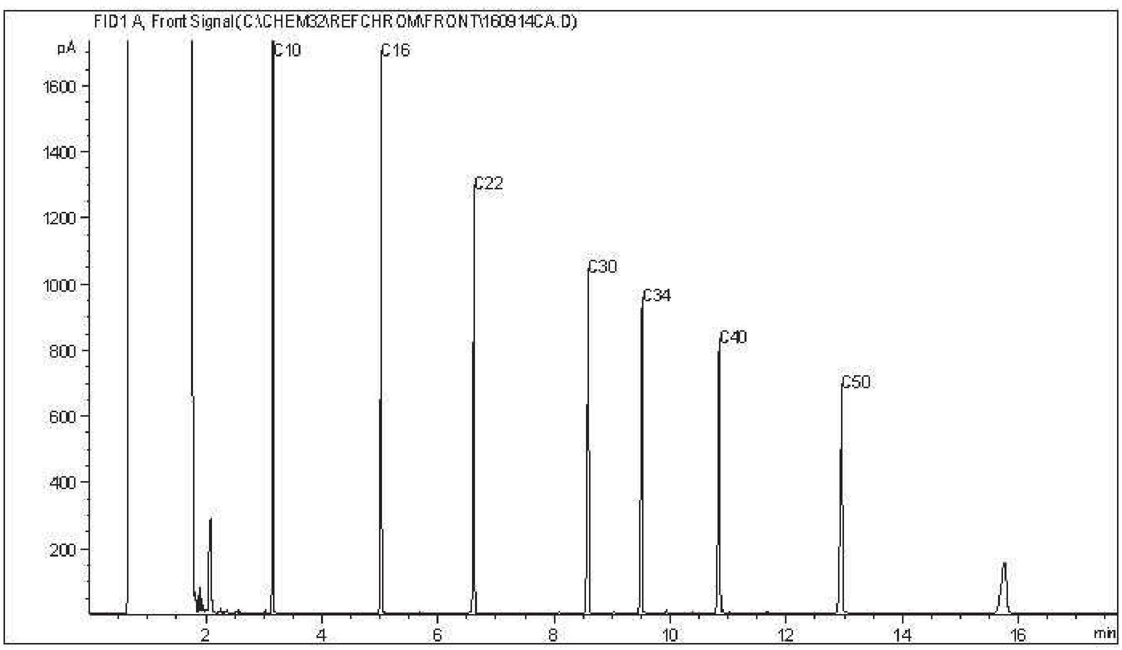
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-25-9

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

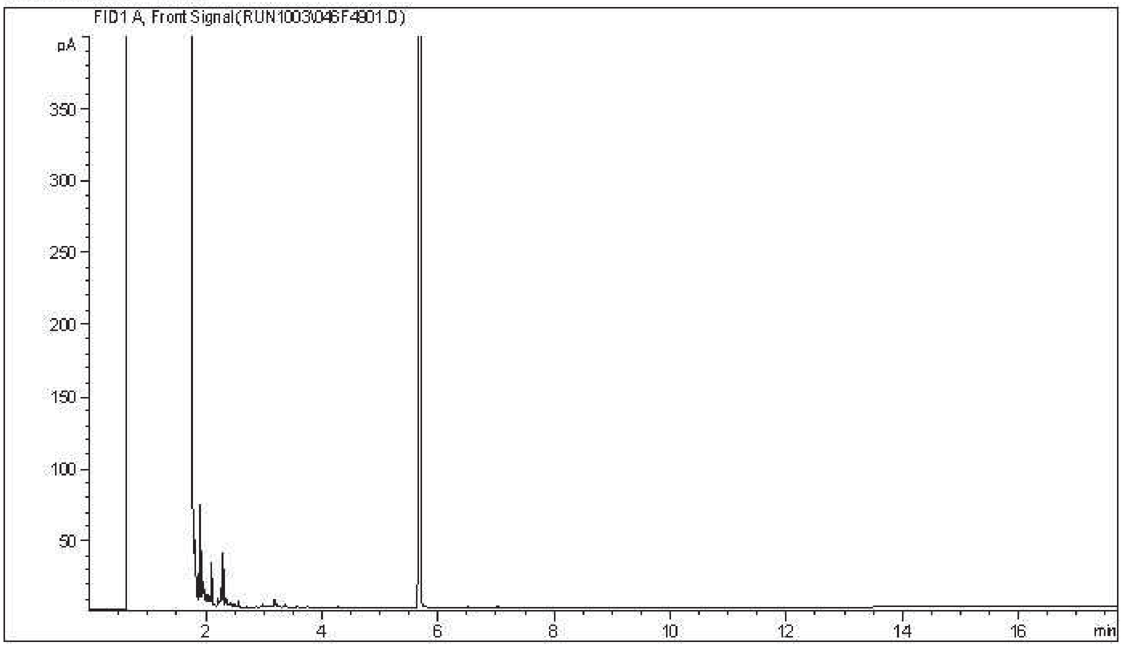
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7068

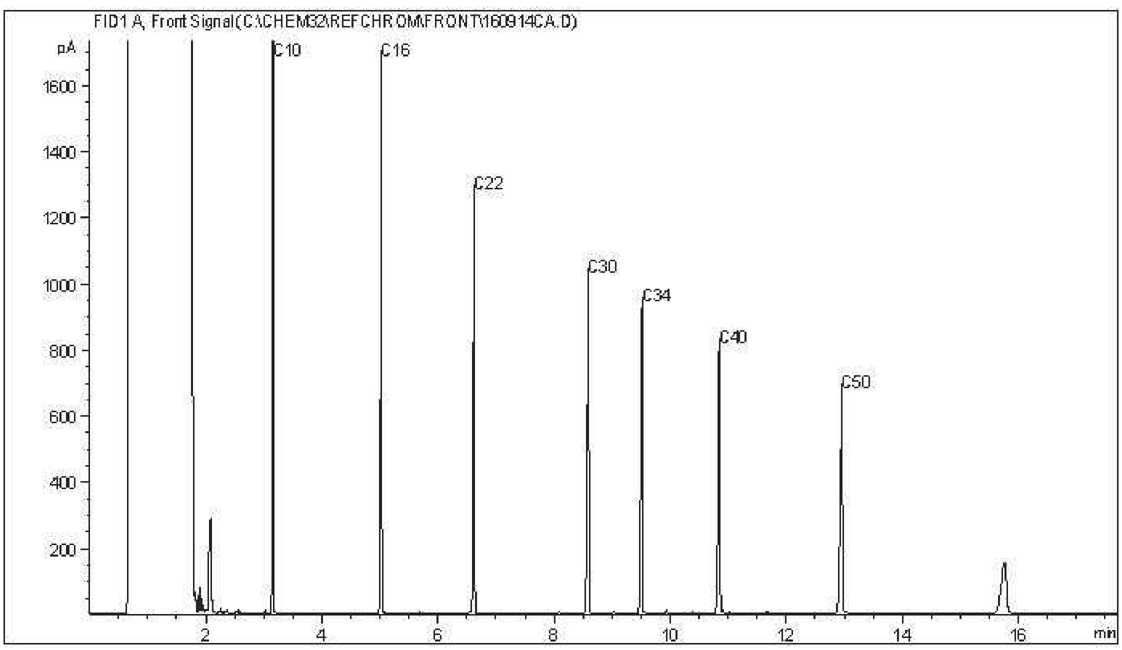
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-11-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4	-	C12	Diesel:	C8	-	C22
Varsol:	C8	-	C12	Lubricating Oils:	C20	-	C40
Kerosene:	C7	-	C16	Crude Oils:	C3	-	C60+

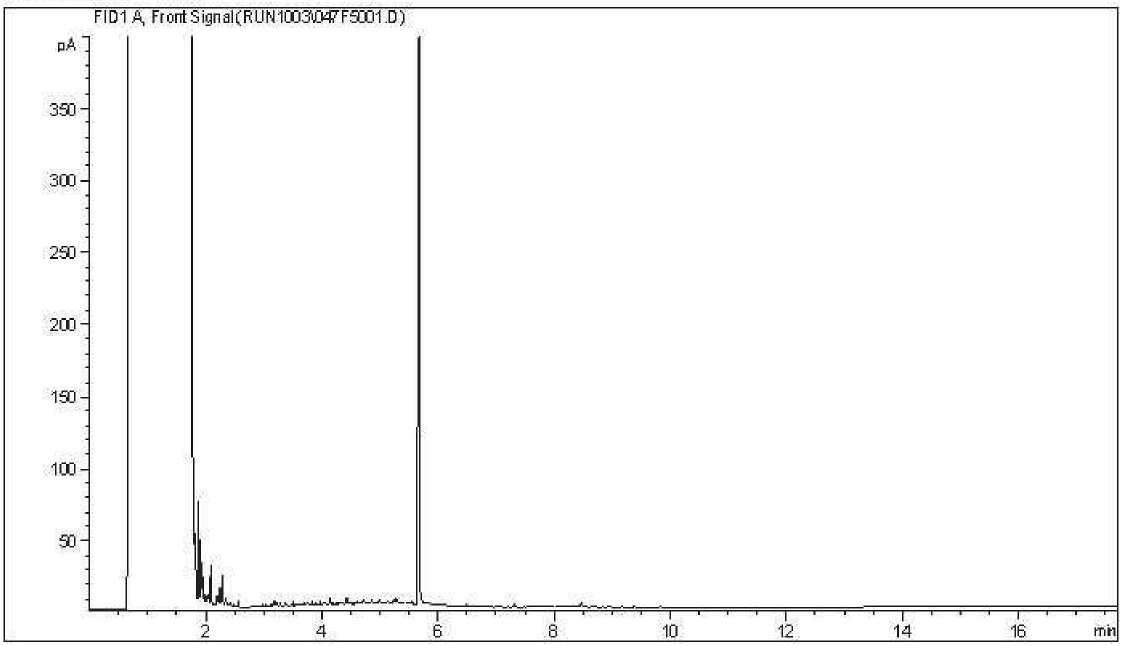
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686123
Report Date: 2016/10/11
Maxxam Sample: PQ7069

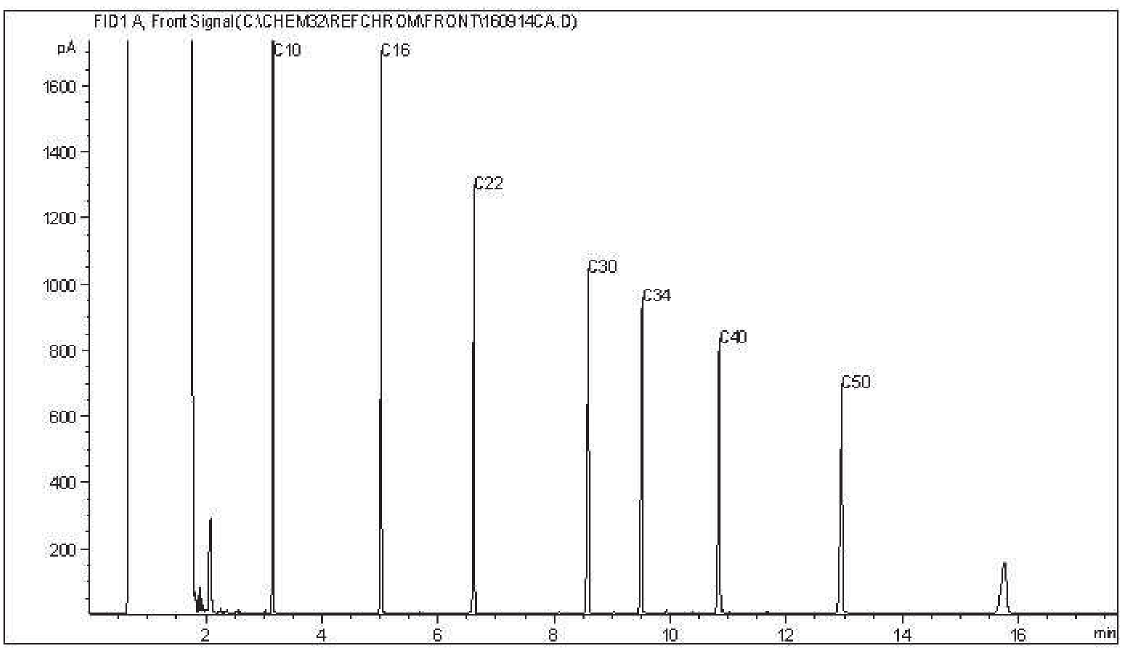
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-2-6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031938

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/12
Report #: R2280617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686741
Received: 2016/10/03, 18:51

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2016/10/04	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	2	N/A	2016/10/08	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	2	N/A	2016/10/07	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	2	2016/10/04	2016/10/05	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	2	2016/10/04	2016/10/05	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	1	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	2	N/A	2016/10/04	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/10/05	2016/10/09	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Hardness	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	1	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/04	2016/10/04	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	2	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	1	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	1	N/A	2016/10/06	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/05	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	2	N/A	2016/10/04	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/05	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/10/07	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	1	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	2	N/A	2016/10/05	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	2	N/A	2016/10/05	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2016/10/04	AB SOP-00023	SM 22 4110 B m
pH @25°C	2	N/A	2016/10/04	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	2	N/A	2016/10/04	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	2	N/A	2016/10/07	AB SOP-00018	SM 22 4500-SO4 E m

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Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031938

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/12
Report #: R2280617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B686741
Received: 2016/10/03, 18:51

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Heterotrophic Plate Count	2	2016/10/04	2016/10/06	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	2	N/A	2016/10/07	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	2	2016/10/06	2016/10/07	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/05	2016/10/05	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	1	2016/10/05	2016/10/06	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR2485	PR2486		
Sampling Date		2016/10/03 14:07	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	**MW16-1-15**	**MW16-16-11**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8422901
Volatiles					
Benzene	mg/L	<0.00040	0.0056	0.00040	8426391
Toluene	mg/L	<0.00040	0.024	0.00040	8426391
Ethylbenzene	mg/L	<0.00040	0.0034	0.00040	8426391
m & p-Xylene	mg/L	<0.00080	0.013	0.00080	8426391
o-Xylene	mg/L	<0.00040	0.0056	0.00040	8426391
Xylenes (Total)	mg/L	<0.00080	0.019	0.00080	8426391
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8426391
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8426391
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	100	101	N/A	8426391
4-Bromofluorobenzene (sur.)	%	97	97	N/A	8426391
D4-1,2-Dichloroethane (sur.)	%	99	96	N/A	8426391
O-TERPHENYL (sur.)	%	100	100	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2485		
Sampling Date		2016/10/03 14:07		
COC Number		M031938		
	UNITS	MW16-1-15	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	25	N/A	8419644
Cation Sum	meq/L	28	N/A	8419644
Hardness (CaCO3)	mg/L	1000	0.50	8420405
Ion Balance	N/A	1.1	0.010	8419643
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8420406
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8420407
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8420406
Calculated Total Dissolved Solids	mg/L	1600	10	8419648
Misc. Inorganics				
Conductivity	uS/cm	2100	1.0	8421412
pH	pH	7.88	N/A	8421411
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8421408
Alkalinity (Total as CaCO3)	mg/L	300	0.50	8421408
Bicarbonate (HCO3)	mg/L	360	0.50	8421408
Carbonate (CO3)	mg/L	<0.50	0.50	8421408
Hydroxide (OH)	mg/L	<0.50	0.50	8421408
Dissolved Sulphate (SO4)	mg/L	910 (1)	10	8426473
Dissolved Chloride (Cl)	mg/L	3.8	1.0	8426470
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8421070
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8421070
Elements				
Dissolved Aluminum (Al)	mg/L	<0.0030	0.0030	8421456
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8421456
Dissolved Arsenic (As)	mg/L	<0.00020	0.00020	8421456
Dissolved Barium (Ba)	mg/L	0.018	0.010	8424663
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8421456
Dissolved Boron (B)	mg/L	0.078	0.020	8424663

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2485		
Sampling Date		2016/10/03 14:07		
COC Number		M031938		
	UNITS	MW16-1-15	RDL	QC Batch
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8421456
Dissolved Calcium (Ca)	mg/L	230	0.30	8424663
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8421456
Dissolved Cobalt (Co)	mg/L	0.0012	0.00030	8421456
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8421456
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8424663
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8421456
Dissolved Lithium (Li)	mg/L	0.022	0.020	8424663
Dissolved Magnesium (Mg)	mg/L	110	0.20	8424663
Dissolved Manganese (Mn)	mg/L	0.88	0.0040	8424663
Dissolved Molybdenum (Mo)	mg/L	0.0028	0.00020	8421456
Dissolved Nickel (Ni)	mg/L	0.0010	0.00050	8421456
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8424663
Dissolved Potassium (K)	mg/L	4.8	0.30	8424663
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8421456
Dissolved Silicon (Si)	mg/L	4.7	0.10	8424663
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8421456
Dissolved Sodium (Na)	mg/L	160	0.50	8424663
Dissolved Strontium (Sr)	mg/L	1.6	0.020	8424663
Dissolved Sulphur (S)	mg/L	340	0.20	8424663
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8421456
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8421456
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8421456
Dissolved Uranium (U)	mg/L	0.0054	0.00010	8421456
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8421456
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8421456
RDL = Reportable Detection Limit				

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	MW16-16-11	MW16-16-11 Lab-Dup	RDL	QC Batch
Calculated Parameters					
Anion Sum	meq/L	78	N/A	N/A	8419644
Cation Sum	meq/L	75	N/A	N/A	8419644
Hardness (CaCO3)	mg/L	2400	N/A	0.50	8420405
Ion Balance	N/A	0.95	N/A	0.010	8419643
Dissolved Nitrate (NO3)	mg/L	0.14	N/A	0.044	8420406
Nitrate plus Nitrite (N)	mg/L	0.031	N/A	0.020	8420407
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	0.033	8420406
Calculated Total Dissolved Solids	mg/L	4900	N/A	10	8419648
Misc. Inorganics					
Conductivity	uS/cm	5400	N/A	1.0	8420879
pH	pH	7.57	N/A	N/A	8420878
Anions					
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8420877
Alkalinity (Total as CaCO3)	mg/L	630	N/A	0.50	8420877
Bicarbonate (HCO3)	mg/L	770	N/A	0.50	8420877
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8420877
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8420877
Dissolved Sulphate (SO4)	mg/L	3100 (1)	N/A	20	8426130
Dissolved Chloride (Cl)	mg/L	7.9	N/A	1.0	8426126
Nutrients					
Dissolved Nitrite (N)	mg/L	<0.010	N/A	0.010	8421070
Dissolved Nitrate (N)	mg/L	0.031	N/A	0.010	8421070
Lab Filtered Elements					
Dissolved Aluminum (Al)	mg/L	0.0056	0.0072	0.0030	8421584
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	8421584
Dissolved Arsenic (As)	mg/L	0.00085	0.00082	0.00020	8421584
Dissolved Barium (Ba)	mg/L	0.026	N/A	0.010	8421809
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	MW16-16-11	MW16-16-11 Lab-Dup	RDL	QC Batch
Dissolved Boron (B)	mg/L	0.20	N/A	0.020	8421809
Dissolved Cadmium (Cd)	mg/L	0.00014 (1)	0.00011 (2)	0.000020	8421584
Dissolved Calcium (Ca)	mg/L	440	N/A	0.30	8421809
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Cobalt (Co)	mg/L	0.0037	0.0035	0.00030	8421584
Dissolved Copper (Cu)	mg/L	0.0097	0.0099	0.00020	8421584
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8421809
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	8421584
Dissolved Lithium (Li)	mg/L	0.15	N/A	0.020	8421809
Dissolved Magnesium (Mg)	mg/L	320	N/A	0.20	8421809
Dissolved Manganese (Mn)	mg/L	2.3	N/A	0.0040	8421809
Dissolved Molybdenum (Mo)	mg/L	0.0011	0.0011	0.00020	8421584
Dissolved Nickel (Ni)	mg/L	0.0066	0.0062	0.00050	8421584
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	0.10	8421809
Dissolved Potassium (K)	mg/L	15	N/A	0.30	8421809
Dissolved Selenium (Se)	mg/L	0.00038	0.00033	0.00020	8421584
Dissolved Silicon (Si)	mg/L	6.3	N/A	0.10	8421809
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	8421584
Dissolved Sodium (Na)	mg/L	600 (3)	N/A	5.0	8421809
Dissolved Strontium (Sr)	mg/L	4.9	N/A	0.020	8421809
Dissolved Sulphur (S)	mg/L	1000 (3)	N/A	2.0	8421809
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	8421584
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	0.0010	8421584
Dissolved Uranium (U)	mg/L	0.033	0.033	0.00010	8421584
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Duplicate exceeds acceptance criteria due to sample non homogeneity.
(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR2486	PR2486		
Sampling Date		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		
	UNITS	**MW16-16-11**	**MW16-16-11 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	<0.0030	<0.0030	0.0030	8421584

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR2485	PR2485		PR2486	PR2486		
Sampling Date		2016/10/03 14:07	2016/10/03 14:07		2016/10/03 17:32	2016/10/03 17:32		
COC Number		M031938	M031938		M031938	M031938		
	UNITS	**MW16-1-15**	**MW16-1-15 Lab-Dup**	**RDL**	**MW16-16-11**	**MW16-16-11 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics								
Dissolved Organic Carbon (C)	mg/L	2.6	N/A	0.50	N/A	N/A	0.50	8424431
Lab Filtered Inorganics								
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	4.6	N/A	0.50	8424424
Microbiological Param.								
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	<100 (1)	N/A	100	8421073
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	<100 (1)	N/A	100	8421072
Heterotrophic Plate Count	CFU/mL	4900 (1)	5100	10	50000 (2)	52000	100	8421074
Total Coliforms DST	mpn/100mL	230 (1)	N/A	10	200 (1)	N/A	100	8421073
Nutrients								
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	N/A	N/A	N/A	8423168
Total Kjeldahl Nitrogen	mg/L	1.5 (3)	N/A	0.50	14 (3)	N/A	0.50	8424394
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	0.0045	N/A	0.0030	8421368
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	N/A	N/A	N/A	8422351
Lab Filtered Nutrients								
Dissolved Ammonia (N)	mg/L	N/A	N/A	N/A	0.60	N/A	0.050	8423178
Dissolved Phosphorus (P)	mg/L	N/A	N/A	N/A	0.011	N/A	0.0030	8422263

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
Spreader colonies were present in the Petri dish. Presence of spreader colonies may obscure other colonies, possibly biasing results.
(3) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PR2485		PR2486		
Sampling Date		2016/10/03 14:07		2016/10/03 17:32		
COC Number		M031938		M031938		
	UNITS	**MW16-1-15**	**RDL**	**MW16-16-11**	**RDL**	**QC Batch**
Low Level Elements						
Dissolved Mercury (Hg)	ug/L	0.0029	0.0020	N/A	0.0020	8428932
Total Mercury (Hg)	ug/L	<2.0 (1)	2.0	<6.0 (1)	6.0	8428935
Lab Filtered Elements-Low						
Dissolved Mercury (Hg)	ug/L	N/A	N/A	<0.0020	0.0020	8421467

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	12.3°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8420877	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/04		93	%	80 - 120
8420877	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/04	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/04	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/04	<0.50		mg/L	
			Carbonate (CO3)	2016/10/04	<0.50		mg/L	
			Hydroxide (OH)	2016/10/04	<0.50		mg/L	
8420877	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/04	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/04	0.43		%	20
			Bicarbonate (HCO3)	2016/10/04	0.43		%	20
			Carbonate (CO3)	2016/10/04	NC		%	20
			Hydroxide (OH)	2016/10/04	NC		%	20
8420878	IK0	Spiked Blank	pH	2016/10/04		100	%	97 - 103
8420878	IK0	RPD	pH	2016/10/04	0.22		%	N/A
8420879	IK0	Spiked Blank	Conductivity	2016/10/04		100	%	90 - 110
8420879	IK0	Method Blank	Conductivity	2016/10/04	<1.0		uS/cm	
8420879	IK0	RPD	Conductivity	2016/10/04	0.59		%	20
8421070	JLD	Matrix Spike	Dissolved Nitrite (N)	2016/10/04		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/04		104	%	80 - 120
8421070	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/10/04		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/04		102	%	80 - 120
8421070	JLD	Method Blank	Dissolved Nitrite (N)	2016/10/04	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/04	<0.010		mg/L	
8421070	JLD	RPD	Dissolved Nitrite (N)	2016/10/04	NC		%	20
			Dissolved Nitrate (N)	2016/10/04	0.18		%	20
8421072	RP0	Method Blank	Fecal Coliforms	2016/10/05	<1.0		MPN/10	
8421072	RP0	RPD	Fecal Coliforms	2016/10/05	NC		%	N/A
8421073	AP1	Method Blank	E.Coli DST	2016/10/05	<1.0		mpn/100	
			Total Coliforms DST	2016/10/05	<1.0		mpn/100	
8421073	AP1	RPD	Total Coliforms DST	2016/10/05	NC		%	N/A
8421074	AP1	Method Blank	Heterotrophic Plate Count	2016/10/06	<1.0		CFU/mL	
8421074	AP1	RPD [PR2485-06]	Heterotrophic Plate Count	2016/10/06	3.6		%	N/A
8421074	AP1	RPD [PR2486-06]	Heterotrophic Plate Count	2016/10/06	3.1		%	N/A
8421368	MB5	Matrix Spike	Orthophosphate (P)	2016/10/04		92	%	80 - 120
8421368	MB5	Spiked Blank	Orthophosphate (P)	2016/10/04		94	%	80 - 120
8421368	MB5	Method Blank	Orthophosphate (P)	2016/10/04	<0.0030		mg/L	
8421368	MB5	RPD	Orthophosphate (P)	2016/10/04	NC		%	20
8421408	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/04		93	%	80 - 120
8421408	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/04	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/04	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/04	<0.50		mg/L	
			Carbonate (CO3)	2016/10/04	<0.50		mg/L	
			Hydroxide (OH)	2016/10/04	<0.50		mg/L	
8421408	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/04	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/04	NC		%	20
			Bicarbonate (HCO3)	2016/10/04	NC		%	20
			Carbonate (CO3)	2016/10/04	NC		%	20
			Hydroxide (OH)	2016/10/04	NC		%	20
8421411	IK0	Spiked Blank	pH	2016/10/04		100	%	97 - 103
8421411	IK0	RPD	pH	2016/10/04	0.98		%	N/A
8421412	IK0	Spiked Blank	Conductivity	2016/10/04		100	%	90 - 110
8421412	IK0	Method Blank	Conductivity	2016/10/04	<1.0		uS/cm	
8421412	IK0	RPD	Conductivity	2016/10/04	NC		%	20

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8421456	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		88	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		86	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		NC	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		92	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		89	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		97	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		97	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		92	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		88	%	80 - 120
8421456	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		121 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		102	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		102	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		101	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		100	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		97	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		100	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		99	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		98	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		90	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		105	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		93	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		101	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		99	%	80 - 120
8421456	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/05	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/05	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/05	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/05	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/05	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/05	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/05	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/05	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/05	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/05	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/05	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/05	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/05	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/05	<0.00020		mg/L	

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Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/05	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/05	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/05	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/05	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/05	<0.0030		mg/L	
8421456	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	4.3		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	NC		%	20
			Dissolved Copper (Cu)	2016/10/06	NC		%	20
			Dissolved Lead (Pb)	2016/10/06	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	NC		%	20
			Dissolved Nickel (Ni)	2016/10/06	0.53		%	20
			Dissolved Selenium (Se)	2016/10/06	NC		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	2.0		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	NC		%	20
8421467	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/04		105	%	80 - 120
8421467	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/04		104	%	80 - 120
8421467	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/04	<0.0020		ug/L	
8421467	RK3	RPD	Dissolved Mercury (Hg)	2016/10/04	NC		%	20
8421584	PC5	Matrix Spike [PR2486-01]	Dissolved Aluminum (Al)	2016/10/05		111	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/05		93	%	80 - 120
			Dissolved Arsenic (As)	2016/10/05		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/05		94	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/05		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/05		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/05		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/05		90	%	80 - 120
			Dissolved Lead (Pb)	2016/10/05		93	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/05		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/05		87	%	80 - 120
			Dissolved Selenium (Se)	2016/10/05		96	%	80 - 120
			Dissolved Silver (Ag)	2016/10/05		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/05		93	%	80 - 120
			Dissolved Tin (Sn)	2016/10/05		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/05		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/05		NC	%	80 - 120
			Dissolved Vanadium (V)	2016/10/05		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/05		89	%	80 - 120
8421584	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/05		121 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/05		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/05		96	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/05		95	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/05		97	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/05		100	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Cobalt (Co)	2016/10/05		100	%	80 - 120
			Dissolved Copper (Cu)	2016/10/05		98	%	80 - 120
			Dissolved Lead (Pb)	2016/10/05		102	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/05		100	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/05		101	%	80 - 120
			Dissolved Selenium (Se)	2016/10/05		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/05		99	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/05		102	%	80 - 120
			Dissolved Tin (Sn)	2016/10/05		103	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/05		100	%	80 - 120
			Dissolved Uranium (U)	2016/10/05		103	%	80 - 120
			Dissolved Vanadium (V)	2016/10/05		101	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/05		92	%	80 - 120
8421584	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/05	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/05	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/05	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/05	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/05	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/05	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/05	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/05	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/05	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/05	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/05	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/05	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/05	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/05	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/05	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/05	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/05	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/05	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/05	<0.0030		mg/L	
8421584	PC5	RPD [PR2486-01]	Dissolved Aluminum (Al)	2016/10/05	NC		%	20
			Dissolved Antimony (Sb)	2016/10/05	NC		%	20
			Dissolved Arsenic (As)	2016/10/05	NC		%	20
			Dissolved Beryllium (Be)	2016/10/05	NC		%	20
			Dissolved Cadmium (Cd)	2016/10/05	25 (1)		%	20
			Dissolved Chromium (Cr)	2016/10/05	NC		%	20
			Dissolved Cobalt (Co)	2016/10/05	6.8		%	20
			Dissolved Copper (Cu)	2016/10/05	1.8		%	20
			Dissolved Lead (Pb)	2016/10/05	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/05	2.8		%	20
			Dissolved Nickel (Ni)	2016/10/05	6.2		%	20
			Dissolved Selenium (Se)	2016/10/05	NC		%	20
			Dissolved Silver (Ag)	2016/10/05	NC		%	20
			Dissolved Thallium (Tl)	2016/10/05	NC		%	20
			Dissolved Tin (Sn)	2016/10/05	NC		%	20
			Dissolved Titanium (Ti)	2016/10/05	NC		%	20
			Dissolved Uranium (U)	2016/10/05	0.46		%	20
			Dissolved Vanadium (V)	2016/10/05	NC		%	20
			Dissolved Zinc (Zn)	2016/10/05	NC		%	20
8421809	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		104	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		95	%	80 - 120
8421809	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/05		95	%	80 - 120
			Dissolved Boron (B)	2016/10/05		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/05		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/05		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/05		97	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/05		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/05		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/05		100	%	80 - 120
			Dissolved Potassium (K)	2016/10/05		103	%	80 - 120
			Dissolved Silicon (Si)	2016/10/05		95	%	80 - 120
			Dissolved Sodium (Na)	2016/10/05		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/05		96	%	80 - 120
8421809	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/05	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/05	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/05	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/05	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/05	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/05	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/05	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/05	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/05	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/05	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/05	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/05	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/05	<0.20		mg/L	
8421809	JHC	RPD	Dissolved Barium (Ba)	2016/10/05	NC		%	20
			Dissolved Boron (B)	2016/10/05	NC		%	20
			Dissolved Calcium (Ca)	2016/10/05	NC		%	20
			Dissolved Iron (Fe)	2016/10/05	NC		%	20
			Dissolved Lithium (Li)	2016/10/05	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/05	NC		%	20
			Dissolved Manganese (Mn)	2016/10/05	NC		%	20
			Dissolved Phosphorus (P)	2016/10/05	NC		%	20
			Dissolved Potassium (K)	2016/10/05	NC		%	20
			Dissolved Silicon (Si)	2016/10/05	NC		%	20
			Dissolved Sodium (Na)	2016/10/05	NC		%	20
			Dissolved Strontium (Sr)	2016/10/05	NC		%	20
			Dissolved Sulphur (S)	2016/10/05	NC		%	20
8422263	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/05		94	%	80 - 120
8422263	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/05		102	%	80 - 120
8422263	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/05		103	%	80 - 120

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422263	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/05	<0.0030		mg/L	
8422263	MB5	RPD	Dissolved Phosphorus (P)	2016/10/05	NC		%	20
8422351	MB5	Matrix Spike	Dissolved Phosphorus (P)	2016/10/06		22 (1)	%	80 - 120
8422351	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/06		107	%	80 - 120
8422351	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/06		105	%	80 - 120
8422351	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/06	<0.0030		mg/L	
8422351	MB5	RPD	Dissolved Phosphorus (P)	2016/10/06	NC		%	20
8422901	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/08		102	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	50 - 130
8422901	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/08		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	70 - 130
8422901	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/08		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08	<0.10		mg/L	
8422901	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/08	NC		%	40
8423168	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423178	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/06		83	%	80 - 120
8423178	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		97	%	80 - 120
8423178	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423178	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8424394	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/07		NC	%	80 - 120
8424394	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/07		89	%	80 - 120
8424394	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/07		84	%	80 - 120
8424394	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/07	<0.050		mg/L	
8424394	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/07	2.0		%	20
8424424	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424424	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		99	%	80 - 120
8424424	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424424	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	2.4		%	20
8424431	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424431	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		103	%	80 - 120
8424431	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424431	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	1.7		%	20
8424663	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/06		95	%	80 - 120
			Dissolved Boron (B)	2016/10/06		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/06		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/06		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/06		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/06		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/06		96	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/06		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/06		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/06		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/06		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/06		NC	%	80 - 120
8424663	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/06		100	%	80 - 120
			Dissolved Boron (B)	2016/10/06		94	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/06		102	%	80 - 120
			Dissolved Iron (Fe)	2016/10/06		98	%	80 - 120
			Dissolved Lithium (Li)	2016/10/06		101	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Magnesium (Mg)	2016/10/06		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/06		100	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/06		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/06		108	%	80 - 120
			Dissolved Silicon (Si)	2016/10/06		96	%	80 - 120
			Dissolved Sodium (Na)	2016/10/06		102	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/06		98	%	80 - 120
8424663	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/06	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/06	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/06	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/06	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/06	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/06	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/06	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/06	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/06	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/06	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/06	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/06	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/06	<0.20		mg/L	
8424663	JHC	RPD	Dissolved Calcium (Ca)	2016/10/07	0.86		%	20
			Dissolved Iron (Fe)	2016/10/07	2.1		%	20
			Dissolved Magnesium (Mg)	2016/10/07	0.073		%	20
			Dissolved Manganese (Mn)	2016/10/07	0.30		%	20
			Dissolved Potassium (K)	2016/10/07	0.63		%	20
			Dissolved Sodium (Na)	2016/10/07	0.074		%	20
8426126	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426126	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		104	%	80 - 120
8426126	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	1.4, RDL=1.0		mg/L	
8426126	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	8.6		%	20
8426130	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426130	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		106	%	80 - 120
8426130	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426130	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.50		%	20
8426391	MZ	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/08		99	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		98	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		96	%	70 - 130
			Benzene	2016/10/08		100	%	70 - 130
			Toluene	2016/10/08		98	%	70 - 130
			Ethylbenzene	2016/10/08		100	%	70 - 130
			m & p-Xylene	2016/10/08		90	%	70 - 130
			o-Xylene	2016/10/08		99	%	70 - 130
			F1 (C6-C10)	2016/10/08		84	%	70 - 130
8426391	MZ	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/08		99	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		97	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		95	%	70 - 130
			Benzene	2016/10/08		98	%	70 - 130
			Toluene	2016/10/08		97	%	70 - 130
			Ethylbenzene	2016/10/08		99	%	70 - 130
			m & p-Xylene	2016/10/08		88	%	70 - 130
			o-Xylene	2016/10/08		102	%	70 - 130

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/08		105	%	70 - 130
8426391	MZ	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/08		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/08		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/08		96	%	70 - 130
			Benzene	2016/10/08	<0.00040		mg/L	
			Toluene	2016/10/08	<0.00040		mg/L	
			Ethylbenzene	2016/10/08	<0.00040		mg/L	
			m & p-Xylene	2016/10/08	<0.00080		mg/L	
			o-Xylene	2016/10/08	<0.00040		mg/L	
			Xylenes (Total)	2016/10/08	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/08	<0.10		mg/L	
			F1 (C6-C10)	2016/10/08	<0.10		mg/L	
8426391	MZ	RPD	Benzene	2016/10/08	NC		%	40
			Toluene	2016/10/08	NC		%	40
			Ethylbenzene	2016/10/08	NC		%	40
			m & p-Xylene	2016/10/08	NC		%	40
			o-Xylene	2016/10/08	NC		%	40
			Xylenes (Total)	2016/10/08	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/08	NC		%	40
			F1 (C6-C10)	2016/10/08	NC		%	40
8426470	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/07		NC	%	80 - 120
8426470	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/07		101	%	80 - 120
8426470	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/07	<1.0		mg/L	
8426470	ZI	RPD	Dissolved Chloride (Cl)	2016/10/07	6.0		%	20
8426473	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/07		NC	%	80 - 120
8426473	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/07		103	%	80 - 120
8426473	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/07	<1.0		mg/L	
8426473	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/07	0.075		%	20
8428932	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/11		107	%	80 - 120
8428932	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/11		120	%	80 - 120
8428932	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/11	0.0030, RDL=0.0020		ug/L	
8428932	RK3	RPD	Dissolved Mercury (Hg)	2016/10/11	NC		%	20
8428935	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/11		114	%	80 - 120
8428935	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/11		108	%	80 - 120
8428935	RK3	Method Blank	Total Mercury (Hg)	2016/10/11	<0.0020		ug/L	

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Maxxam Job #: B686741
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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428935	RK3	RPD	Total Mercury (Hg)	2016/10/11	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Maxxam Job #: B686741
Report Date: 2016/10/12

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Junzhi Gao

Janet Gao, B.Sc., QP, Supervisor, Organics

Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
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CHAIN OF CUSTODY RECORD M031938 Page 1 of 1

56

Invoice Information	Report Information (if differs from invoice)	Project Information	Turnaround Time (TAT) Required
Company: Stantec Consulting Ltd	Company:	Quotation #:	[✓] 5-7 Days Regular (Most analyses)
Contact Name: Dylan King	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 10160 112 St, Edmonton AB, T5K 2L6	Address:	Project #: 110773396	Rush TAT (Surcharges will be applied): Same Day / 2 Days / 1 Day / 3-4 Days
Phone: (780) 969-2223	Phone:	Site Location: Springbank SR1	
Email: Dylan.King@stantec.com	Email:	Site #:	Date Required:
Copies: Dale.Nisbet@stantec.com	Copies:	Sampled By: D. Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID	
Seal Present		✓	Temp	10 14 13
Seal Intact		✓		
Cooling Media	✓			

Depot Reception

Analysis Requested

Columns: # of containers; BTEX F1 ☐ VOC ☐; BTEX F1-F2; BTEX F1-F4; Routine Water; Regulated Metals Tot ☐ Diss ☑; Mercury Total ☑ Dissolved ☑; Salinity 4; Sieve (75 micron); Texture (% Sand, Silt, Clay); Basic Class II Landfill; Dissolved phosphorous; Phosphate; Dissolved Ammonia; TKN; DOC; Total Coliforms; E. Coli; Fecal Coliforms; Heterotrophic plate count; HOLD - DO NOT ANALYZE

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	Analyses
1	MW16-1-15		2016/10/03	14:07	W	13	✓ BTEX F1-F2, Routine Water, Regulated Metals, Mercury, Dissolved phosphorous, Phosphate, Dissolved Ammonia, TKN, DOC, Total Coliforms, E. Coli, Fecal Coliforms, Heterotrophic plate count
2	MW16-16-11		2016/10/03	17:32	W	10	✓ BTEX F1-F2, Regulated Metals, Mercury, Dissolved phosphorous, Phosphate, Dissolved Ammonia, TKN, DOC, Total Coliforms, E. Coli, Fecal Coliforms, Heterotrophic plate count
3							
4							
5							
6							
7							
8							
9							
10							MW16-1-15 10 11' 12'; MW16-16-11 14 12 10

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- [✓] AT1/CCME
- [✓] Drinking Water
- [ ] Saskatchewan
- [ ] D50 (Drilling Waste)
- [ ] Other:

Special Instructions

For MW16-16-11 please take dissolved parameters out of Routine Bottle due to low sample volume.

Submitted same day as sampled

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
D. Nisbet / Dale Nisbet	2016/10/03	18:50	[illegible] / NAHEE BLANSUCET	2016/10/03	18:51

03-Oct-16 18:51
Wendy Sears
B686741
NB6 INS-0001

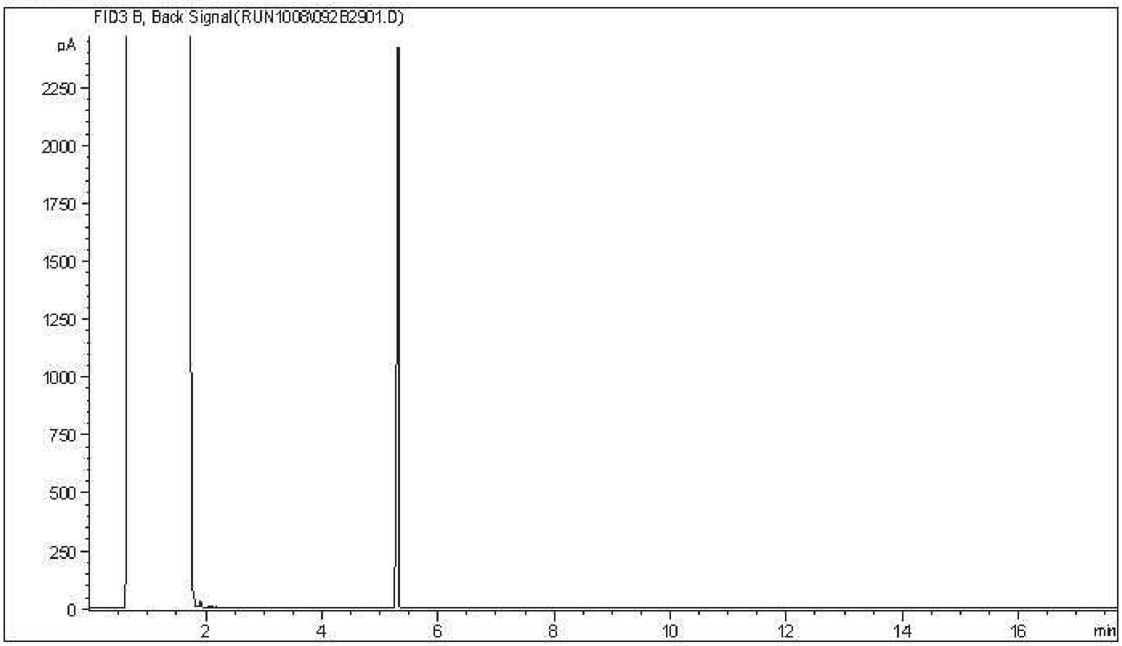
AB FCD-00331/6

Maxxam Job #: B686741
Report Date: 2016/10/12
Maxxam Sample: PR2485

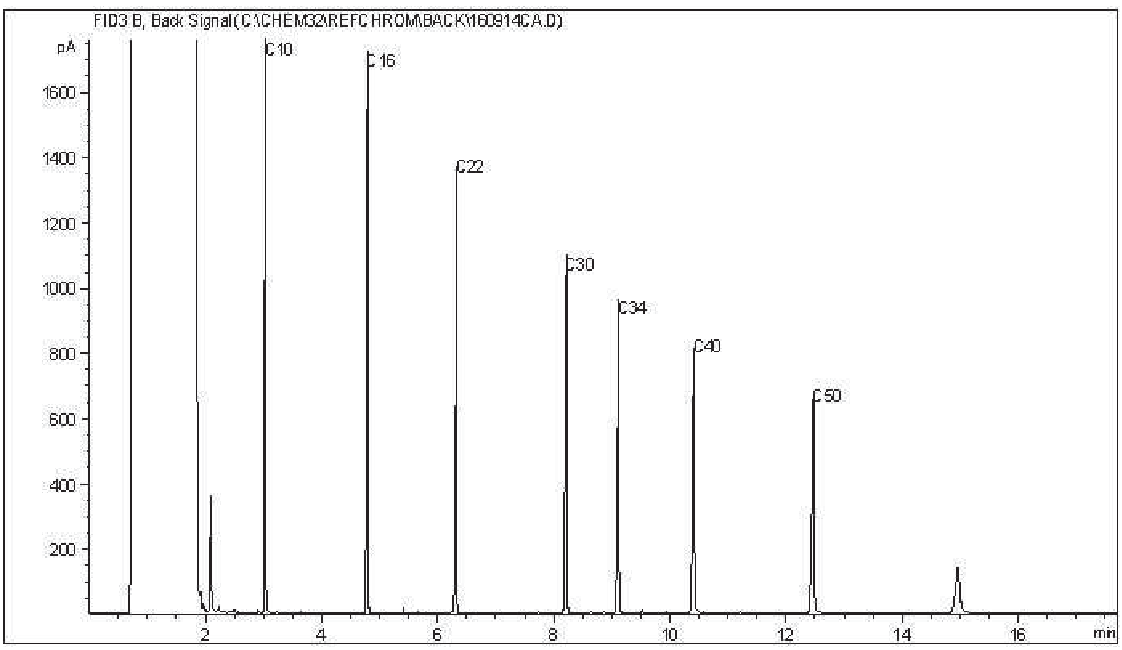
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-1-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

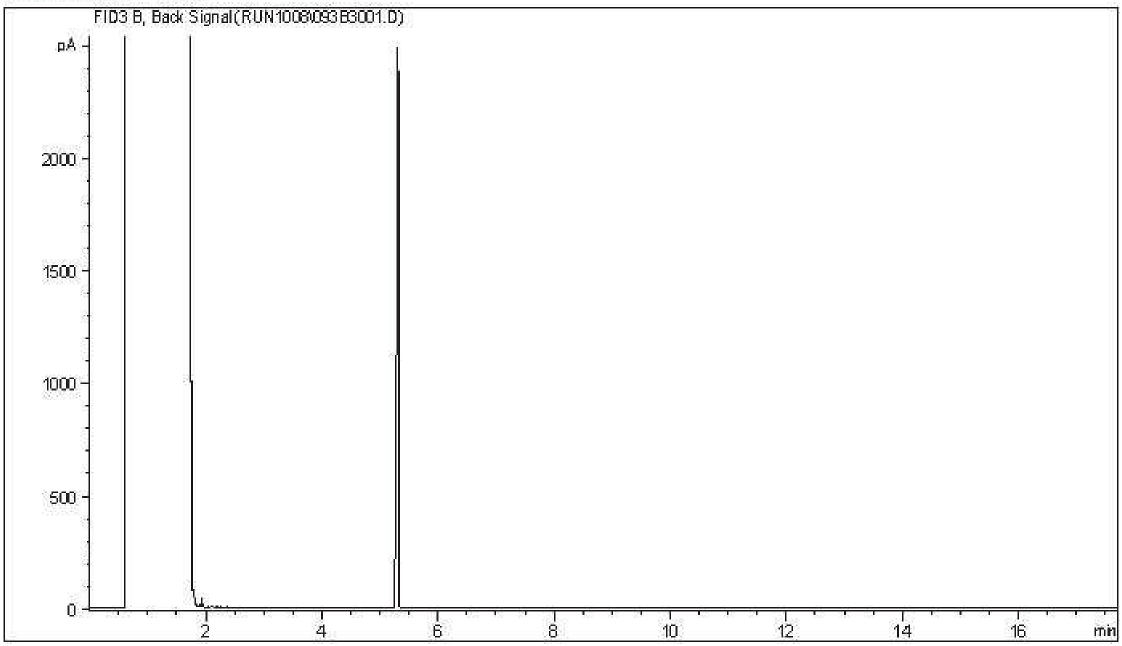
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B686741
Report Date: 2016/10/12
Maxxam Sample: PR2486

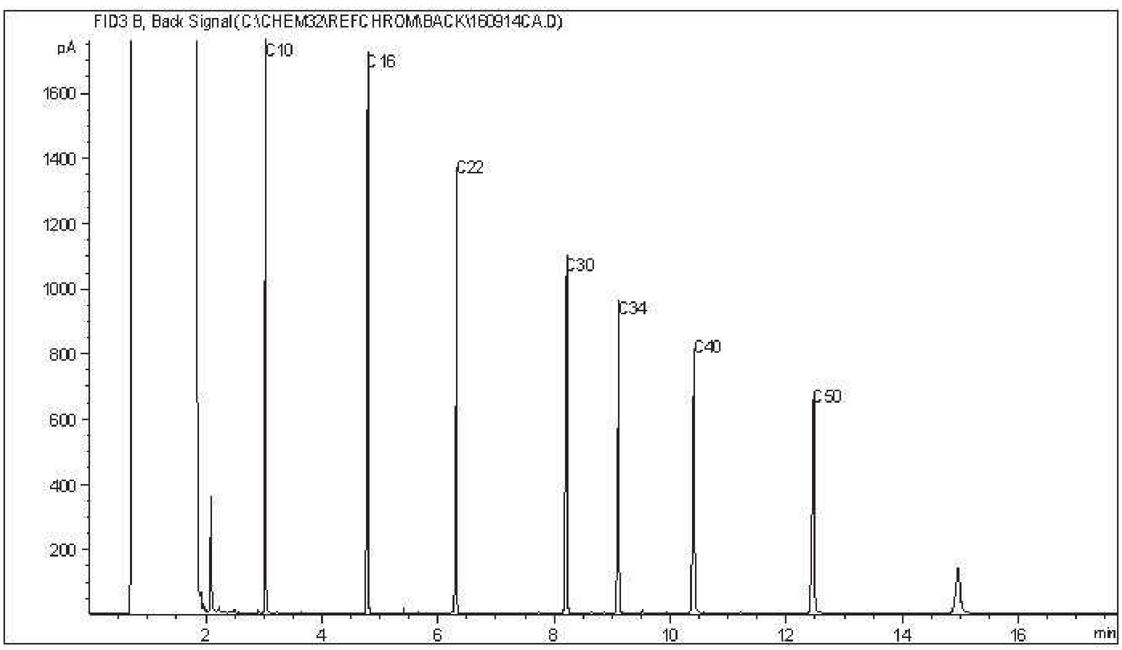
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-16-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031942

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/13
Report #: R2281727
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B687243
Received: 2016/10/04, 18:07

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	8	N/A	2016/10/05	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	8	N/A	2016/10/12	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	8	N/A	2016/10/08	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	8	2016/10/05	2016/10/06	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	8	2016/10/05	2016/10/06	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) -Lab Filtered (1)	1	N/A	2016/10/07	CAL SOP-00077	MMCW 119 1996 m
Carbon (DOC) (1)	7	N/A	2016/10/06	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	7	N/A	2016/10/05	AB SOP-00005	SM 22 2510 B m
Conductivity @25C	1	N/A	2016/10/11	AB SOP-00004	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	6	2016/10/05	2016/10/09	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/10/05	2016/10/10	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	7	2016/10/12	2016/10/12	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury-Low Level-Dissolved-Lab Filtered	1	2016/10/13	2016/10/13	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	8	2016/10/11	2016/10/11	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	7	N/A	2016/10/08	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/10/07	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	7	N/A	2016/10/06	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS-Dissolved-Lab Filtered	1	N/A	2016/10/07	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	8	N/A	2016/10/06	AB WI-00065	Auto Calc
Sum of cations, anions	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Ammonia-N (Dissolved) - Lab Filtered	1	N/A	2016/10/09	AB SOP-00007	EPA 350.1 R2.0 m
Ammonia-N (Dissolved)	7	N/A	2016/10/05	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	8	N/A	2016/10/07	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	8	N/A	2016/10/07	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	8	N/A	2016/10/06	AB SOP-00023	SM 22 4110 B m
pH @25°C	7	N/A	2016/10/05	AB SOP-00005	SM 22 4500-H+B m
pH @25C	1	N/A	2016/10/11	AB SOP-00006	SM 22 4500 H+B m
Orthophosphate by Konelab	8	N/A	2016/10/06	AB SOP-00025	SM 22 4500-P A,F m

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Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031942

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/13
Report #: R2281727
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B687243
Received: 2016/10/04, 18:07

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sulphate by Automated Colourimetry	8	N/A	2016/10/08	AB SOP-00018	SM 22 4500-SO4 E m
Heterotrophic Plate Count	8	2016/10/05	2016/10/07	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	8	N/A	2016/10/08	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	2	2016/10/07	2016/10/07	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	6	2016/10/10	2016/10/12	AB SOP-00008	EPA 351.1 R1978 m
Total Phosphorus-Dissolved-Lab Filtered	1	2016/10/06	2016/10/09	AB SOP-00024	SM 22 4500-P A,B,F m
Phosphorus -P (Total, Dissolved)	7	2016/10/05	2016/10/06	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR5499	PR5500	PR5501	PR5502	PR5503	PR5504		
Sampling Date		2016/10/04 10:50	2016/10/04 10:10	2016/10/04 12:14	2016/10/04 13:16	2016/10/04 15:04	2016/10/04 16:12		
COC Number		M031942	M031942	M031942	M031942	M031942	M031942		
	UNITS	**MW16-18-6**	**MW16-18-10**	**MW16-4-20**	**MW16-5-11**	**MW16-10-15**	**MW16-8-8**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8422901
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	0.00055	<0.00040	<0.00040	0.00040	8428043
Toluene	mg/L	<0.00040	0.0013	<0.00040	0.0013	<0.00040	<0.00040	0.00040	8428043
Ethylbenzene	mg/L	0.00062	0.00068	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8428043
m & p-Xylene	mg/L	0.0020	0.0029	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8428043
o-Xylene	mg/L	0.0010	0.0012	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8428043
Xylenes (Total)	mg/L	0.0030	0.0041	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8428043
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8428043
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8428043
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	104	107	106	106	107	106	N/A	8428043
4-Bromofluorobenzene (sur.)	%	100	100	100	99	102	101	N/A	8428043
D4-1,2-Dichloroethane (sur.)	%	102	101	102	100	102	100	N/A	8428043
O-TERPHENYL (sur.)	%	97	97	98	95	97	98	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PR5505	PR5506		
Sampling Date		2016/10/04 16:06	2016/10/04 12:15		
COC Number		M031942	M031942		
	UNITS	**MW16-8-19**	**MW16-4-16**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8422901
Volatiles					
Benzene	mg/L	<0.00040	<0.00040	0.00040	8428043
Toluene	mg/L	<0.00040	<0.00040	0.00040	8428043
Ethylbenzene	mg/L	<0.00040	<0.00040	0.00040	8428043
m & p-Xylene	mg/L	<0.00080	<0.00080	0.00080	8428043
o-Xylene	mg/L	<0.00040	<0.00040	0.00040	8428043
Xylenes (Total)	mg/L	<0.00080	<0.00080	0.00080	8428043
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	0.10	8428043
F1 (C6-C10)	mg/L	<0.10	<0.10	0.10	8428043
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	105	107	N/A	8428043
4-Bromofluorobenzene (sur.)	%	101	102	N/A	8428043
D4-1,2-Dichloroethane (sur.)	%	100	103	N/A	8428043
O-TERPHENYL (sur.)	%	97	95	N/A	8422901

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5499	PR5499	PR5500		PR5501		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		
COC Number		M031942	M031942	M031942		M031942		
	UNITS	**MW16-18-6**	**MW16-18-6 Lab-Dup**	**MW16-18-10**	**RDL**	**MW16-4-20**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	13	N/A	13	N/A	54	N/A	8421120
Cation Sum	meq/L	12	N/A	12	N/A	50	N/A	8421120
Hardness (CaCO3)	mg/L	480	N/A	160	0.50	1700	0.50	8422175
Ion Balance	N/A	0.98	N/A	0.93	0.010	0.94	0.010	8421119
Dissolved Nitrate (NO3)	mg/L	5.3	N/A	0.51	0.044	<0.044	0.044	8421045
Nitrate plus Nitrite (N)	mg/L	1.2	N/A	0.13	0.020	<0.020	0.020	8421046
Dissolved Nitrite (NO2)	mg/L	0.10	N/A	0.054	0.033	<0.033	0.033	8421045
Calculated Total Dissolved Solids	mg/L	650	N/A	680	10	3400	10	8421121
Misc. Inorganics								
Conductivity	uS/cm	1100	N/A	1200	1.0	4000	1.0	8422994
pH	pH	8.01	N/A	8.10	N/A	7.52	N/A	8422993
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	420	N/A	410	0.50	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	510	N/A	500	0.50	570	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	N/A	<0.50	0.50	<0.50	0.50	8422991
Dissolved Sulphate (SO4)	mg/L	100	100	110	1.0	2100 (1)	20	8427521
Dissolved Chloride (Cl)	mg/L	72	69	78	1.0	3.0	1.0	8427519
Nutrients								
Dissolved Nitrite (N)	mg/L	0.031	N/A	0.017	0.010	<0.010	0.010	8423525
Dissolved Nitrate (N)	mg/L	1.2	N/A	0.12	0.010	<0.010	0.010	8423525
Elements								
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	<0.0030	0.0030	<0.0030	0.0030	8422814
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	<0.00060	0.00060	<0.00060	0.00060	8422814
Dissolved Arsenic (As)	mg/L	0.00022	N/A	0.00039	0.00020	0.0017	0.00020	8422814
Dissolved Barium (Ba)	mg/L	0.075	N/A	0.030	0.010	<0.010	0.010	8426610
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Boron (B)	mg/L	0.088	N/A	0.14	0.020	0.11	0.020	8426610

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5499	PR5499	PR5500		PR5501		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		
COC Number		M031942	M031942	M031942		M031942		
	UNITS	**MW16-18-6**	**MW16-18-6 Lab-Dup**	**MW16-18-10**	**RDL**	**MW16-4-20**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	<0.000020	N/A	<0.000020	0.000020	<0.000020	0.000020	8422814
Dissolved Calcium (Ca)	mg/L	86	N/A	38	0.30	380	0.30	8426610
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Cobalt (Co)	mg/L	<0.00030	N/A	0.00034	0.00030	0.00034	0.00030	8422814
Dissolved Copper (Cu)	mg/L	0.00067	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Iron (Fe)	mg/L	<0.060	N/A	<0.060	0.060	2.2	0.060	8426610
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Lithium (Li)	mg/L	0.026	N/A	0.031	0.020	0.070	0.020	8426610
Dissolved Magnesium (Mg)	mg/L	63	N/A	16	0.20	180	0.20	8426610
Dissolved Manganese (Mn)	mg/L	0.058	N/A	0.20	0.0040	0.60	0.0040	8426610
Dissolved Molybdenum (Mo)	mg/L	0.0019	N/A	0.0037	0.00020	0.0016	0.00020	8422814
Dissolved Nickel (Ni)	mg/L	0.00099	N/A	<0.00050	0.00050	<0.00050	0.00050	8422814
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	<0.10	0.10	<0.10	0.10	8426610
Dissolved Potassium (K)	mg/L	2.4	N/A	1.3	0.30	8.2	0.30	8426610
Dissolved Selenium (Se)	mg/L	0.0012	N/A	0.00066	0.00020	<0.00020	0.00020	8422814
Dissolved Silicon (Si)	mg/L	4.1	N/A	3.4	0.10	4.3	0.10	8426610
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	<0.00010	0.00010	<0.00010	0.00010	8422814
Dissolved Sodium (Na)	mg/L	66	N/A	200	0.50	370	0.50	8426610
Dissolved Strontium (Sr)	mg/L	0.75	N/A	0.27	0.020	6.0 (1)	0.20	8426610
Dissolved Sulphur (S)	mg/L	29	N/A	33	0.20	730 (1)	2.0	8426610
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	<0.00020	0.00020	<0.00020	0.00020	8422814
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Uranium (U)	mg/L	0.011	N/A	0.0064	0.00010	0.0023	0.00010	8422814
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	<0.0010	0.0010	<0.0010	0.0010	8422814
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	<0.0030	0.0030	<0.0030	0.0030	8422814

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5502	PR5502		PR5503		PR5503	
Sampling Date		2016/10/04 13:16	2016/10/04 13:16		2016/10/04 15:04		2016/10/04 15:04	
COC Number		M031942	M031942		M031942		M031942	
	UNITS	MW16-5-11	MW16-5-11 Lab-Dup	QC Batch	MW16-10-15	RDL	MW16-10-15 Lab-Dup	QC Batch
Calculated Parameters								
Anion Sum	meq/L	8.8	N/A	8421120	N/A	N/A	N/A	8421120
Cation Sum	meq/L	8.7	N/A	8421120	N/A	N/A	N/A	8421120
Hardness (CaCO3)	mg/L	340	N/A	8422175	N/A	0.50	N/A	8422175
Ion Balance	N/A	0.99	N/A	8421119	N/A	0.010	N/A	8421119
Dissolved Nitrate (NO3)	mg/L	3.3	N/A	8421045	N/A	0.044	N/A	8421045
Nitrate plus Nitrite (N)	mg/L	0.76	N/A	8421046	N/A	0.020	N/A	8421046
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	8421045	N/A	0.033	N/A	8421045
Calculated Total Dissolved Solids	mg/L	440	N/A	8421121	N/A	10	N/A	8421121
Misc. Inorganics								
Conductivity	uS/cm	780	N/A	8422994	3000	1.0	N/A	8429611
pH	pH	7.96	N/A	8422993	7.65	N/A	7.62	8429487
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Alkalinity (Total as CaCO3)	mg/L	380	N/A	8422991	N/A	0.50	N/A	N/A
Bicarbonate (HCO3)	mg/L	470	N/A	8422991	N/A	0.50	N/A	N/A
Carbonate (CO3)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Hydroxide (OH)	mg/L	<0.50	N/A	8422991	N/A	0.50	N/A	N/A
Dissolved Sulphate (SO4)	mg/L	43	N/A	8427480	N/A	1.0	N/A	N/A
Dissolved Chloride (Cl)	mg/L	4.8	N/A	8427477	N/A	1.0	N/A	N/A
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.010	N/A	8423525	N/A	0.010	N/A	N/A
Dissolved Nitrate (N)	mg/L	0.76	N/A	8423525	N/A	0.010	N/A	N/A
Elements								
Dissolved Aluminum (Al)	mg/L	0.011	N/A	8422814	N/A	0.0030	N/A	N/A
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	8422814	N/A	0.00060	N/A	N/A
Dissolved Arsenic (As)	mg/L	0.0010	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Barium (Ba)	mg/L	0.068	0.068	8426625	N/A	0.010	N/A	N/A
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Boron (B)	mg/L	0.036	0.035	8426625	N/A	0.020	N/A	N/A
Dissolved Cadmium (Cd)	mg/L	<0.000020	N/A	8422814	N/A	0.000020	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5502	PR5502		PR5503		PR5503	
Sampling Date		2016/10/04 13:16	2016/10/04 13:16		2016/10/04 15:04		2016/10/04 15:04	
COC Number		M031942	M031942		M031942		M031942	
	UNITS	**MW16-5-11**	**MW16-5-11 Lab-Dup**	**QC Batch**	**MW16-10-15**	**RDL**	**MW16-10-15 Lab-Dup**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	76	76	8426625	N/A	0.30	N/A	N/A
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Cobalt (Co)	mg/L	0.0010	N/A	8422814	N/A	0.00030	N/A	N/A
Dissolved Copper (Cu)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Iron (Fe)	mg/L	0.061	0.062	8426625	N/A	0.060	N/A	N/A
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	8426625	N/A	0.020	N/A	N/A
Dissolved Magnesium (Mg)	mg/L	38	38	8426625	N/A	0.20	N/A	N/A
Dissolved Manganese (Mn)	mg/L	0.15	0.15	8426625	N/A	0.0040	N/A	N/A
Dissolved Molybdenum (Mo)	mg/L	0.012	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Nickel (Ni)	mg/L	0.0020	N/A	8422814	N/A	0.00050	N/A	N/A
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	8426625	N/A	0.10	N/A	N/A
Dissolved Potassium (K)	mg/L	3.7	3.7	8426625	N/A	0.30	N/A	N/A
Dissolved Selenium (Se)	mg/L	0.0031	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Silicon (Si)	mg/L	4.2	4.1	8426625	N/A	0.10	N/A	N/A
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	8422814	N/A	0.00010	N/A	N/A
Dissolved Sodium (Na)	mg/L	39	39	8426625	N/A	0.50	N/A	N/A
Dissolved Strontium (Sr)	mg/L	0.82	0.81	8426625	N/A	0.020	N/A	N/A
Dissolved Sulphur (S)	mg/L	13	13	8426625	N/A	0.20	N/A	N/A
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	8422814	N/A	0.00020	N/A	N/A
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Uranium (U)	mg/L	0.0053	N/A	8422814	N/A	0.00010	N/A	N/A
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	8422814	N/A	0.0010	N/A	N/A
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	8422814	N/A	0.0030	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5504		PR5505			PR5506		
Sampling Date		2016/10/04 16:12		2016/10/04 16:06			2016/10/04 12:15		
COC Number		M031942		M031942			M031942		
	UNITS	**MW16-8-8**	**QC Batch**	**MW16-8-19**	**RDL**	**QC Batch**	**MW16-4-16**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	meq/L	12	8421120	15	N/A	8421120	55	N/A	8421120
Cation Sum	meq/L	12	8421120	14	N/A	8421120	51	N/A	8421120
Hardness (CaCO3)	mg/L	550	8422175	580	0.50	8422175	1700	0.50	8422175
Ion Balance	N/A	1.0	8421119	0.93	0.010	8422190	0.94	0.010	8422190
Dissolved Nitrate (NO3)	mg/L	6.9	8421045	3.1	0.044	8422191	0.045	0.044	8422191
Nitrate plus Nitrite (N)	mg/L	1.6	8421046	0.70	0.020	8422192	<0.020	0.020	8422192
Dissolved Nitrite (NO2)	mg/L	<0.033	8421045	<0.033	0.033	8422191	<0.033	0.033	8422191
Calculated Total Dissolved Solids	mg/L	640	8421121	750	10	8422193	3400	10	8422193
Misc. Inorganics									
Conductivity	uS/cm	1100	8422994	1300	1.0	8422994	4000	1.0	8422994
pH	pH	7.90	8422993	7.74	N/A	8422993	7.45	N/A	8422993
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	370	8422991	460	0.50	8422991	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	450	8422991	560	0.50	8422991	560	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	8422991	<0.50	0.50	8422991	<0.50	0.50	8422991
Dissolved Sulphate (SO4)	mg/L	140	8427521	110	1.0	8427521	2200 (1)	20	8427480
Dissolved Chloride (Cl)	mg/L	60	8427519	110	1.0	8427519	3.0	1.0	8427477
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.010	8423525	<0.010	0.010	8423525	<0.010	0.010	8423525
Dissolved Nitrate (N)	mg/L	1.6	8423525	0.70	0.010	8423525	0.010	0.010	8423525
Elements									
Dissolved Aluminum (Al)	mg/L	<0.0030	8422814	<0.0030	0.0030	8422814	<0.0030	0.0030	8422814
Dissolved Antimony (Sb)	mg/L	<0.00060	8422814	<0.00060	0.00060	8422814	<0.00060	0.00060	8422814
Dissolved Arsenic (As)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	0.0019	0.00020	8422814
Dissolved Barium (Ba)	mg/L	0.039	8426610	0.054	0.010	8426610	<0.010	0.010	8426610
Dissolved Beryllium (Be)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Boron (B)	mg/L	0.043	8426610	0.043	0.020	8426610	0.11	0.020	8426610
Dissolved Cadmium (Cd)	mg/L	0.000040	8422814	0.000029	0.000020	8422814	<0.000020	0.000020	8422814

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5504		PR5505			PR5506		
Sampling Date		2016/10/04 16:12		2016/10/04 16:06			2016/10/04 12:15		
COC Number		M031942		M031942			M031942		
	UNITS	**MW16-8-8**	**QC Batch**	**MW16-8-19**	**RDL**	**QC Batch**	**MW16-4-16**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	120	8426610	130	0.30	8426610	380	0.30	8426610
Dissolved Chromium (Cr)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Cobalt (Co)	mg/L	0.00057	8422814	<0.00030	0.00030	8422814	0.00031	0.00030	8422814
Dissolved Copper (Cu)	mg/L	0.00032	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Iron (Fe)	mg/L	<0.060	8426610	<0.060	0.060	8426610	2.2	0.060	8426610
Dissolved Lead (Pb)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Lithium (Li)	mg/L	<0.020	8426610	<0.020	0.020	8426610	0.074	0.020	8426610
Dissolved Magnesium (Mg)	mg/L	60	8426610	60	0.20	8426610	180	0.20	8426610
Dissolved Manganese (Mn)	mg/L	0.12	8426610	0.0062	0.0040	8426610	0.60	0.0040	8426610
Dissolved Molybdenum (Mo)	mg/L	0.0011	8422814	0.00085	0.00020	8422814	0.0015	0.00020	8422814
Dissolved Nickel (Ni)	mg/L	0.0025	8422814	<0.00050	0.00050	8422814	<0.00050	0.00050	8422814
Dissolved Phosphorus (P)	mg/L	<0.10	8426610	<0.10	0.10	8426610	<0.10	0.10	8426610
Dissolved Potassium (K)	mg/L	5.8	8426610	5.7	0.30	8426610	8.5	0.30	8426610
Dissolved Selenium (Se)	mg/L	0.011	8422814	0.0080	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Silicon (Si)	mg/L	4.2	8426610	3.7	0.10	8426610	4.4	0.10	8426610
Dissolved Silver (Ag)	mg/L	<0.00010	8422814	<0.00010	0.00010	8422814	<0.00010	0.00010	8422814
Dissolved Sodium (Na)	mg/L	25	8426610	47	0.50	8426610	390	0.50	8426610
Dissolved Strontium (Sr)	mg/L	0.90	8426610	1.3	0.020	8426610	5.9 (1)	0.20	8426610
Dissolved Sulphur (S)	mg/L	45	8426610	29	0.20	8426610	720 (1)	2.0	8426610
Dissolved Thallium (Tl)	mg/L	<0.00020	8422814	<0.00020	0.00020	8422814	<0.00020	0.00020	8422814
Dissolved Tin (Sn)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Titanium (Ti)	mg/L	<0.0010	8422814	0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Uranium (U)	mg/L	0.011	8422814	0.0053	0.00010	8422814	0.0022	0.00010	8422814
Dissolved Vanadium (V)	mg/L	<0.0010	8422814	<0.0010	0.0010	8422814	<0.0010	0.0010	8422814
Dissolved Zinc (Zn)	mg/L	<0.0030	8422814	<0.0030	0.0030	8422814	<0.0030	0.0030	8422814

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5506		
Sampling Date		2016/10/04 12:15		
COC Number		M031942		
	UNITS	**MW16-4-16 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics				
Conductivity	uS/cm	4000	1.0	8422994
pH	pH	7.46	N/A	8422993
Anions				
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8422991
Alkalinity (Total as CaCO3)	mg/L	460	0.50	8422991
Bicarbonate (HCO3)	mg/L	560	0.50	8422991
Carbonate (CO3)	mg/L	<0.50	0.50	8422991
Hydroxide (OH)	mg/L	<0.50	0.50	8422991

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5503		
Sampling Date		2016/10/04 15:04		
COC Number		M031942		
	UNITS	MW16-10-15	RDL	QC Batch
Calculated Parameters				
Anion Sum	meq/L	45	N/A	8421120
Cation Sum	meq/L	42	N/A	8421120
Hardness (CaCO3)	mg/L	1400	0.50	8422175
Ion Balance	N/A	0.94	0.010	8421119
Dissolved Nitrate (NO3)	mg/L	0.12	0.044	8421045
Nitrate plus Nitrite (N)	mg/L	0.027	0.020	8421046
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8421045
Calculated Total Dissolved Solids	mg/L	2800	10	8421121
Anions				
Alkalinity (PP as CaCO3)	mg/L	<5.0	5.0	8422991
Alkalinity (Total as CaCO3)	mg/L	380	5.0	8422991
Bicarbonate (HCO3)	mg/L	470	5.0	8422991
Carbonate (CO3)	mg/L	<5.0	5.0	8422991
Hydroxide (OH)	mg/L	<5.0	5.0	8422991
Dissolved Sulphate (SO4)	mg/L	1800 (1)	20	8427480
Dissolved Chloride (Cl)	mg/L	7.1	1.0	8427477
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8423539
Dissolved Nitrate (N)	mg/L	0.027	0.010	8423539
Lab Filtered Elements				
Dissolved Aluminum (Al)	mg/L	0.0042	0.0030	8423671
Dissolved Antimony (Sb)	mg/L	0.00079	0.00060	8423671
Dissolved Arsenic (As)	mg/L	0.0012	0.00020	8423671
Dissolved Barium (Ba)	mg/L	0.022	0.010	8426641
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8423671
Dissolved Boron (B)	mg/L	0.12	0.020	8426641
Dissolved Cadmium (Cd)	mg/L	0.00010	0.000020	8423671
Dissolved Calcium (Ca)	mg/L	320	0.30	8426641
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8423671

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PR5503		
Sampling Date		2016/10/04 15:04		
COC Number		M031942		
	UNITS	**MW16-10-15**	**RDL**	**QC Batch**
Dissolved Cobalt (Co)	mg/L	0.0043	0.00030	8423671
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8423671
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8426641
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8423671
Dissolved Lithium (Li)	mg/L	0.055	0.020	8426641
Dissolved Magnesium (Mg)	mg/L	140	0.20	8426641
Dissolved Manganese (Mn)	mg/L	1.0	0.0040	8426641
Dissolved Molybdenum (Mo)	mg/L	0.0034	0.00020	8423671
Dissolved Nickel (Ni)	mg/L	0.013	0.00050	8423671
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8426641
Dissolved Potassium (K)	mg/L	11	0.30	8426641
Dissolved Selenium (Se)	mg/L	0.00038	0.00020	8423671
Dissolved Silicon (Si)	mg/L	4.5	0.10	8426641
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8423671
Dissolved Sodium (Na)	mg/L	330	0.50	8426641
Dissolved Strontium (Sr)	mg/L	3.4	0.020	8426641
Dissolved Sulphur (S)	mg/L	650 (1)	2.0	8426641
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8423671
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8423671
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8423671
Dissolved Uranium (U)	mg/L	0.012	0.00010	8423671
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8423671
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8423671

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5499	PR5499			PR5500	PR5500		
Sampling Date		2016/10/04 10:50	2016/10/04 10:50			2016/10/04 10:10	2016/10/04 10:10		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	MW16-18-6	MW16-18-6 Lab-Dup	RDL	QC Batch	MW16-18-10	MW16-18-10 Lab-Dup	RDL	QC Batch
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.9	N/A	0.50	8424431	2.6	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	4400 (2)	4400	10	8422824	17000 (2)	18000	100	8422824
Total Coliforms DST	mpn/100mL	140 (1)	N/A	10	8422823	310 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8423168	<0.050	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8428234	18 (3)	N/A	1.3	8428215
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	0.0038	N/A	0.0030	8422351	<0.0030	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5501	PR5501			PR5502	PR5502		
Sampling Date		2016/10/04 12:14	2016/10/04 12:14			2016/10/04 13:16	2016/10/04 13:16		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	**MW16-4-20**	**MW16-4-20 Lab-Dup**	**RDL**	**QC Batch**	**MW16-5-11**	**MW16-5-11 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	5.1	N/A	0.50	8424431	2.8	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<2.0 (1)	N/A	2.0	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	<2.0 (1)	N/A	2.0	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	550 (2)	560	2.0	8422824	44000 (2)	44000	100	8422824
Total Coliforms DST	mpn/100mL	<2.0 (1)	N/A	2.0	8422823	<100 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	0.96	N/A	0.050	8423168	0.062	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.1	N/A	0.050	8425847	7.5 (2)	N/A	0.25	8428216
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	<0.0030 (3)	<0.0030	0.0030	8422351	0.0034	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Matrix Spike exceeds acceptance limits due to matrix interference. Reanalysis yields similar results.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5503	PR5503			PR5504	PR5504		
Sampling Date		2016/10/04 15:04	2016/10/04 15:04			2016/10/04 16:12	2016/10/04 16:12		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	**MW16-10-15**	**MW16-10-15 Lab-Dup**	**RDL**	**QC Batch**	**MW16-8-8**	**MW16-8-8 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	N/A	N/A	0.50	8424431	2.8	N/A	0.50	8424431
Lab Filtered Inorganics									
Dissolved Organic Carbon (C)	mg/L	4.2	4.1	0.50	8426109	N/A	N/A	0.50	8426109
Microbiological Param.									
E.Coli DST	mpn/100mL	<100 (1)	N/A	100	8422823	<100 (1)	N/A	100	8422823
Fecal Coliforms	MPN/100mL	100 (1)	N/A	100	8422822	<100 (1)	N/A	100	8422822
Heterotrophic Plate Count	CFU/mL	>6000 (2)	>6000	100	8422824	34000 (2)	34000	100	8422824
Total Coliforms DST	mpn/100mL	9100 (1)	N/A	100	8422823	<100 (1)	N/A	100	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	N/A	N/A	0.050	8423168	0.055	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	5.4 (3)	N/A	0.25	8428234	0.95	N/A	0.050	8428215
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	N/A	N/A	0.0030	N/A	0.0045	N/A	0.0030	8422351
Lab Filtered Nutrients									
Dissolved Ammonia (N)	mg/L	0.59	0.69	0.050	8428116	N/A	N/A	N/A	N/A
Dissolved Phosphorus (P)	mg/L	0.0035	N/A	0.0030	8423804	N/A	N/A	N/A	N/A

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(3) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PR5505	PR5505			PR5506	PR5506		
Sampling Date		2016/10/04 16:06	2016/10/04 16:06			2016/10/04 12:15	2016/10/04 12:15		
COC Number		M031942	M031942			M031942	M031942		
	UNITS	**MW16-8-19**	**MW16-8-19 Lab-Dup**	**RDL**	**QC Batch**	**MW16-4-16**	**MW16-4-16 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Organic Carbon (C)	mg/L	1.3	N/A	0.50	8424431	5.2	N/A	0.50	8424431
Microbiological Param.									
E.Coli DST	mpn/100mL	<1.0	<1.0	1.0	8422823	<2.0 (1)	N/A	2.0	8422823
Fecal Coliforms	MPN/100mL	<1.0	<1.0	1.0	8422822	<2.0 (1)	N/A	2.0	8422822
Heterotrophic Plate Count	CFU/mL	620	610	1.0	8422824	630 (2)	670	2.0	8422824
Total Coliforms DST	mpn/100mL	27	30	1.0	8422823	<2.0 (1)	N/A	2.0	8422823
Nutrients									
Dissolved Ammonia (N)	mg/L	<0.050	N/A	0.050	8423168	1.0	N/A	0.050	8423168
Total Kjeldahl Nitrogen	mg/L	1.3	N/A	0.050	8428216	1.1	N/A	0.050	8425847
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	8424717	<0.0030	N/A	0.0030	8424717
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	8422351	<0.0030	N/A	0.0030	8422351

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PR5499	PR5500		PR5501		PR5502	PR5503		
Sampling Date		2016/10/04 10:50	2016/10/04 10:10		2016/10/04 12:14		2016/10/04 13:16	2016/10/04 15:04		
COC Number		M031942	M031942		M031942		M031942	M031942		
	UNITS	**MW16-18-6**	**MW16-18-10**	**RDL**	**MW16-4-20**	**RDL**	**MW16-5-11**	**MW16-10-15**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	0.0020	<0.0020	0.0020	<0.0020	N/A	0.0020	8430325
Total Mercury (Hg)	ug/L	<6.0 (1)	<6.0 (1)	6.0	<2.0 (1)	2.0	<20 (1)	<20 (1)	20	8428935
Lab Filtered Elements-Low										
Dissolved Mercury (Hg)	ug/L	N/A	N/A	N/A	N/A	N/A	N/A	<0.0020	0.0020	8431903

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PR5504			PR5505	PR5505		PR5506		
Sampling Date		2016/10/04 16:12			2016/10/04 16:06	2016/10/04 16:06		2016/10/04 12:15		
COC Number		M031942			M031942	M031942		M031942		
	UNITS	**MW16-8-8**	**RDL**	**QC Batch**	**MW16-8-19**	**MW16-8-19 Lab-Dup**	**RDL**	**MW16-4-16**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8430325	<0.0020	<0.0020	0.0020	<0.0020	0.0020	8430330
Total Mercury (Hg)	ug/L	<20 (1)	20	8428935	<0.10 (1)	N/A	0.10	<6.0 (1)	6.0	8428935

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C

ROUTINE WATER & DISS. REGULATED METALS (WATER) Comments

Sample PR5503-01 Alkalinity @25C (pp, total), CO3,HCO3,OH: Detection limits raised due to sample matrix.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8422351	MB5	Matrix Spike [PR5501-03]	Dissolved Phosphorus (P)	2016/10/06		22 (1)	%	80 - 120
8422351	MB5	QC Standard	Dissolved Phosphorus (P)	2016/10/06		107	%	80 - 120
8422351	MB5	Spiked Blank	Dissolved Phosphorus (P)	2016/10/06		105	%	80 - 120
8422351	MB5	Method Blank	Dissolved Phosphorus (P)	2016/10/06	<0.0030		mg/L	
8422351	MB5	RPD [PR5501-03]	Dissolved Phosphorus (P)	2016/10/06	NC		%	20
8422814	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		108	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		94	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		95	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		99	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		98	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		96	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		98	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		99	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		96	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		96	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		93	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		104	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		94	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		103	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		95	%	80 - 120
8422814	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		102	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		96	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		98	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		95	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		96	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		93	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		97	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		96	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		93	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		94	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		93	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		100	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		97	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		92	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		96	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		97	%	80 - 120
8422814	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/06	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/06	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/06	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/06	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/06	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/06	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/06	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/06	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/06	<0.00020		mg/L	

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Molybdenum (Mo)	2016/10/06	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/06	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/06	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/06	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/06	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/06	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/06	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/06	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/06	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/06	<0.0030		mg/L	
8422814	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	NC		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	NC		%	20
			Dissolved Copper (Cu)	2016/10/06	NC		%	20
			Dissolved Lead (Pb)	2016/10/06	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	NC		%	20
			Dissolved Nickel (Ni)	2016/10/06	NC		%	20
			Dissolved Selenium (Se)	2016/10/06	NC		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	0.56		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	NC		%	20
8422822	RP0	Method Blank	Fecal Coliforms	2016/10/06	<1.0		MPN/10	
8422822	RP0	RPD [PR5505-09]	Fecal Coliforms	2016/10/06	NC		%	N/A
8422823	AP1	Method Blank	E.Coli DST	2016/10/06	<1.0		mpn/100	
			Total Coliforms DST	2016/10/06	<1.0		mpn/100	
8422823	AP1	RPD [PR5505-09]	E.Coli DST	2016/10/06	NC		%	N/A
			Total Coliforms DST	2016/10/06	11		%	N/A
8422824	AP1	Method Blank	Heterotrophic Plate Count	2016/10/07	<1.0		CFU/mL	
8422824	AP1	RPD [PR5499-09]	Heterotrophic Plate Count	2016/10/07	0.90		%	N/A
8422824	AP1	RPD [PR5500-09]	Heterotrophic Plate Count	2016/10/07	8.7		%	N/A
8422824	AP1	RPD [PR5501-09]	Heterotrophic Plate Count	2016/10/07	1.8		%	N/A
8422824	AP1	RPD [PR5502-09]	Heterotrophic Plate Count	2016/10/07	1.6		%	N/A
8422824	AP1	RPD [PR5503-09]	Heterotrophic Plate Count	2016/10/07	NC		%	N/A
8422824	AP1	RPD [PR5504-09]	Heterotrophic Plate Count	2016/10/07	1.2		%	N/A
8422824	AP1	RPD [PR5505-09]	Heterotrophic Plate Count	2016/10/07	1.6		%	N/A
8422824	AP1	RPD [PR5506-09]	Heterotrophic Plate Count	2016/10/07	7.4		%	N/A
8422901	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/08		102	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	50 - 130
8422901	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/08		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08		100	%	70 - 130
8422901	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/08		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/08	<0.10		mg/L	
8422901	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/08	NC		%	40
8422991	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/05		98	%	80 - 120
8422991	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/05	<0.50		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Alkalinity (Total as CaCO3)	2016/10/05	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/05	<0.50		mg/L	
			Carbonate (CO3)	2016/10/05	<0.50		mg/L	
			Hydroxide (OH)	2016/10/05	<0.50		mg/L	
8422991	IK0	RPD [PR5506-01]	Alkalinity (PP as CaCO3)	2016/10/05	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/05	0.13		%	20
			Bicarbonate (HCO3)	2016/10/05	0.13		%	20
			Carbonate (CO3)	2016/10/05	NC		%	20
			Hydroxide (OH)	2016/10/05	NC		%	20
8422993	IK0	Spiked Blank	pH	2016/10/05		101	%	97 - 103
8422993	IK0	RPD [PR5506-01]	pH	2016/10/05	0.17		%	N/A
8422994	IK0	Spiked Blank	Conductivity	2016/10/05		99	%	90 - 110
8422994	IK0	Method Blank	Conductivity	2016/10/05	<1.0		uS/cm	
8422994	IK0	RPD [PR5506-01]	Conductivity	2016/10/05	0.25		%	20
8423168	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/10/05		93	%	80 - 120
8423168	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/10/05		94	%	80 - 120
8423168	MB5	Method Blank	Dissolved Ammonia (N)	2016/10/05	<0.050		mg/L	
8423168	MB5	RPD	Dissolved Ammonia (N)	2016/10/05	NC		%	20
8423525	CT6	Matrix Spike	Dissolved Nitrite (N)	2016/10/06		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		103	%	80 - 120
8423525	CT6	Spiked Blank	Dissolved Nitrite (N)	2016/10/06		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		101	%	80 - 120
8423525	CT6	Method Blank	Dissolved Nitrite (N)	2016/10/06	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/06	<0.010		mg/L	
8423525	CT6	RPD	Dissolved Nitrite (N)	2016/10/06	NC		%	20
			Dissolved Nitrate (N)	2016/10/06	NC		%	20
8423539	CT6	Matrix Spike	Dissolved Nitrite (N)	2016/10/06		NC	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		105	%	80 - 120
8423539	CT6	Spiked Blank	Dissolved Nitrite (N)	2016/10/06		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/06		101	%	80 - 120
8423539	CT6	Method Blank	Dissolved Nitrite (N)	2016/10/06	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/06	<0.010		mg/L	
8423539	CT6	RPD	Dissolved Nitrite (N)	2016/10/06	2.0		%	20
			Dissolved Nitrate (N)	2016/10/06	2.5		%	20
8423671	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/06		93	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		95	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		96	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		83	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		96	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		93	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		91	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		90	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		103	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		92	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		97	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		90	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		110	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		98	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		90	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		97	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Zinc (Zn)	2016/10/06		NC	%	80 - 120
8423671	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/06		128 (1)	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/06		98	%	80 - 120
			Dissolved Arsenic (As)	2016/10/06		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/06		86	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/06		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/06		100	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/06		100	%	80 - 120
			Dissolved Copper (Cu)	2016/10/06		98	%	80 - 120
			Dissolved Lead (Pb)	2016/10/06		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/06		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/06		99	%	80 - 120
			Dissolved Selenium (Se)	2016/10/06		96	%	80 - 120
			Dissolved Silver (Ag)	2016/10/06		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/06		95	%	80 - 120
			Dissolved Tin (Sn)	2016/10/06		91	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/06		104	%	80 - 120
			Dissolved Uranium (U)	2016/10/06		95	%	80 - 120
			Dissolved Vanadium (V)	2016/10/06		100	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/06		93	%	80 - 120
8423671	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/06	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/06	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/06	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/06	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/06	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/06	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/06	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/06	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/06	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/06	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/06	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/06	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/06	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/06	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/10/06	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/06	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/06	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/06	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/06	<0.0030		mg/L	
8423671	PC5	RPD	Dissolved Aluminum (Al)	2016/10/06	NC		%	20
			Dissolved Antimony (Sb)	2016/10/06	NC		%	20
			Dissolved Arsenic (As)	2016/10/06	4.4		%	20
			Dissolved Beryllium (Be)	2016/10/06	NC		%	20
			Dissolved Chromium (Cr)	2016/10/06	NC		%	20
			Dissolved Cobalt (Co)	2016/10/06	3.4		%	20
			Dissolved Copper (Cu)	2016/10/06	2.6		%	20
			Dissolved Lead (Pb)	2016/10/06	1.7		%	20
			Dissolved Molybdenum (Mo)	2016/10/06	0.33		%	20
			Dissolved Nickel (Ni)	2016/10/06	0.66		%	20
			Dissolved Selenium (Se)	2016/10/06	4.5		%	20
			Dissolved Silver (Ag)	2016/10/06	NC		%	20
			Dissolved Thallium (Tl)	2016/10/06	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/06	NC		%	20
			Dissolved Titanium (Ti)	2016/10/06	NC		%	20
			Dissolved Uranium (U)	2016/10/06	1.6		%	20
			Dissolved Vanadium (V)	2016/10/06	NC		%	20
			Dissolved Zinc (Zn)	2016/10/06	4.1		%	20
8423804	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/09		97	%	80 - 120
8423804	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/09		94	%	80 - 120
8423804	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/09		93	%	80 - 120
8423804	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/09	0.0031, RDL=0.0030		mg/L	
8423804	RM9	RPD	Dissolved Phosphorus (P)	2016/10/09	NC		%	20
8424431	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/06		NC	%	80 - 120
8424431	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/06		103	%	80 - 120
8424431	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/06	<0.50		mg/L	
8424431	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/06	1.7		%	20
8424717	MB5	Matrix Spike	Orthophosphate (P)	2016/10/06		97	%	80 - 120
8424717	MB5	Spiked Blank	Orthophosphate (P)	2016/10/06		100	%	80 - 120
8424717	MB5	Method Blank	Orthophosphate (P)	2016/10/06	<0.0030		mg/L	
8424717	MB5	RPD	Orthophosphate (P)	2016/10/06	NC		%	20
8425847	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/07		84	%	80 - 120
8425847	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/07		85	%	80 - 120
8425847	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/07		89	%	80 - 120
8425847	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/07	0.071, RDL=0.050		mg/L	
8425847	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/07	NC		%	20
8426109	MUK	Matrix Spike [PR5503-01]	Dissolved Organic Carbon (C)	2016/10/07		104	%	80 - 120
8426109	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/07		102	%	80 - 120
8426109	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/07	<0.50		mg/L	
8426109	MUK	RPD [PR5503-01]	Dissolved Organic Carbon (C)	2016/10/07	0.86		%	20
8426610	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		83	%	80 - 120
			Dissolved Boron (B)	2016/10/08		82	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		83	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		88	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		84	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		88	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		97	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		85	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		94	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		80	%	80 - 120
8426610	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/08		85	%	80 - 120
			Dissolved Boron (B)	2016/10/08		82	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		91	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		88	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		89	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		91	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		87	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		89	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		97	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		86	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		96	%	80 - 120

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Strontium (Sr)	2016/10/08		83	%	80 - 120
8426610	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/08	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/08	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/08	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/08	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/08	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/08	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/08	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/08	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/08	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/08	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/08	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/08	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/08	<0.20		mg/L	
8426610	JHC	RPD	Dissolved Barium (Ba)	2016/10/08	2.6		%	20
			Dissolved Boron (B)	2016/10/08	NC		%	20
			Dissolved Calcium (Ca)	2016/10/08	2.9		%	20
			Dissolved Iron (Fe)	2016/10/08	2.9		%	20
			Dissolved Lithium (Li)	2016/10/08	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/08	2.2		%	20
			Dissolved Manganese (Mn)	2016/10/08	3.1		%	20
			Dissolved Phosphorus (P)	2016/10/08	NC		%	20
			Dissolved Potassium (K)	2016/10/08	0.48		%	20
			Dissolved Silicon (Si)	2016/10/08	2.8		%	20
			Dissolved Sodium (Na)	2016/10/08	1.3		%	20
			Dissolved Strontium (Sr)	2016/10/08	2.7		%	20
			Dissolved Sulphur (S)	2016/10/08	2.7		%	20
8426625	MAP	Matrix Spike [PR5502-04]	Dissolved Barium (Ba)	2016/10/08		86	%	80 - 120
			Dissolved Boron (B)	2016/10/08		83	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		85	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		89	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		92	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		93	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		89	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		91	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		84	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		85	%	80 - 120
8426625	MAP	Spiked Blank	Dissolved Barium (Ba)	2016/10/08		89	%	80 - 120
			Dissolved Boron (B)	2016/10/08		85	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		97	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		94	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		95	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		93	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		89	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		90	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		90	%	80 - 120
8426625	MAP	Method Blank	Dissolved Barium (Ba)	2016/10/08	<0.010		mg/L	

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2016/10/08	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/08	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/08	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/08	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/08	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/08	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/08	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/08	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/08	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/08	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/08	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/08	<0.20		mg/L	
8426625	MAP	RPD [PR5502-04]	Dissolved Barium (Ba)	2016/10/08	0.16		%	20
			Dissolved Boron (B)	2016/10/08	NC		%	20
			Dissolved Calcium (Ca)	2016/10/08	0.21		%	20
			Dissolved Iron (Fe)	2016/10/08	NC		%	20
			Dissolved Lithium (Li)	2016/10/08	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/08	0.68		%	20
			Dissolved Manganese (Mn)	2016/10/08	0.20		%	20
			Dissolved Phosphorus (P)	2016/10/08	NC		%	20
			Dissolved Potassium (K)	2016/10/08	0.10		%	20
			Dissolved Silicon (Si)	2016/10/08	0.54		%	20
			Dissolved Sodium (Na)	2016/10/08	0.29		%	20
			Dissolved Strontium (Sr)	2016/10/08	0.20		%	20
			Dissolved Sulphur (S)	2016/10/08	0.74		%	20
8426641	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/08		82	%	80 - 120
			Dissolved Boron (B)	2016/10/08		84	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/08		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/08		88	%	80 - 120
			Dissolved Lithium (Li)	2016/10/08		87	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/08		NC	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/08		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/08		102	%	80 - 120
			Dissolved Potassium (K)	2016/10/08		95	%	80 - 120
			Dissolved Silicon (Si)	2016/10/08		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/08		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/08		NC	%	80 - 120
8426641	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/07		91	%	80 - 120
			Dissolved Boron (B)	2016/10/07		87	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/07		97	%	80 - 120
			Dissolved Iron (Fe)	2016/10/07		94	%	80 - 120
			Dissolved Lithium (Li)	2016/10/07		91	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/07		95	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/07		93	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/07		94	%	80 - 120
			Dissolved Potassium (K)	2016/10/07		101	%	80 - 120
			Dissolved Silicon (Si)	2016/10/07		91	%	80 - 120
			Dissolved Sodium (Na)	2016/10/07		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/07		88	%	80 - 120
8426641	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/07	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/07	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/07	<0.30		mg/L	

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Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Iron (Fe)	2016/10/07	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/07	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/07	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/07	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/07	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/07	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/07	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/07	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/07	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/07	<0.20		mg/L	
8426641	JHC	RPD	Dissolved Calcium (Ca)	2016/10/07	0.18		%	20
			Dissolved Iron (Fe)	2016/10/07	6.5		%	20
			Dissolved Magnesium (Mg)	2016/10/07	0.23		%	20
			Dissolved Manganese (Mn)	2016/10/07	0.34		%	20
			Dissolved Potassium (K)	2016/10/07	1.5		%	20
			Dissolved Sodium (Na)	2016/10/07	3.3		%	20
8427477	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/08		NC	%	80 - 120
8427477	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/08		104	%	80 - 120
8427477	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/08	1.5, RDL=1.0		mg/L	
8427477	ZI	RPD	Dissolved Chloride (Cl)	2016/10/08	1.0		%	20
8427480	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/08		NC	%	80 - 120
8427480	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/08		102	%	80 - 120
8427480	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/08	<1.0		mg/L	
8427480	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/08	2.2		%	20
8427519	ZI	Matrix Spike [PR5499-01]	Dissolved Chloride (Cl)	2016/10/08		NC	%	80 - 120
8427519	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/08		106	%	80 - 120
8427519	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/08	1.8, RDL=1.0		mg/L	
8427519	ZI	RPD [PR5499-01]	Dissolved Chloride (Cl)	2016/10/08	4.9		%	20
8427521	ZI	Matrix Spike [PR5499-01]	Dissolved Sulphate (SO4)	2016/10/08		NC	%	80 - 120
8427521	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/08		101	%	80 - 120
8427521	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/08	<1.0		mg/L	
8427521	ZI	RPD [PR5499-01]	Dissolved Sulphate (SO4)	2016/10/08	0.75		%	20
8428043	RSU	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/12		97	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		94	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		95	%	70 - 130
			Benzene	2016/10/12		94	%	70 - 130
			Toluene	2016/10/12		88	%	70 - 130
			Ethylbenzene	2016/10/12		98	%	70 - 130
			m & p-Xylene	2016/10/12		91	%	70 - 130
			o-Xylene	2016/10/12		94	%	70 - 130
			F1 (C6-C10)	2016/10/12		105	%	70 - 130
8428043	RSU	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/12		98	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		93	%	70 - 130
			Benzene	2016/10/12		95	%	70 - 130
			Toluene	2016/10/12		89	%	70 - 130
			Ethylbenzene	2016/10/12		101	%	70 - 130
			m & p-Xylene	2016/10/12		93	%	70 - 130
			o-Xylene	2016/10/12		95	%	70 - 130
			F1 (C6-C10)	2016/10/12		107	%	70 - 130

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Maxxam Job #: B687243
Report Date: 2016/10/13

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428043	RSU	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/12		106	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/12		101	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/12		98	%	70 - 130
			Benzene	2016/10/12	<0.00040		mg/L	
			Toluene	2016/10/12	<0.00040		mg/L	
			Ethylbenzene	2016/10/12	<0.00040		mg/L	
			m & p-Xylene	2016/10/12	<0.00080		mg/L	
			o-Xylene	2016/10/12	<0.00040		mg/L	
			Xylenes (Total)	2016/10/12	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/12	<0.10		mg/L	
			F1 (C6-C10)	2016/10/12	<0.10		mg/L	
8428043	RSU	RPD	Benzene	2016/10/12	NC		%	40
			Toluene	2016/10/12	NC		%	40
			Ethylbenzene	2016/10/12	NC		%	40
			m & p-Xylene	2016/10/12	NC		%	40
			o-Xylene	2016/10/12	NC		%	40
			Xylenes (Total)	2016/10/12	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/12	NC		%	40
			F1 (C6-C10)	2016/10/12	NC		%	40
8428116	RM9	Matrix Spike [PR5503-01]	Dissolved Ammonia (N)	2016/10/09		NC	%	80 - 120
8428116	RM9	Spiked Blank	Dissolved Ammonia (N)	2016/10/09		101	%	80 - 120
8428116	RM9	Method Blank	Dissolved Ammonia (N)	2016/10/09	<0.050		mg/L	
8428116	RM9	RPD [PR5503-01]	Dissolved Ammonia (N)	2016/10/09	16		%	20
8428215	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/12		NC	%	80 - 120
8428215	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/12		94	%	N/A
8428215	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/12		93	%	80 - 120
8428215	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/12	<0.050		mg/L	
8428215	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/12	9.5		%	20
8428216	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/12		85	%	80 - 120
8428216	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/12		90	%	80 - 120
8428216	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/12		87	%	80 - 120
8428216	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/12	<0.050		mg/L	
8428216	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/12	NC		%	20
8428234	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/11		86	%	80 - 120
8428234	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/11		96	%	80 - 120
8428234	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/11		92	%	80 - 120
8428234	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/11	<0.050		mg/L	
8428234	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/11	NC		%	20
8428935	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/11		114	%	80 - 120
8428935	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/11		108	%	80 - 120
8428935	RK3	Method Blank	Total Mercury (Hg)	2016/10/11	<0.0020		ug/L	
8428935	RK3	RPD	Total Mercury (Hg)	2016/10/11	NC		%	20
8429487	YU	Spiked Blank	pH	2016/10/11		100	%	97 - 103
8429487	YU	RPD [PR5503-01]	pH	2016/10/11	0.39		%	N/A
8429611	FM0	Spiked Blank	Conductivity	2016/10/11		100	%	90 - 110
8429611	FM0	Method Blank	Conductivity	2016/10/11	1.4, RDL=1.0		uS/cm	
8429611	FM0	RPD	Conductivity	2016/10/11	2.1		%	20
8430325	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/12		112	%	80 - 120
8430325	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/12		98	%	80 - 120
8430325	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/12	<0.0020		ug/L	
8430325	RK3	RPD	Dissolved Mercury (Hg)	2016/10/12	NC		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8430330	RK3	Matrix Spike [PR5506-06]	Dissolved Mercury (Hg)	2016/10/12		103	%	80 - 120
8430330	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/12		96	%	80 - 120
8430330	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/12	<0.0020		ug/L	
8430330	RK3	RPD [PR5505-06]	Dissolved Mercury (Hg)	2016/10/12	NC		%	20
8431903	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/13		101	%	80 - 120
8431903	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/13		110	%	80 - 120
8431903	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/13	<0.0020		ug/L	
8431903	RK3	RPD	Dissolved Mercury (Hg)	2016/10/13	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B687243
Report Date: 2016/10/13

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Harry (Peng) Liang, Senior Analyst

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
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Calgary: 4000 19th St. NE, T2E 6P8. Toll Free (800) 386-7247
Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD

M 031942

Page 1 of 1

124

Invoice Information		Report Information (if differs from invoice)		Project Information	
Company:	Stantec Consulting Ltd	Company:		Quotation #:	
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:	
Address:	10160 112St, Edmonton AB, T5K 2L6	Address:		Project #:	110773396
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1
Email:	Dylan.King@stantec.com	Email:		Site #:	
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet

Turnaround Time (TAT) Required

- [x] 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

- [ ] Same Day
- [ ] 2 Days
- [ ] 1 Day
- [ ] 3-4 Days

Date Required:

Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓				
Seal Intact		✓	Temp	8	7	6
Cooling Media	✓					
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						
	YES	NO	Cooler ID			
Seal Present						
Seal Intact			Temp			
Cooling Media						

Depot Reception

Analysis Requested

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1 ☐ VOC ☐	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals Tot ☐ Diss ☒	Mercury Total ☒ Dissolved ☒	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	Dissolved Phosphorus	phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count	HOLD - DO NOT ANALYZE
1	MW16-16-6		2016/10/04	10:50	W	13		V		✓	✓	✓		7°	6°	7°	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	MW16-18-10			10:10										7°	6	6°										
3	MW16-4-20			12:14										7	8	7°										
4	MW16-5-11			13:16										7°	8	8°										
5	MW16-10-15			15:04										0	7°	8°										
6	MW16-4-4			16:12										8	8°	8°										
7	MW16-8-19			16:06										0	7°	7°										
8	MW16-4-16			12:15										8°	7°	6°										
9																										
10																										

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Regulatory Criteria

- [x] AT1/CCME
- [x] Drinking Water
- [ ] Saskatchewan
- [ ] D50 (Drilling Waste)
- [ ] Other:

Special Instructions

please filter and preserve dissolved parameters for MW16-10-15. Not field filtered due to turbidity.

Submitted same day as sampled.

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] Dale Nisbet	2016/10/04	18:06	[signature] NATIBE BLANQUET	2016/10/04	18:07

04-Oct-16 18:07
Wendy Sears
B687243
NB6 INS-0001

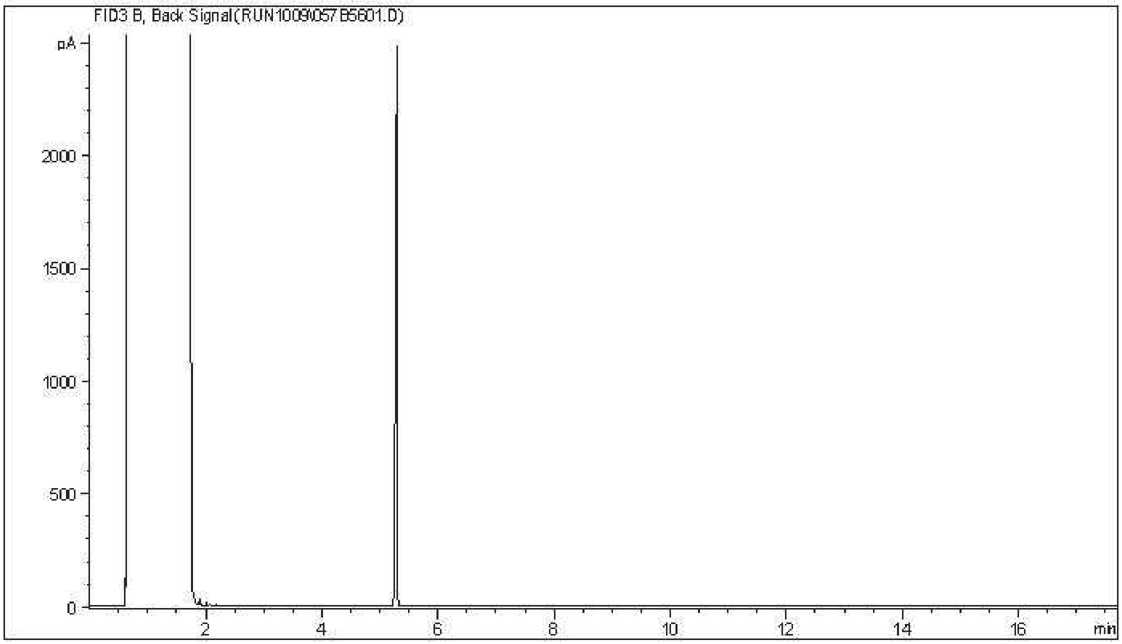
AB FCD-00331/6

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5499

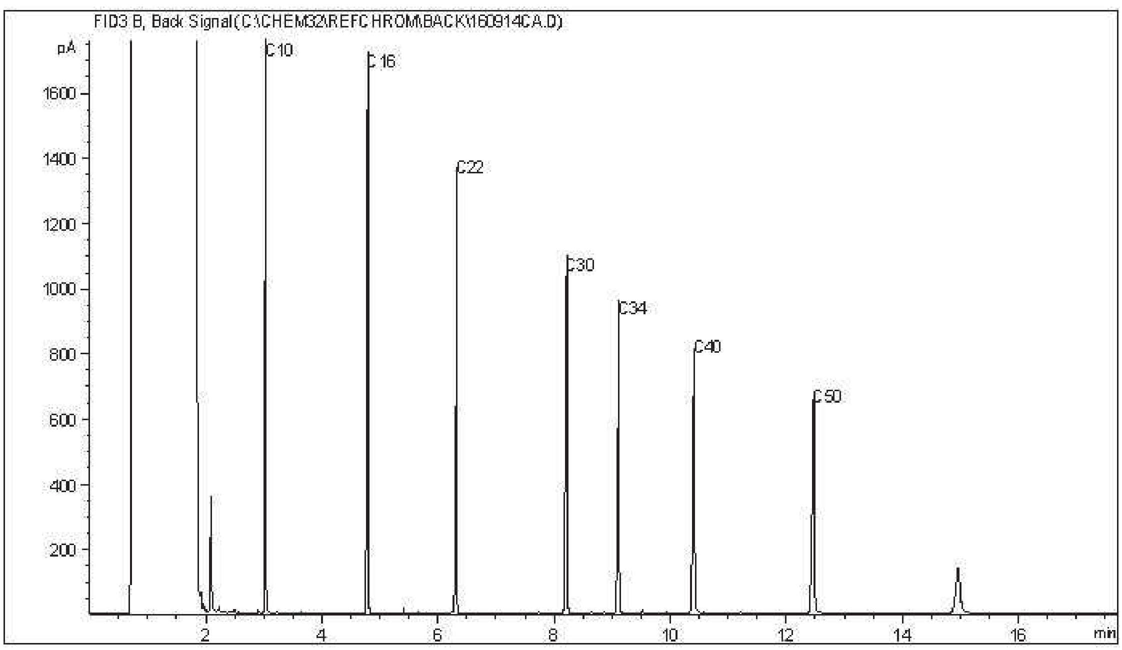
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-18-6

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

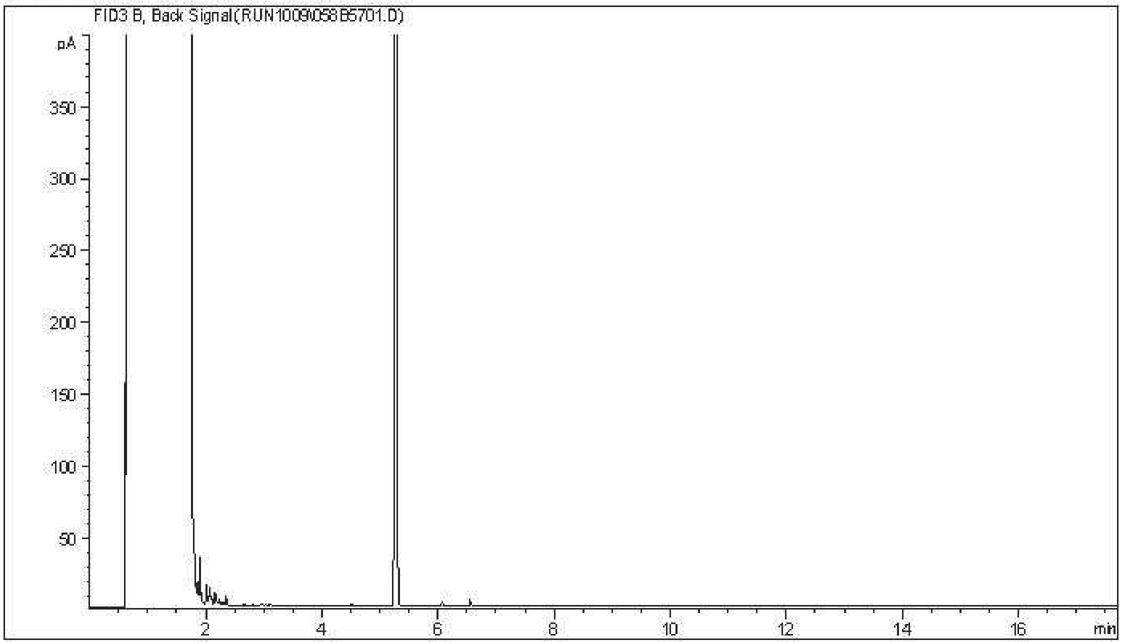
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5500

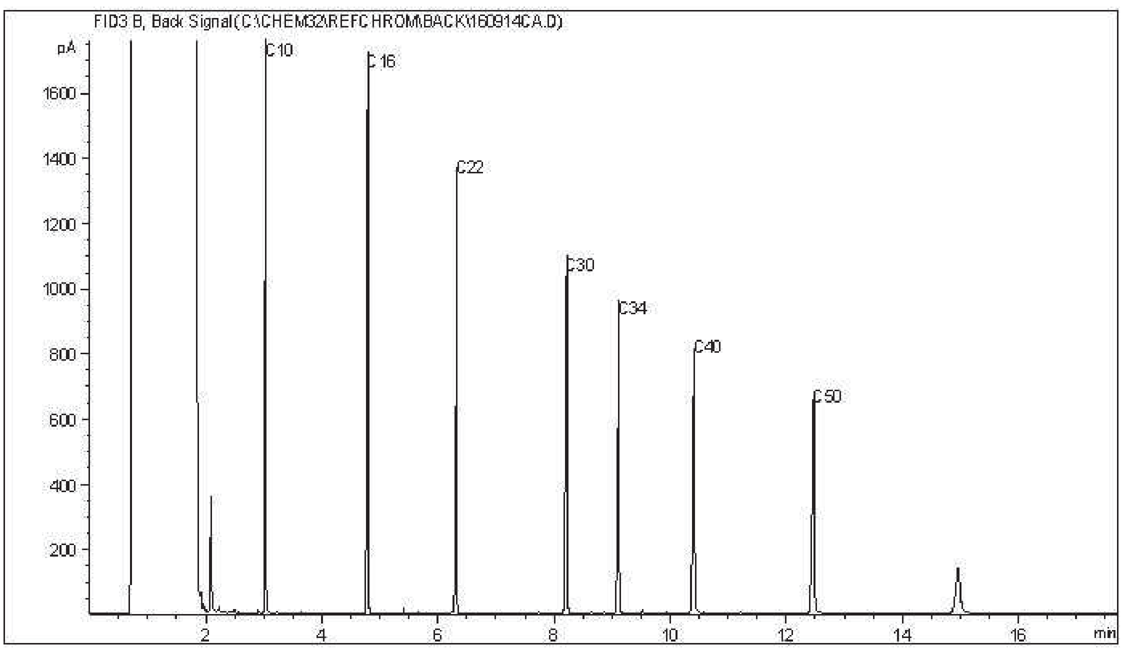
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-18-10

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

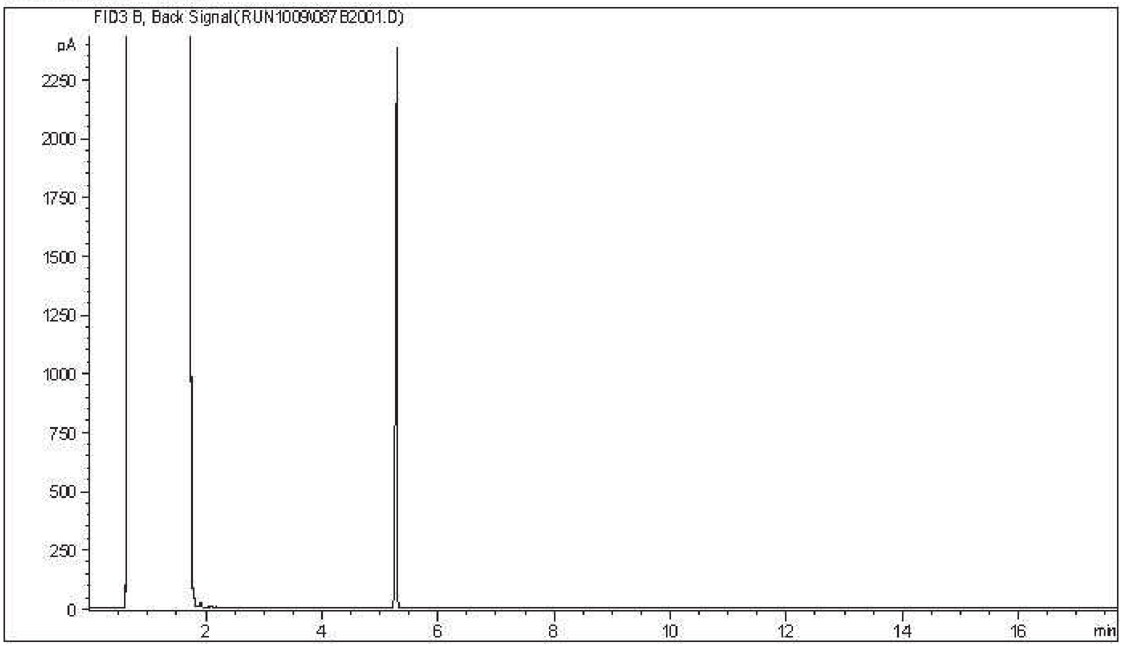
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5501

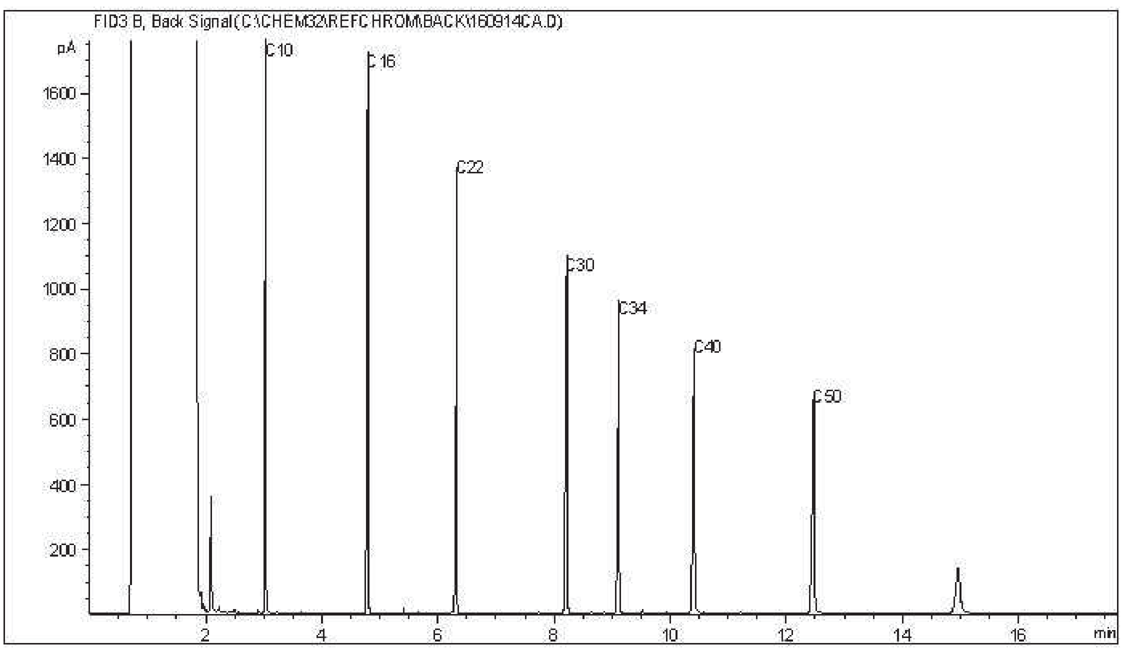
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-4-20

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

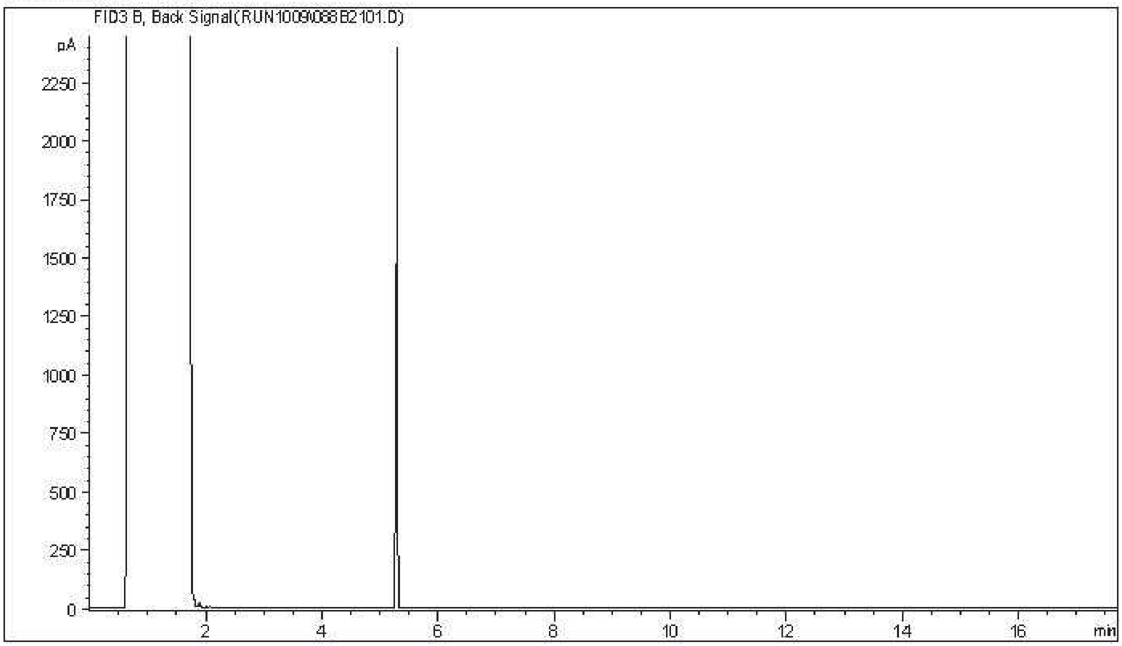
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5502

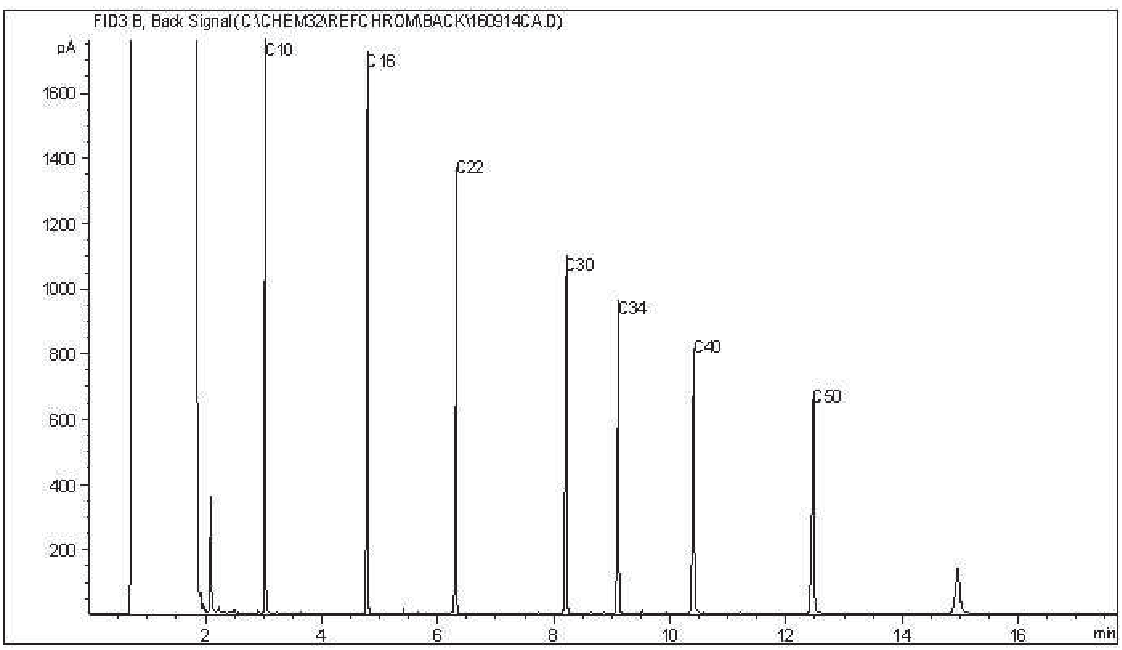
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-5-11

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

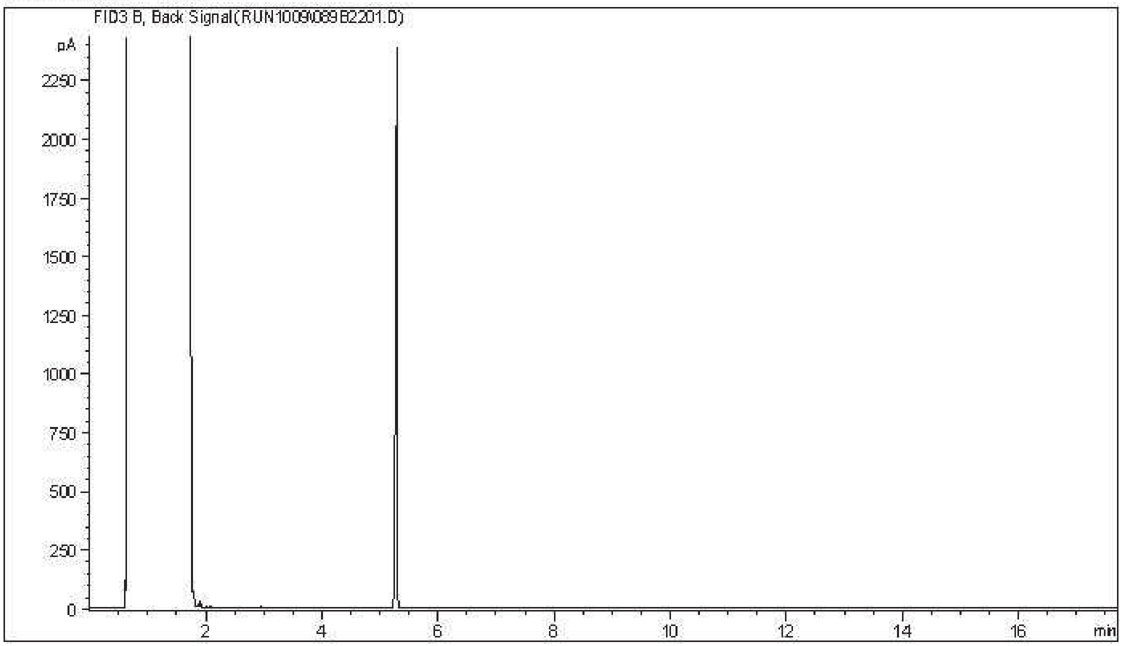
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5503

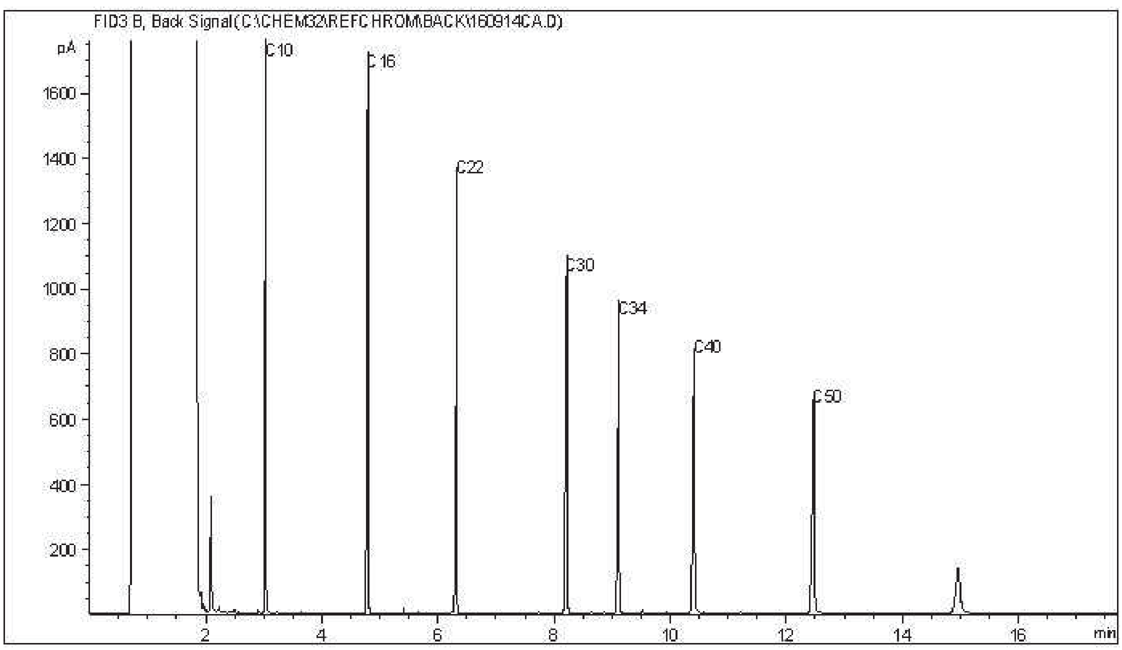
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-10-15

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

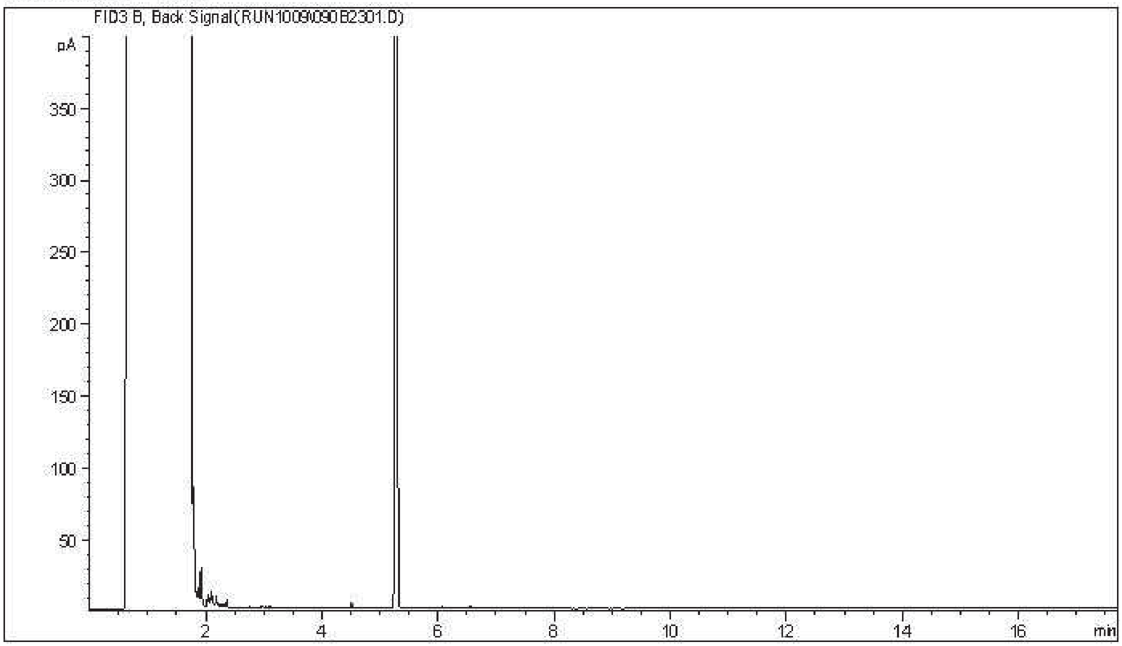
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5504

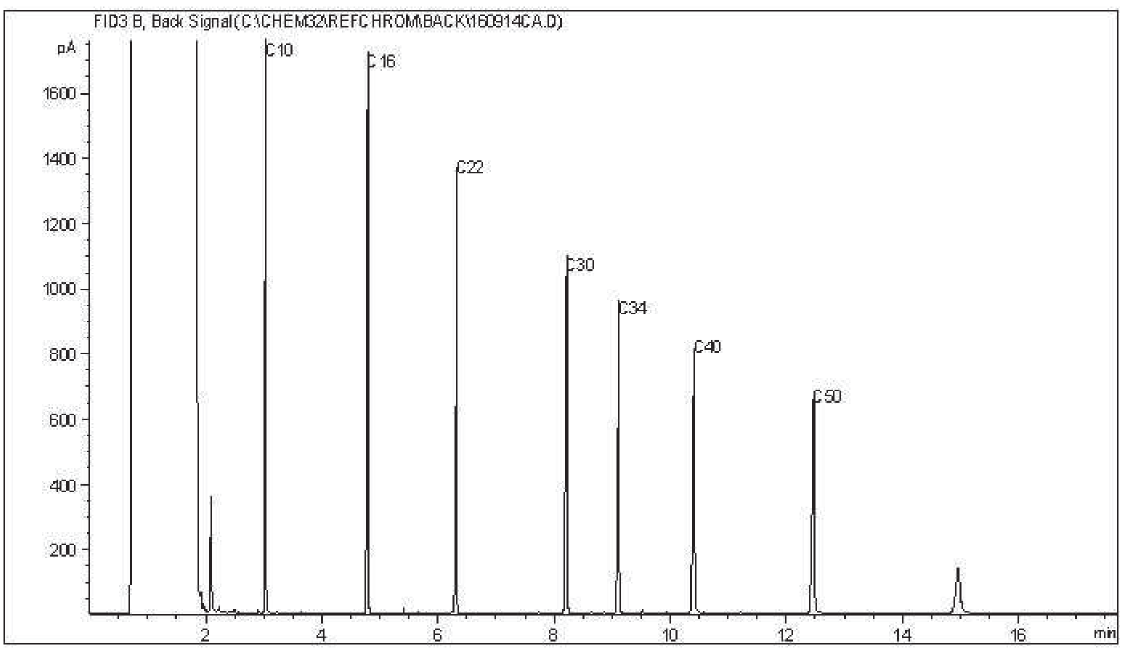
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-8-8

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

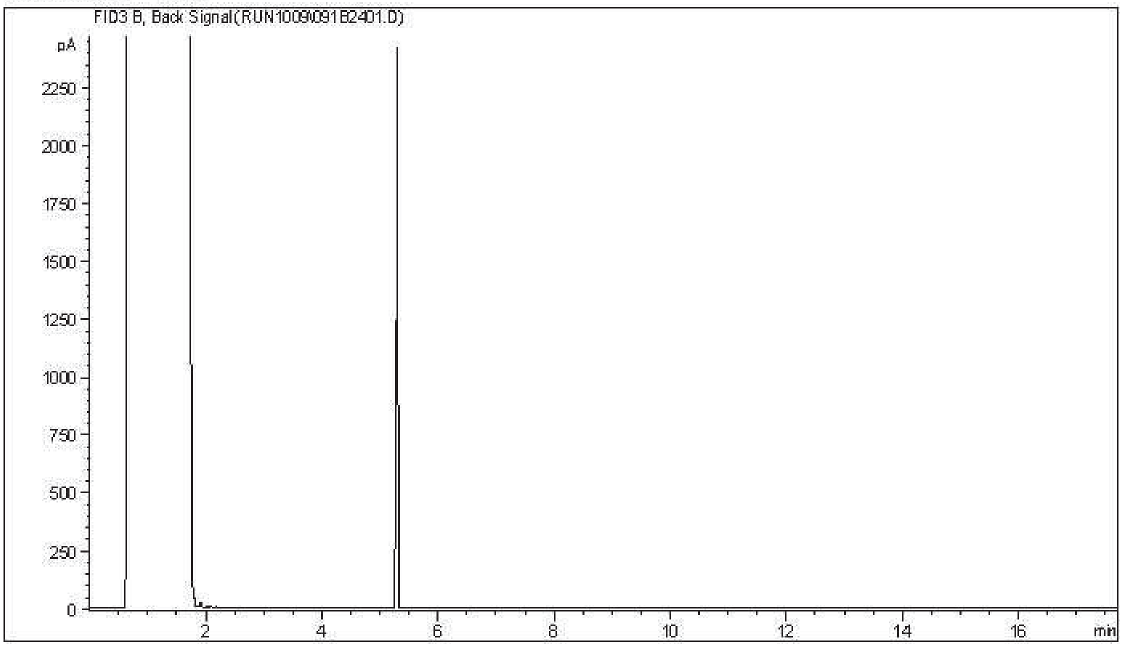
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5505

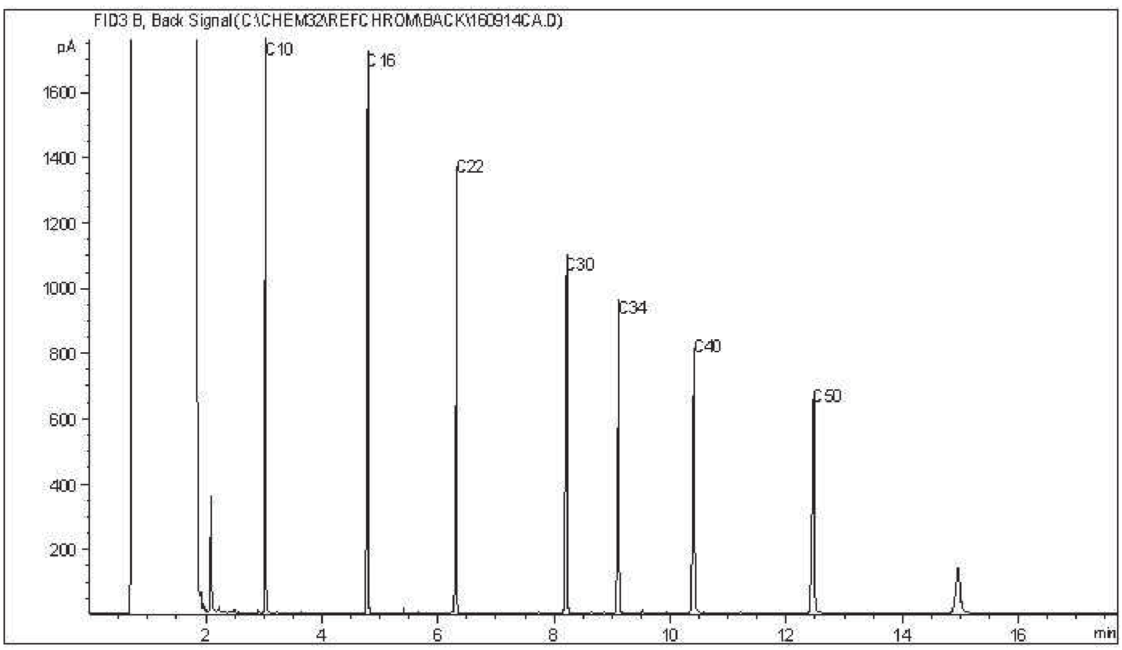
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-8-19

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12			Diesel:	C8 - C22		
Varsol:	C8 - C12			Lubricating Oils:	C20 - C40		
Kerosene:	C7 - C16			Crude Oils:	C3 - C60+		

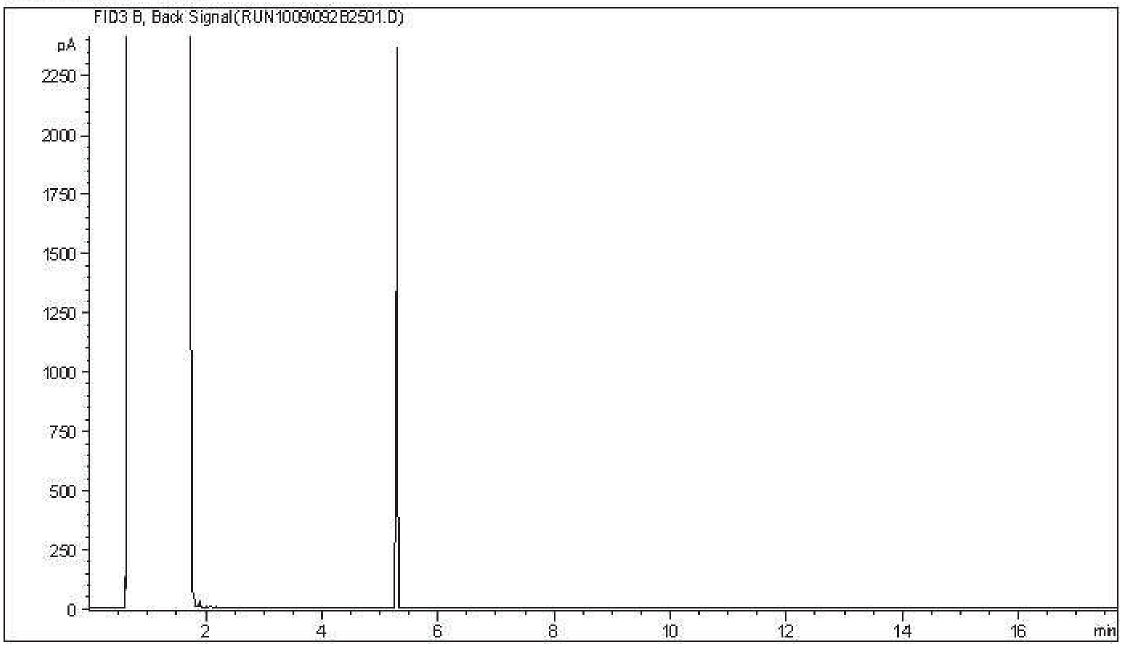
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B687243
Report Date: 2016/10/13
Maxxam Sample: PR5506

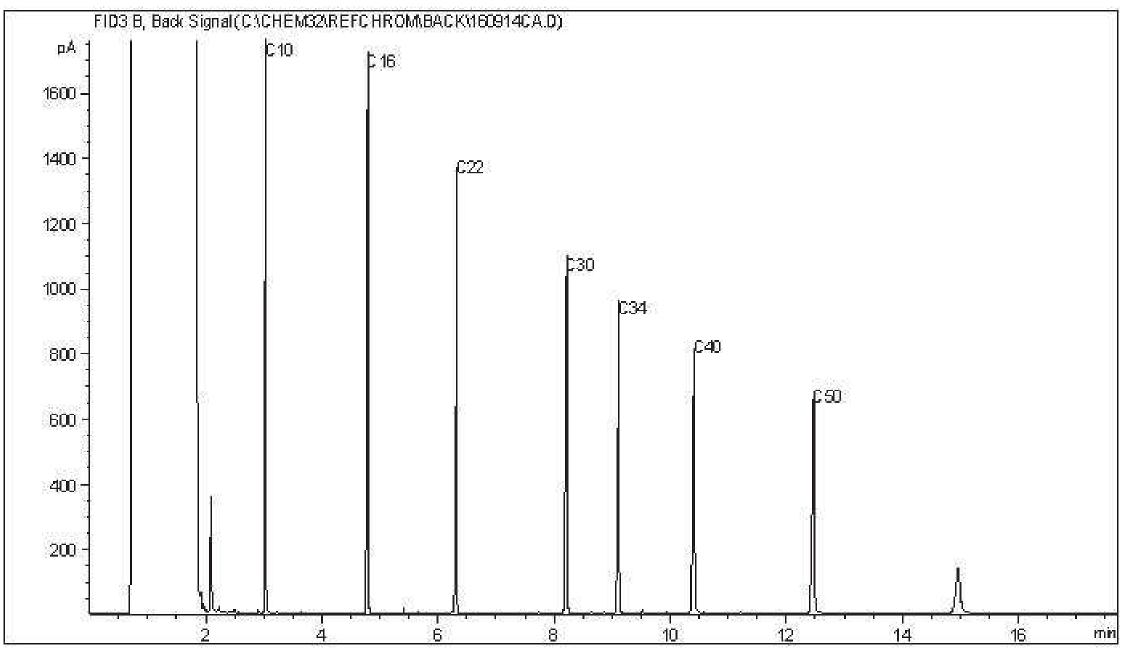
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-4-16

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031946

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/18
Report #: R2284237
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B688395
Received: 2016/10/06, 18:35

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2016/10/11	AB SOP-00005	SM 22 2320 B m
Chloride by Automated Colourimetry	2	N/A	2016/10/14	AB SOP-00020	SM 22-4500-Cl G m
Conductivity @25C	2	N/A	2016/10/11	AB SOP-00005	SM 22 2510 B m
Hardness	2	N/A	2016/10/13	AB WI-00065	Auto Calc
Mercury-Low Level-Dissolved-Lab Filtered	2	2016/10/13	2016/10/13	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	2	2016/10/17	2016/10/18	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP-Dissolved-Lab Filtered	2	N/A	2016/10/12	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS-Dissolved-Lab Filtered	2	N/A	2016/10/11	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Sum of cations, anions	2	N/A	2016/10/13	AB WI-00065	Auto Calc
Nitrate and Nitrite	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	2	N/A	2016/10/12	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	2	N/A	2016/10/11	AB SOP-00023	SM 22 4110 B m
pH @25°C	2	N/A	2016/10/11	AB SOP-00005	SM 22 4500-H+B m
Sulphate by Automated Colourimetry	2	N/A	2016/10/14	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Calculated)	2	N/A	2016/10/14	AB WI-00065	Auto Calc

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PS2812	PS2812			PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 10:10			2016/10/06 16:56		
COC Number		M031946	M031946			M031946		
	UNITS	**MW16-17-5**	**MW16-17-5 Lab-Dup**	**RDL**	**QC Batch**	**MW16-12-3**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	110	N/A	N/A	8425566	33	N/A	8425566
Cation Sum	meq/L	100	N/A	N/A	8425566	31	N/A	8425566
Hardness (CaCO3)	mg/L	3500	N/A	0.50	8425564	1300	0.50	8425564
Ion Balance	N/A	0.93	N/A	0.010	8425565	0.94	0.010	8425565
Dissolved Nitrate (NO3)	mg/L	5.0	N/A	0.044	8425549	1.5	0.044	8425549
Nitrate plus Nitrite (N)	mg/L	1.3	N/A	0.020	8425550	0.34	0.020	8425550
Dissolved Nitrite (NO2)	mg/L	0.55	N/A	0.033	8425549	<0.033	0.033	8425549
Calculated Total Dissolved Solids	mg/L	6900	N/A	10	8425570	1900	10	8425570
Misc. Inorganics								
Conductivity	uS/cm	6900	N/A	1.0	8428919	2600	1.0	8428919
pH	pH	7.81	N/A	N/A	8428920	7.97	N/A	8428920
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Alkalinity (Total as CaCO3)	mg/L	520	N/A	0.50	8428917	410	0.50	8428917
Bicarbonate (HCO3)	mg/L	640	N/A	0.50	8428917	510	0.50	8428917
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	8428917	<0.50	0.50	8428917
Dissolved Sulphate (SO4)	mg/L	4800 (1)	N/A	50	8433413	900 (1)	10	8433413
Dissolved Chloride (Cl)	mg/L	8.7	N/A	1.0	8433409	230 (1)	2.0	8433409
Nutrients								
Dissolved Nitrite (N)	mg/L	0.17	0.17	0.010	8428824	<0.010	0.010	8428827
Dissolved Nitrate (N)	mg/L	1.1	1.1	0.010	8428824	0.34	0.010	8428827
Lab Filtered Elements								
Dissolved Aluminum (Al)	mg/L	0.0039	N/A	0.0030	8428460	0.0070	0.0030	8428460
Dissolved Antimony (Sb)	mg/L	0.00062	N/A	0.00060	8428460	<0.00060	0.00060	8428460
Dissolved Arsenic (As)	mg/L	0.00053	N/A	0.00020	8428460	0.00092	0.00020	8428460
Dissolved Barium (Ba)	mg/L	0.041	N/A	0.010	8431017	0.12	0.010	8431036
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Boron (B)	mg/L	0.12	N/A	0.020	8431017	0.051	0.020	8431036

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PS2812	PS2812			PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 10:10			2016/10/06 16:56		
COC Number		M031946	M031946			M031946		
	UNITS	**MW16-17-5**	**MW16-17-5 Lab-Dup**	**RDL**	**QC Batch**	**MW16-12-3**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	0.00028	N/A	0.000020	8428460	0.000036	0.000020	8428460
Dissolved Calcium (Ca)	mg/L	410	N/A	0.30	8431017	270	0.30	8431036
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Cobalt (Co)	mg/L	0.00083	N/A	0.00030	8428460	<0.00030	0.00030	8428460
Dissolved Copper (Cu)	mg/L	0.0017	N/A	0.00020	8428460	0.0018	0.00020	8428460
Dissolved Iron (Fe)	mg/L	<0.060	N/A	0.060	8431017	<0.060	0.060	8431036
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	0.00020	8428460	<0.00020	0.00020	8428460
Dissolved Lithium (Li)	mg/L	0.15	N/A	0.020	8431017	0.030	0.020	8431036
Dissolved Magnesium (Mg)	mg/L	600 (1)	N/A	2.0	8431017	160	0.20	8431036
Dissolved Manganese (Mn)	mg/L	0.39	N/A	0.0040	8431017	0.025	0.0040	8431036
Dissolved Molybdenum (Mo)	mg/L	0.0015	N/A	0.00020	8428460	0.0021	0.00020	8428460
Dissolved Nickel (Ni)	mg/L	0.0054	N/A	0.00050	8428460	0.0041	0.00050	8428460
Dissolved Phosphorus (P)	mg/L	0.11	N/A	0.10	8431017	<0.10	0.10	8431036
Dissolved Potassium (K)	mg/L	11	N/A	0.30	8431017	6.4	0.30	8431036
Dissolved Selenium (Se)	mg/L	0.034	N/A	0.00020	8428460	0.0016	0.00020	8428460
Dissolved Silicon (Si)	mg/L	5.2	N/A	0.10	8431017	6.1	0.10	8431036
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	0.00010	8428460	<0.00010	0.00010	8428460
Dissolved Sodium (Na)	mg/L	750 (1)	N/A	5.0	8431017	110	0.50	8431036
Dissolved Strontium (Sr)	mg/L	4.7	N/A	0.020	8431017	1.1	0.020	8431036
Dissolved Sulphur (S)	mg/L	1500 (1)	N/A	2.0	8431017	270	0.20	8431036
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	0.00020	8428460	<0.00020	0.00020	8428460
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	0.0010	8428460	<0.0010	0.0010	8428460
Dissolved Uranium (U)	mg/L	0.031	N/A	0.00010	8428460	0.010	0.00010	8428460
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	0.0010	8428460	0.0011	0.0010	8428460
Dissolved Zinc (Zn)	mg/L	0.0062	N/A	0.0030	8428460	<0.0030	0.0030	8428460

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Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PS2812	PS2813		
Sampling Date		2016/10/06 10:10	2016/10/06 16:56		
COC Number		M031946	M031946		
	UNITS	**MW16-17-5**	**MW16-12-3**	**RDL**	**QC Batch**
Low Level Elements					
Total Mercury (Hg)	ug/L	<0.20 (1)	0.30 (1)	0.20	8435873
Lab Filtered Elements-Low					
Dissolved Mercury (Hg)	ug/L	<0.0020	<0.0020	0.0020	8431903

RDL = Reportable Detection Limit

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.7°C

Results relate only to the items tested.

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Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428460	PC5	Matrix Spike	Dissolved Aluminum (Al)	2016/10/11		89	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/11		93	%	80 - 120
			Dissolved Arsenic (As)	2016/10/11		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/11		93	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/11		95	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/11		93	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/11		90	%	80 - 120
			Dissolved Copper (Cu)	2016/10/11		87	%	80 - 120
			Dissolved Lead (Pb)	2016/10/11		90	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/11		102	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/11		88	%	80 - 120
			Dissolved Selenium (Se)	2016/10/11		101	%	80 - 120
			Dissolved Silver (Ag)	2016/10/11		95	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/11		91	%	80 - 120
			Dissolved Tin (Sn)	2016/10/11		101	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/11		96	%	80 - 120
			Dissolved Uranium (U)	2016/10/11		91	%	80 - 120
			Dissolved Vanadium (V)	2016/10/11		95	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/11		90	%	80 - 120
8428460	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/10/11		119	%	80 - 120
			Dissolved Antimony (Sb)	2016/10/11		88	%	80 - 120
			Dissolved Arsenic (As)	2016/10/11		88	%	80 - 120
			Dissolved Beryllium (Be)	2016/10/11		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/10/11		88	%	80 - 120
			Dissolved Chromium (Cr)	2016/10/11		91	%	80 - 120
			Dissolved Cobalt (Co)	2016/10/11		87	%	80 - 120
			Dissolved Copper (Cu)	2016/10/11		89	%	80 - 120
			Dissolved Lead (Pb)	2016/10/11		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/10/11		89	%	80 - 120
			Dissolved Nickel (Ni)	2016/10/11		86	%	80 - 120
			Dissolved Selenium (Se)	2016/10/11		93	%	80 - 120
			Dissolved Silver (Ag)	2016/10/11		89	%	80 - 120
			Dissolved Thallium (Tl)	2016/10/11		90	%	80 - 120
			Dissolved Tin (Sn)	2016/10/11		83	%	80 - 120
			Dissolved Titanium (Ti)	2016/10/11		85	%	80 - 120
			Dissolved Uranium (U)	2016/10/11		88	%	80 - 120
			Dissolved Vanadium (V)	2016/10/11		89	%	80 - 120
			Dissolved Zinc (Zn)	2016/10/11		85	%	80 - 120
8428460	PC5	Method Blank	Dissolved Aluminum (Al)	2016/10/11	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/10/11	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/10/11	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/10/11	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/10/11	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/10/11	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/10/11	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/10/11	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/10/11	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/10/11	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/10/11	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/10/11	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/10/11	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/10/11	<0.00020		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Tin (Sn)	2016/10/11	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/10/11	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/10/11	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/10/11	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/10/11	0.0046, RDL=0.0030		mg/L	
8428460	PC5	RPD	Dissolved Aluminum (Al)	2016/10/11	NC		%	20
			Dissolved Antimony (Sb)	2016/10/11	NC		%	20
			Dissolved Arsenic (As)	2016/10/11	NC		%	20
			Dissolved Beryllium (Be)	2016/10/11	NC		%	20
			Dissolved Chromium (Cr)	2016/10/11	NC		%	20
			Dissolved Cobalt (Co)	2016/10/11	6.4		%	20
			Dissolved Copper (Cu)	2016/10/11	NC		%	20
			Dissolved Lead (Pb)	2016/10/11	NC		%	20
			Dissolved Molybdenum (Mo)	2016/10/11	4.9		%	20
			Dissolved Nickel (Ni)	2016/10/11	1.7		%	20
			Dissolved Selenium (Se)	2016/10/11	NC		%	20
			Dissolved Silver (Ag)	2016/10/11	NC		%	20
			Dissolved Thallium (Tl)	2016/10/11	NC		%	20
			Dissolved Tin (Sn)	2016/10/11	NC		%	20
			Dissolved Titanium (Ti)	2016/10/11	NC		%	20
			Dissolved Uranium (U)	2016/10/11	0.93		%	20
			Dissolved Vanadium (V)	2016/10/11	NC		%	20
			Dissolved Zinc (Zn)	2016/10/11	NC		%	20
8428824	NW4	Matrix Spike [PS2812-01]	Dissolved Nitrite (N)	2016/10/11		102	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428824	NW4	Spiked Blank	Dissolved Nitrite (N)	2016/10/11		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428824	NW4	Method Blank	Dissolved Nitrite (N)	2016/10/11	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/11	<0.010		mg/L	
8428824	NW4	RPD [PS2812-01]	Dissolved Nitrite (N)	2016/10/11	0.48		%	20
			Dissolved Nitrate (N)	2016/10/11	0.053		%	20
8428827	NW4	Matrix Spike	Dissolved Nitrite (N)	2016/10/11		101	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		102	%	80 - 120
8428827	NW4	Spiked Blank	Dissolved Nitrite (N)	2016/10/11		100	%	80 - 120
			Dissolved Nitrate (N)	2016/10/11		101	%	80 - 120
8428827	NW4	Method Blank	Dissolved Nitrite (N)	2016/10/11	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/10/11	<0.010		mg/L	
8428827	NW4	RPD	Dissolved Nitrite (N)	2016/10/11	NC		%	20
			Dissolved Nitrate (N)	2016/10/11	0		%	20
8428917	JLD	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/11		99	%	80 - 120
8428917	JLD	Method Blank	Alkalinity (PP as CaCO3)	2016/10/11	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/11	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/11	<0.50		mg/L	
			Carbonate (CO3)	2016/10/11	<0.50		mg/L	
			Hydroxide (OH)	2016/10/11	<0.50		mg/L	
8428917	JLD	RPD	Alkalinity (PP as CaCO3)	2016/10/11	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/11	0.80		%	20
			Bicarbonate (HCO3)	2016/10/11	0.80		%	20
			Carbonate (CO3)	2016/10/11	NC		%	20
			Hydroxide (OH)	2016/10/11	NC		%	20
8428919	JLD	Spiked Blank	Conductivity	2016/10/11		99	%	90 - 110

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Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8428919	JLD	Method Blank	Conductivity	2016/10/11	<1.0		uS/cm	
8428919	JLD	RPD	Conductivity	2016/10/11	0.15		%	20
8428920	JLD	Spiked Blank	pH	2016/10/11		101	%	97 - 103
8428920	JLD	RPD	pH	2016/10/11	0.43		%	N/A
8431017	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/12		86	%	80 - 120
			Dissolved Boron (B)	2016/10/12		90	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		86	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		99	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		93	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		NC	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		105	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		98	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		88	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		96	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		88	%	80 - 120
8431017	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		92	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		95	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		100	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		99	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		101	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		94	%	80 - 120
8431017	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/12	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/12	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/12	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/12	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/12	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/12	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/12	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/12	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/12	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/12	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/12	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/12	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/12	<0.20		mg/L	
8431017	JHC	RPD	Dissolved Calcium (Ca)	2016/10/12	0.75		%	20
			Dissolved Iron (Fe)	2016/10/12	11		%	20
			Dissolved Magnesium (Mg)	2016/10/12	0.97		%	20
			Dissolved Manganese (Mn)	2016/10/12	0.68		%	20
			Dissolved Potassium (K)	2016/10/12	0.28		%	20
			Dissolved Sodium (Na)	2016/10/12	0.24		%	20
8431036	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		95	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		96	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		100	%	80 - 120

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Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Magnesium (Mg)	2016/10/12		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		96	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		99	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		99	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		91	%	80 - 120
8431036	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/12		93	%	80 - 120
			Dissolved Boron (B)	2016/10/12		93	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/12		94	%	80 - 120
			Dissolved Iron (Fe)	2016/10/12		95	%	80 - 120
			Dissolved Lithium (Li)	2016/10/12		102	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/12		104	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/12		99	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/12		98	%	80 - 120
			Dissolved Potassium (K)	2016/10/12		102	%	80 - 120
			Dissolved Silicon (Si)	2016/10/12		94	%	80 - 120
			Dissolved Sodium (Na)	2016/10/12		100	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/12		94	%	80 - 120
8431036	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/12	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/12	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/12	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/12	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/12	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/12	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/12	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/12	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/12	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/12	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/12	<0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/12	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/12	<0.20		mg/L	
8431036	JHC	RPD	Dissolved Calcium (Ca)	2016/10/12	NC		%	20
			Dissolved Iron (Fe)	2016/10/12	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/12	NC		%	20
			Dissolved Manganese (Mn)	2016/10/12	NC		%	20
			Dissolved Potassium (K)	2016/10/12	NC		%	20
			Dissolved Sodium (Na)	2016/10/12	NC		%	20
8431903	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/13		101	%	80 - 120
8431903	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/13		110	%	80 - 120
8431903	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/13	<0.0020		ug/L	
8431903	RK3	RPD	Dissolved Mercury (Hg)	2016/10/13	NC		%	20
8433409	ZI	Matrix Spike	Dissolved Chloride (Cl)	2016/10/14		NC	%	80 - 120
8433409	ZI	Spiked Blank	Dissolved Chloride (Cl)	2016/10/14		105	%	80 - 120
8433409	ZI	Method Blank	Dissolved Chloride (Cl)	2016/10/14	<1.0		mg/L	
8433409	ZI	RPD	Dissolved Chloride (Cl)	2016/10/14	13		%	20
8433413	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/14		NC	%	80 - 120
8433413	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/14		107	%	80 - 120
8433413	ZI	Method Blank	Dissolved Sulphate (SO4)	2016/10/14	<1.0		mg/L	
8433413	ZI	RPD	Dissolved Sulphate (SO4)	2016/10/14	0.68		%	20
8435873	RK3	Matrix Spike	Total Mercury (Hg)	2016/10/17		82	%	80 - 120
8435873	RK3	Spiked Blank	Total Mercury (Hg)	2016/10/17		81	%	80 - 120

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Maxxam Job #: B688395
Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8435873	RK3	Method Blank	Total Mercury (Hg)	2016/10/17	0.0028, RDL=0.0020		ug/L	
8435873	RK3	RPD	Total Mercury (Hg)	2016/10/18	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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Report Date: 2016/10/18

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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277

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD M031946 Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required
Company:	Stantec Consulting Ltd	Company:		Quotation #:		☑ 5 - 7 Days Regular (Most analyses)
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	10160 112 St, Edmonton AB, T5K-2L6	Address:		Project #:	110773396	Rush TAT (Surcharges will be applied): ☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days
Phone:	(780) 969-2223	Phone:		Site Location:	Springbank SR1	
Email:	Dylan.King@stantec.com	Email:		Site #:		Date Required:
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet	Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present		✓	Temp	12	12	11
Seal Intact		✓				
Cooling Media	✓					

Depot Reception

Analysis Requested: # of containers; BTEX F1 ☐ VOC ☐; BTEX F1-F2; BTEX F1-F4; Routine Water; Regulated Metals Tot ☐ Diss ☒; Mercury Total ☒ Dissolved ☒; Salinity 4; Sieve (75 micron); Texture (% Sand, Silt, Clay); Basic Class II Landfill; HOLD - DO NOT ANALYZE

Regulatory Criteria: ☑ AT1/CCME; ☑ Drinking Water; ☐ Saskatchewan; ☐ D50 (Drilling Waste); ☐ Other:

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	Routine Water	Regulated Metals	Mercury
1	MW16-17-5		2016/10/06	10:10	W	1	✓	✓	✓
2	MW16-12-3		2016/10/06	16:56	W	1	✓	✓	✓
3									
4									
5									
6									
7									
8									
9									
10									

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Special Instructions: Due to low volume only Routine bottle filled. Please prioritize analysis to routine parameters followed by dissolved metals and finally mercury if sufficient volume present

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
D.Nisbet / Dale Nisbet	2016/10/06	18:34	Jason Bil	20161006	1835

06-Oct-16 18:35
Wendy Sears
B688395

AB FCD-00331/6

AV2 INS-0001

Success Through Science®

Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031890

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/19
Report #: R2285204
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B685112
Received: 2016/09/29, 07:13

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	5	N/A	2016/09/30	AB SOP-00005	SM 22 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH	1	N/A	2016/10/01	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	6	N/A	2016/10/04	AB SOP-00039	CCME CWS/EPA 8260c m
Chloride by Automated Colourimetry	4	N/A	2016/10/02	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry	2	N/A	2016/10/03	AB SOP-00020	SM 22-4500-Cl G m
Fecal Coliforms (MPN/100mL)	6	2016/09/29	2016/09/30	CAL SOP-00013	SM 22 9223 A,B m
Total Coliforms and E.Coli	6	2016/09/29	2016/09/30	CAL SOP-00013	SM 22 9223 A,B m
Carbon (DOC) (1)	6	N/A	2016/10/01	CAL SOP-00077	MMCW 119 1996 m
Conductivity @25C	5	N/A	2016/09/30	AB SOP-00005	SM 22 2510 B m
Conductivity @25C	1	N/A	2016/10/01	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	2	2016/09/30	2016/10/01	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	4	2016/09/30	2016/10/02	AB SOP-00040 AB SOP-00037	CCME PHC-CWS m
Hardness	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Mercury - Low Level (Dissolved)	6	2016/10/03	2016/10/03	CAL SOP-00007	EPA 1631 RE 20460 m
Mercury - Low Level (Total)	6	2016/09/30	2016/09/30	CAL SOP-00007	EPA 1631 RE 20460 m
Elements by ICP - Dissolved	6	N/A	2016/10/01	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	6	N/A	2016/09/30	AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	6	N/A	2016/09/30	AB WI-00065	Auto Calc
Sum of cations, anions	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Ammonia-N (Dissolved)	6	N/A	2016/09/30	AB SOP-00007	EPA 350.1 R2.0 m
Nitrate and Nitrite	6	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	6	N/A	2016/10/03	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2016/09/30	AB SOP-00023	SM 22 4110 B m
Nitrogen, (Nitrite, Nitrate) by IC	5	N/A	2016/10/01	AB SOP-00023	SM 22 4110 B m
pH @25°C	5	N/A	2016/09/30	AB SOP-00005	SM 22 4500-H+B m
pH @25°C	1	N/A	2016/10/01	AB SOP-00005	SM 22 4500-H+B m
Orthophosphate by Konelab	6	N/A	2016/09/30	AB SOP-00025	SM 22 4500-P A,F m
Sulphate by Automated Colourimetry	4	N/A	2016/10/02	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry	2	N/A	2016/10/03	AB SOP-00018	SM 22 4500-SO4 E m

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Your Project #: 110773396
Site Location: SPRINGBANK SR1
Your C.O.C. #: M031890

Attention:DYLAN KING

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2016/10/19
Report #: R2285204
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B685112
Received: 2016/09/29, 07:13

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Heterotrophic Plate Count	6	2016/09/29	2016/10/01	CAL SOP-00012	SM 22 9215 A & B m
Total Dissolved Solids (Calculated)	6	N/A	2016/10/04	AB WI-00065	Auto Calc
Total Kjeldahl Nitrogen	1	2016/10/02	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Total Kjeldahl Nitrogen	5	2016/10/03	2016/10/03	AB SOP-00008	EPA 351.1 R1978 m
Phosphorus -P (Total, Dissolved)	6	2016/09/30	2016/10/01	AB SOP-00024	SM 22 4500-P A,B,F m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) DOC present in the sample should be considered as non-purgeable DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
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AT1 BTEX AND F1-F2 IN WATER (WATER)

Maxxam ID		PQ0280	PQ0281	PQ0282	PQ0283	PQ0284	PQ0285		
Sampling Date		2016/09/28 10:16	2016/09/28 10:58	2016/09/28 11:45	2016/09/28 17:10	2016/09/28 17:11	2016/09/28 18:34		
COC Number		M031890	M031890	M031890	M031890	M031890	M031890		
	UNITS	**MW16-27-9**	**MW16-26-18**	**MW16-3-7**	**MW16-24-30**	**MW16-15-16**	**MW16-22-26**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8416283
Volatiles									
Benzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Toluene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Ethylbenzene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
m & p-Xylene	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8420469
o-Xylene	mg/L	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00040	8420469
Xylenes (Total)	mg/L	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	<0.00080	0.00080	8420469
F1 (C6-C10) - BTEX	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8420469
F1 (C6-C10)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	8420469
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	108	109	108	109	108	108	N/A	8420469
4-Bromofluorobenzene (sur.)	%	106	106	106	107	107	106	N/A	8420469
D4-1,2-Dichloroethane (sur.)	%	119	121	119	122	120	121	N/A	8420469
O-TERPHENYL (sur.)	%	133 (1)	92	82	82	82	85	N/A	8416283

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Surrogate recovery exceeds acceptance criteria (high recovery). As results are non-detect, there is no impact on data quality.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0280	PQ0280		PQ0281		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58		
COC Number		M031890	M031890		M031890		
	UNITS	**MW16-27-9**	**MW16-27-9 Lab-Dup**	**QC Batch**	**MW16-26-18**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	25	N/A	8415152	14	N/A	8415152
Cation Sum	meq/L	22	N/A	8415152	14	N/A	8415152
Hardness (CaCO3)	mg/L	800	N/A	8415148	140	0.50	8415148
Ion Balance	N/A	0.90	N/A	8415150	1.0	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	<0.044	N/A	8415154	<0.044	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	<0.020	N/A	8415156	<0.020	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	<0.033	N/A	8415154	<0.033	0.033	8415154
Calculated Total Dissolved Solids	mg/L	1400	N/A	8415158	870	10	8415158
Misc. Inorganics							
Conductivity	uS/cm	2000	N/A	8416121	1300	1.0	8416121
pH	pH	7.77	N/A	8416120	8.29	N/A	8416120
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	530	N/A	8416112	260	0.50	8416112
Bicarbonate (HCO3)	mg/L	650	N/A	8416112	310	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	N/A	8416112	<0.50	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	690 (1)	N/A	8419223	400 (1)	5.0	8419230
Dissolved Chloride (Cl)	mg/L	2.1	N/A	8419222	2.0	1.0	8419229
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	8416726	<0.010	0.010	8416726
Dissolved Nitrate (N)	mg/L	<0.010	<0.010	8416726	<0.010	0.010	8416726
Elements							
Dissolved Aluminum (Al)	mg/L	<0.0030	N/A	8417228	0.0037	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	N/A	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00036	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Barium (Ba)	mg/L	<0.010	N/A	8417829	<0.010	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.13	N/A	8417829	0.13	0.020	8417829

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0280	PQ0280		PQ0281		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58		
COC Number		M031890	M031890		M031890		
	UNITS	**MW16-27-9**	**MW16-27-9 Lab-Dup**	**QC Batch**	**MW16-26-18**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	0.000026	N/A	8417228	<0.000020	0.000020	8417228
Dissolved Calcium (Ca)	mg/L	200	N/A	8417829	40	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.0014	N/A	8417228	<0.00030	0.00030	8417228
Dissolved Copper (Cu)	mg/L	<0.00020	N/A	8417228	0.00021	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.42	N/A	8417829	0.15	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.041	N/A	8417829	0.035	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	75	N/A	8417829	11	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.41	N/A	8417829	0.083	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.00058	N/A	8417228	0.0048	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.00062	N/A	8417228	<0.00050	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	N/A	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	4.9	N/A	8417829	2.8	0.30	8417829
Dissolved Selenium (Se)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	5.7	N/A	8417829	4.5	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	N/A	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	140	N/A	8417829	250	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.6	N/A	8417829	0.61	0.020	8417829
Dissolved Sulphur (S)	mg/L	180	N/A	8417829	130	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	N/A	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.0049	N/A	8417228	0.00013	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	N/A	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	N/A	8417228	<0.0030	0.0030	8417228

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0282			PQ0283	PQ0283		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		
COC Number		M031890			M031890	M031890		
	UNITS	**MW16-3-7**	**RDL**	**QC Batch**	**MW16-24-30**	**MW16-24-30 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	32	N/A	8415152	13	N/A	N/A	8415152
Cation Sum	meq/L	33	N/A	8415152	14	N/A	N/A	8415152
Hardness (CaCO3)	mg/L	950	0.50	8415148	160	N/A	0.50	8415148
Ion Balance	N/A	1.0	0.010	8415150	1.1	N/A	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	1.3	0.044	8415154	<0.044	N/A	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	0.30	0.020	8415156	<0.020	N/A	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	0.051	0.033	8415154	<0.033	N/A	0.033	8415154
Calculated Total Dissolved Solids	mg/L	2000	10	8415158	730	N/A	10	8415158
Misc. Inorganics								
Conductivity	uS/cm	2600	1.0	8416130	1100	N/A	1.0	8416121
pH	pH	8.16	N/A	8416129	8.19	N/A	N/A	8416120
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	450	0.50	8416126	460	N/A	0.50	8416112
Bicarbonate (HCO3)	mg/L	550	0.50	8416126	560	N/A	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	0.50	8416126	<0.50	N/A	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	1100 (1)	10	8419661	160	N/A	1.0	8419223
Dissolved Chloride (Cl)	mg/L	12	1.0	8419658	<1.0	N/A	1.0	8419222
Nutrients								
Dissolved Nitrite (N)	mg/L	0.016	0.010	8416726	<0.010	N/A	0.010	8416726
Dissolved Nitrate (N)	mg/L	0.29	0.010	8416726	<0.010	N/A	0.010	8416726
Elements								
Dissolved Aluminum (Al)	mg/L	0.0064	0.0030	8417228	<0.0030	<0.0030	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8417228	<0.00060	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.00078	0.00020	8417228	0.0023	0.0022	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.035	0.010	8417829	0.019	N/A	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.10	0.020	8417829	0.089	N/A	0.020	8417829

RDL = Reportable Detection Limit
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N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0282			PQ0283	PQ0283		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		
COC Number		M031890			M031890	M031890		
	UNITS	**MW16-3-7**	**RDL**	**QC Batch**	**MW16-24-30**	**MW16-24-30 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Cadmium (Cd)	mg/L	0.000036	0.000020	8417228	<0.000020	<0.000020	0.000020	8417228
Dissolved Calcium (Ca)	mg/L	170	0.30	8417829	38	N/A	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	0.0023	0.00030	8417228	<0.00030	<0.00030	0.00030	8417228
Dissolved Copper (Cu)	mg/L	0.00085	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.17	0.060	8417829	0.14	N/A	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.057	0.020	8417829	0.054	N/A	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	130	0.20	8417829	16	N/A	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.39	0.0040	8417829	0.067	N/A	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0020	0.00020	8417228	0.0014	0.0013	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	0.0065	0.00050	8417228	<0.00050	<0.00050	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417829	<0.10	N/A	0.10	8417829
Dissolved Potassium (K)	mg/L	6.1	0.30	8417829	4.0	N/A	0.30	8417829
Dissolved Selenium (Se)	mg/L	0.00026	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Silicon (Si)	mg/L	5.1	0.10	8417829	3.6	N/A	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8417228	<0.00010	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	320	0.50	8417829	240	N/A	0.50	8417829
Dissolved Strontium (Sr)	mg/L	1.6	0.020	8417829	0.66	N/A	0.020	8417829
Dissolved Sulphur (S)	mg/L	370	0.20	8417829	51	N/A	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8417228	<0.00020	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.014	0.00010	8417228	0.00022	0.00019	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8417228	<0.0010	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8417228	<0.0030	<0.0030	0.0030	8417228

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0284			PQ0285		
Sampling Date		2016/09/28 17:11			2016/09/28 18:34		
COC Number		M031890			M031890		
	UNITS	**MW16-15-16**	**RDL**	**QC Batch**	**MW16-22-26**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	12	N/A	8415152	26	N/A	8415152
Cation Sum	meq/L	14	N/A	8415152	26	N/A	8415152
Hardness (CaCO3)	mg/L	160	0.50	8415148	640	0.50	8415148
Ion Balance	N/A	1.1	0.010	8415150	1.0	0.010	8415150
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8415154	0.054	0.044	8415154
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8415156	<0.020	0.020	8415156
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8415154	<0.033	0.033	8415154
Calculated Total Dissolved Solids	mg/L	720	10	8415158	1700	10	8415158
Misc. Inorganics							
Conductivity	uS/cm	1100	1.0	8416121	2200	1.0	8416121
pH	pH	8.18	N/A	8416120	8.04	N/A	8416120
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Alkalinity (Total as CaCO3)	mg/L	460	0.50	8416112	180	0.50	8416112
Bicarbonate (HCO3)	mg/L	560	0.50	8416112	220	0.50	8416112
Carbonate (CO3)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Hydroxide (OH)	mg/L	<0.50	0.50	8416112	<0.50	0.50	8416112
Dissolved Sulphate (SO4)	mg/L	150	1.0	8419661	1100 (1)	10	8419223
Dissolved Chloride (Cl)	mg/L	2.4	1.0	8419658	4.9	1.0	8419222
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8416726	<0.010	0.010	8416726
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8416726	0.012	0.010	8416726
Elements							
Dissolved Aluminum (Al)	mg/L	<0.0030	0.0030	8417228	0.0036	0.0030	8417228
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	8417228	<0.00060	0.00060	8417228
Dissolved Arsenic (As)	mg/L	0.0022	0.00020	8417228	0.00073	0.00020	8417228
Dissolved Barium (Ba)	mg/L	0.018	0.010	8417829	0.034	0.010	8417829
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Boron (B)	mg/L	0.089	0.020	8417829	0.098	0.020	8417829
Dissolved Cadmium (Cd)	mg/L	<0.000020	0.000020	8417228	<0.000020	0.000020	8417228

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Sampler Initials: DN

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		PQ0284			PQ0285		
Sampling Date		2016/09/28 17:11			2016/09/28 18:34		
COC Number		M031890			M031890		
	UNITS	MW16-15-16	RDL	QC Batch	MW16-22-26	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	38	0.30	8417829	170	0.30	8417829
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	8417228	0.00087	0.00030	8417228
Dissolved Copper (Cu)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Iron (Fe)	mg/L	0.15	0.060	8417829	0.11	0.060	8417829
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Lithium (Li)	mg/L	0.053	0.020	8417829	0.064	0.020	8417829
Dissolved Magnesium (Mg)	mg/L	15	0.20	8417829	54	0.20	8417829
Dissolved Manganese (Mn)	mg/L	0.066	0.0040	8417829	0.51	0.0040	8417829
Dissolved Molybdenum (Mo)	mg/L	0.0015	0.00020	8417228	0.0039	0.00020	8417228
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	8417228	0.0018	0.00050	8417228
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	8417829	<0.10	0.10	8417829
Dissolved Potassium (K)	mg/L	3.9	0.30	8417829	7.1	0.30	8417829
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	8417228	0.00023	0.00020	8417228
Dissolved Silicon (Si)	mg/L	3.6	0.10	8417829	4.8	0.10	8417829
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	8417228	<0.00010	0.00010	8417228
Dissolved Sodium (Na)	mg/L	230	0.50	8417829	310	0.50	8417829
Dissolved Strontium (Sr)	mg/L	0.65	0.020	8417829	2.4	0.020	8417829
Dissolved Sulphur (S)	mg/L	50	0.20	8417829	350	0.20	8417829
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	8417228	<0.00020	0.00020	8417228
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Uranium (U)	mg/L	0.00020	0.00010	8417228	0.0044	0.00010	8417228
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	8417228	<0.0010	0.0010	8417228
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	8417228	<0.0030	0.0030	8417228
RDL = Reportable Detection Limit							

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STANTEC CONSULTING LTD
Client Project #: 110773396
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RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0280	PQ0280		PQ0281	PQ0281		PQ0282		
Sampling Date		2016/09/28 10:16	2016/09/28 10:16		2016/09/28 10:58	2016/09/28 10:58		2016/09/28 11:45		
COC Number		M031890	M031890		M031890	M031890		M031890		
	UNITS	**MW16-27-9**	**MW16-27-9 Lab-Dup**	**RDL**	**MW16-26-18**	**MW16-26-18 Lab-Dup**	**QC Batch**	**MW16-3-7**	**RDL**	**QC Batch**
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	1.8	N/A	0.50	2.1	N/A	8418320	8.0	0.50	8418320
Microbiological Param.										
E.Coli DST	mpn/100mL	<10 (1)	N/A	10	<10 (1)	N/A	8415435	<10 (1)	10	8415435
Fecal Coliforms	MPN/100mL	<10 (1)	N/A	10	<10 (1)	N/A	8415437	<10 (1)	10	8415437
Heterotrophic Plate Count	CFU/mL	980	1100	1.0	>6000	>6000	8415432	>6000	1.0	8415432
Total Coliforms DST	mpn/100mL	850 (1)	N/A	10	580 (1)	N/A	8415435	450 (1)	10	8415435
Nutrients										
Dissolved Ammonia (N)	mg/L	0.38	N/A	0.050	0.64	N/A	8417670	0.20	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	1.1	N/A	0.050	4.5 (1)	N/A	8419317	1.7 (1)	0.25	8419317
Orthophosphate (P)	mg/L	<0.0030	N/A	0.0030	<0.0030	N/A	8417394	0.0099 (2)	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	<0.0030	N/A	0.0030	0.0062	N/A	8416951	0.0067	0.0030	8416975

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Orthophosphate greater than dissolved and total phosphate. Results within acceptable limits of precision.

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Maxxam
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Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0282			PQ0283	PQ0283		PQ0284		
Sampling Date		2016/09/28 11:45			2016/09/28 17:10	2016/09/28 17:10		2016/09/28 17:11		
COC Number		M031890			M031890	M031890		M031890		
	UNITS	MW16-3-7 Lab-Dup	RDL	QC Batch	MW16-24-30	MW16-24-30 Lab-Dup	QC Batch	MW16-15-16	RDL	QC Batch
Misc. Inorganics										
Dissolved Organic Carbon (C)	mg/L	N/A	0.50	8418320	1.2	1.2	8418321	1.4	0.50	8418321
Microbiological Param.										
E.Coli DST	mpn/100mL	N/A	10	8415435	<1.0	N/A	8415435	<1.0	1.0	8415435
Fecal Coliforms	MPN/100mL	N/A	10	8415437	<1.0	N/A	8415437	<1.0	1.0	8415437
Heterotrophic Plate Count	CFU/mL	>6000	1.0	8415432	48	50	8415432	120	1.0	8415432
Total Coliforms DST	mpn/100mL	N/A	10	8415435	2.0	N/A	8415435	1.0	1.0	8415435
Nutrients										
Dissolved Ammonia (N)	mg/L	N/A	0.050	8417670	0.86	N/A	8417670	0.84 (1)	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	N/A	0.25	8419317	0.88	N/A	8419053	0.81	0.050	8419317
Orthophosphate (P)	mg/L	N/A	0.0030	8417394	<0.0030	N/A	8417394	<0.0030	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	0.0030	8416975	<0.0030	N/A	8416951	0.0069	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Ammonia greater than TKN. Results are within acceptable limits of precision.

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		PQ0284		PQ0285	PQ0285		
Sampling Date		2016/09/28 17:11		2016/09/28 18:34	2016/09/28 18:34		
COC Number		M031890		M031890	M031890		
	UNITS	**MW16-15-16 Lab-Dup**	**RDL**	**MW16-22-26**	**MW16-22-26 Lab-Dup**	**RDL**	**QC Batch**
Misc. Inorganics							
Dissolved Organic Carbon (C)	mg/L	N/A	0.50	3.3	N/A	0.50	8418321
Microbiological Param.							
E.Coli DST	mpn/100mL	<1.0	1.0	<10 (1)	N/A	10	8415435
Fecal Coliforms	MPN/100mL	<1.0	1.0	<10 (1)	N/A	10	8415437
Heterotrophic Plate Count	CFU/mL	110	1.0	>6000	>6000	1.0	8415432
Total Coliforms DST	mpn/100mL	1.0	1.0	2000 (1)	N/A	10	8415435
Nutrients							
Dissolved Ammonia (N)	mg/L	N/A	0.050	0.68	N/A	0.050	8417670
Total Kjeldahl Nitrogen	mg/L	N/A	0.050	0.97	N/A	0.050	8419317
Orthophosphate (P)	mg/L	N/A	0.0030	0.0076 (2)	N/A	0.0030	8417394
Dissolved Phosphorus (P)	mg/L	N/A	0.0030	<0.0030	N/A	0.0030	8416951

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(2) Orthophosphate greater than total phosphate. Results within acceptable limits of precision.

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		PQ0280		PQ0281	PQ0282		PQ0283	PQ0284		
Sampling Date		2016/09/28 10:16		2016/09/28 10:58	2016/09/28 11:45		2016/09/28 17:10	2016/09/28 17:11		
COC Number		M031890		M031890	M031890		M031890	M031890		
	UNITS	**MW16-27-9**	**RDL**	**MW16-26-18**	**MW16-3-7**	**RDL**	**MW16-24-30**	**MW16-15-16**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<20 (1)	20	<6.0 (1)	<6.0 (1)	6.0	<0.0020	<0.0020	0.0020	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

Maxxam ID		PQ0285		
Sampling Date		2016/09/28 18:34		
COC Number		M031890		
	UNITS	**MW16-22-26**	**RDL**	**QC Batch**
Low Level Elements				
Dissolved Mercury (Hg)	ug/L	<0.0020	0.0020	8419725
Total Mercury (Hg)	ug/L	<6.0 (1)	6.0	8417247

RDL = Reportable Detection Limit
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.0°C
Package 2	5.7°C

As per client request, the client ID for sample PQ0283 was changed from MW16-15-30 to MW16-24-30. The client request was received 2016/10/19.

Results relate only to the items tested.

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STANTEC CONSULTING LTD
Client Project #: 110773396
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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8415432	GK1	Method Blank	Heterotrophic Plate Count	2016/10/01	<1.0		CFU/mL	
8415432	GK1	RPD [PQ0280-07]	Heterotrophic Plate Count	2016/10/01	12		%	N/A
8415432	GK1	RPD [PQ0281-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD [PQ0282-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD [PQ0283-07]	Heterotrophic Plate Count	2016/10/01	4.1		%	N/A
8415432	GK1	RPD [PQ0284-07]	Heterotrophic Plate Count	2016/10/01	6.8		%	N/A
8415432	GK1	RPD [PQ0285-07]	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415432	GK1	RPD	Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
			Heterotrophic Plate Count	2016/10/01	NC		%	N/A
8415435	GK1	Method Blank	E.Coli DST	2016/09/30	<1.0		mpn/100	
			Total Coliforms DST	2016/09/30	<1.0		mpn/100	
8415435	GK1	RPD [PQ0284-07]	E.Coli DST	2016/09/30	NC		%	N/A
			Total Coliforms DST	2016/09/30	NC		%	N/A
8415437	GK1	Method Blank	Fecal Coliforms	2016/09/30	<1.0		MPN/10	
8415437	GK1	RPD [PQ0284-07]	Fecal Coliforms	2016/09/30	NC		%	N/A
8416112	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/30		94	%	80 - 120
8416112	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/09/30	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/30	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/30	<0.50		mg/L	
			Carbonate (CO3)	2016/09/30	<0.50		mg/L	
			Hydroxide (OH)	2016/09/30	<0.50		mg/L	
8416112	IK0	RPD	Alkalinity (PP as CaCO3)	2016/09/30	NC		%	20
			Alkalinity (Total as CaCO3)	2016/09/30	NC		%	20
			Bicarbonate (HCO3)	2016/09/30	NC		%	20
			Carbonate (CO3)	2016/09/30	NC		%	20
			Hydroxide (OH)	2016/09/30	NC		%	20
8416120	IK0	Spiked Blank	pH	2016/09/30		100	%	97 - 103
8416120	IK0	RPD	pH	2016/09/30	0.55		%	N/A
8416121	IK0	Spiked Blank	Conductivity	2016/09/30		100	%	90 - 110
8416121	IK0	Method Blank	Conductivity	2016/09/30	<1.0		uS/cm	
8416121	IK0	RPD	Conductivity	2016/09/30	NC		%	20
8416126	IK0	Spiked Blank	Alkalinity (Total as CaCO3)	2016/10/01		98	%	80 - 120
8416126	IK0	Method Blank	Alkalinity (PP as CaCO3)	2016/10/01	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/10/01	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/10/01	<0.50		mg/L	
			Carbonate (CO3)	2016/10/01	<0.50		mg/L	
			Hydroxide (OH)	2016/10/01	<0.50		mg/L	
8416126	IK0	RPD	Alkalinity (PP as CaCO3)	2016/10/01	NC		%	20
			Alkalinity (Total as CaCO3)	2016/10/01	5.3		%	20
			Bicarbonate (HCO3)	2016/10/01	5.3		%	20
			Carbonate (CO3)	2016/10/01	NC		%	20
			Hydroxide (OH)	2016/10/01	NC		%	20
8416129	IK0	Spiked Blank	pH	2016/10/01		101	%	97 - 103
8416129	IK0	RPD	pH	2016/10/01	0.18		%	N/A
8416130	IK0	Spiked Blank	Conductivity	2016/10/01		99	%	90 - 110
8416130	IK0	Method Blank	Conductivity	2016/10/01	<1.0		uS/cm	
8416130	IK0	RPD	Conductivity	2016/10/01	0.32		%	20
8416283	VP4	Matrix Spike	O-TERPHENYL (sur.)	2016/10/01		85	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/01		89	%	50 - 130
8416283	VP4	Spiked Blank	O-TERPHENYL (sur.)	2016/10/01		86	%	50 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F2 (C10-C16 Hydrocarbons)	2016/10/01		90	%	70 - 130
8416283	VP4	Method Blank	O-TERPHENYL (sur.)	2016/10/01		87	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/10/01	<0.10		mg/L	
8416283	VP4	RPD	F2 (C10-C16 Hydrocarbons)	2016/10/01	NC		%	40
8416726	JLD	Matrix Spike [PQ0280-01]	Dissolved Nitrite (N)	2016/10/01		108	%	80 - 120
			Dissolved Nitrate (N)	2016/10/01		109	%	80 - 120
8416726	JLD	Spiked Blank	Dissolved Nitrite (N)	2016/09/30		101	%	80 - 120
			Dissolved Nitrate (N)	2016/09/30		101	%	80 - 120
8416726	JLD	Method Blank	Dissolved Nitrite (N)	2016/09/30	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/30	<0.010		mg/L	
8416726	JLD	RPD [PQ0280-01]	Dissolved Nitrite (N)	2016/10/01	NC		%	20
			Dissolved Nitrate (N)	2016/10/01	NC		%	20
8416951	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		103	%	80 - 120
8416951	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		104	%	80 - 120
8416951	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		100	%	80 - 120
8416951	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	0.0037, RDL=0.0030		mg/L	
8416951	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	NC		%	20
8416975	RM9	Matrix Spike	Dissolved Phosphorus (P)	2016/10/01		98	%	80 - 120
8416975	RM9	QC Standard	Dissolved Phosphorus (P)	2016/10/01		0.0	%	N/A
8416975	RM9	Spiked Blank	Dissolved Phosphorus (P)	2016/10/01		102	%	80 - 120
8416975	RM9	Method Blank	Dissolved Phosphorus (P)	2016/10/01	<0.0030		mg/L	
8416975	RM9	RPD	Dissolved Phosphorus (P)	2016/10/01	3.0		%	20
8417228	PC5	Matrix Spike [PQ0283-04]	Dissolved Aluminum (Al)	2016/09/30		104	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		99	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		87	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		94	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		92	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		88	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		99	%	80 - 120
			Dissolved Nickel (Ni)	2016/09/30		89	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		96	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		92	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		94	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		94	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		94	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		91	%	80 - 120
8417228	PC5	Spiked Blank	Dissolved Aluminum (Al)	2016/09/30		105	%	80 - 120
			Dissolved Antimony (Sb)	2016/09/30		96	%	80 - 120
			Dissolved Arsenic (As)	2016/09/30		95	%	80 - 120
			Dissolved Beryllium (Be)	2016/09/30		96	%	80 - 120
			Dissolved Cadmium (Cd)	2016/09/30		93	%	80 - 120
			Dissolved Chromium (Cr)	2016/09/30		90	%	80 - 120
			Dissolved Cobalt (Co)	2016/09/30		90	%	80 - 120
			Dissolved Copper (Cu)	2016/09/30		90	%	80 - 120
			Dissolved Lead (Pb)	2016/09/30		87	%	80 - 120
			Dissolved Molybdenum (Mo)	2016/09/30		93	%	80 - 120

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2016/09/30		88	%	80 - 120
			Dissolved Selenium (Se)	2016/09/30		95	%	80 - 120
			Dissolved Silver (Ag)	2016/09/30		91	%	80 - 120
			Dissolved Thallium (Tl)	2016/09/30		88	%	80 - 120
			Dissolved Tin (Sn)	2016/09/30		95	%	80 - 120
			Dissolved Titanium (Ti)	2016/09/30		100	%	80 - 120
			Dissolved Uranium (U)	2016/09/30		83	%	80 - 120
			Dissolved Vanadium (V)	2016/09/30		93	%	80 - 120
			Dissolved Zinc (Zn)	2016/09/30		89	%	80 - 120
8417228	PC5	Method Blank	Dissolved Aluminum (Al)	2016/09/30	<0.0030		mg/L	
			Dissolved Antimony (Sb)	2016/09/30	<0.00060		mg/L	
			Dissolved Arsenic (As)	2016/09/30	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2016/09/30	<0.0010		mg/L	
			Dissolved Cadmium (Cd)	2016/09/30	<0.000020		mg/L	
			Dissolved Chromium (Cr)	2016/09/30	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2016/09/30	<0.00030		mg/L	
			Dissolved Copper (Cu)	2016/09/30	<0.00020		mg/L	
			Dissolved Lead (Pb)	2016/09/30	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2016/09/30	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2016/09/30	<0.00050		mg/L	
			Dissolved Selenium (Se)	2016/09/30	<0.00020		mg/L	
			Dissolved Silver (Ag)	2016/09/30	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2016/09/30	<0.00020		mg/L	
			Dissolved Tin (Sn)	2016/09/30	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2016/09/30	<0.0010		mg/L	
			Dissolved Uranium (U)	2016/09/30	<0.00010		mg/L	
			Dissolved Vanadium (V)	2016/09/30	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2016/09/30	<0.0030		mg/L	
8417228	PC5	RPD [PQ0283-04]	Dissolved Aluminum (Al)	2016/09/30	NC		%	20
			Dissolved Antimony (Sb)	2016/09/30	NC		%	20
			Dissolved Arsenic (As)	2016/09/30	2.8		%	20
			Dissolved Beryllium (Be)	2016/09/30	NC		%	20
			Dissolved Cadmium (Cd)	2016/09/30	NC		%	20
			Dissolved Chromium (Cr)	2016/09/30	NC		%	20
			Dissolved Cobalt (Co)	2016/09/30	NC		%	20
			Dissolved Copper (Cu)	2016/09/30	NC		%	20
			Dissolved Lead (Pb)	2016/09/30	NC		%	20
			Dissolved Molybdenum (Mo)	2016/09/30	6.0		%	20
			Dissolved Nickel (Ni)	2016/09/30	NC		%	20
			Dissolved Selenium (Se)	2016/09/30	NC		%	20
			Dissolved Silver (Ag)	2016/09/30	NC		%	20
			Dissolved Thallium (Tl)	2016/09/30	NC		%	20
			Dissolved Tin (Sn)	2016/09/30	NC		%	20
			Dissolved Titanium (Ti)	2016/09/30	NC		%	20
			Dissolved Uranium (U)	2016/09/30	NC		%	20
			Dissolved Vanadium (V)	2016/09/30	NC		%	20
			Dissolved Zinc (Zn)	2016/09/30	NC		%	20
8417247	RK3	Matrix Spike	Total Mercury (Hg)	2016/09/30		109	%	80 - 120
8417247	RK3	Spiked Blank	Total Mercury (Hg)	2016/09/30		104	%	80 - 120
8417247	RK3	Method Blank	Total Mercury (Hg)	2016/09/30	<0.0020		ug/L	
8417247	RK3	RPD	Total Mercury (Hg)	2016/09/30	NC		%	20
8417394	MB5	Matrix Spike	Orthophosphate (P)	2016/09/30		96	%	80 - 120

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STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8417394	MB5	Spiked Blank	Orthophosphate (P)	2016/09/30		96	%	80 - 120
8417394	MB5	Method Blank	Orthophosphate (P)	2016/09/30	<0.0030		mg/L	
8417394	MB5	RPD	Orthophosphate (P)	2016/09/30	1.7		%	20
8417670	MB5	Matrix Spike	Dissolved Ammonia (N)	2016/09/30		NC	%	80 - 120
8417670	MB5	Spiked Blank	Dissolved Ammonia (N)	2016/09/30		98	%	80 - 120
8417670	MB5	Method Blank	Dissolved Ammonia (N)	2016/09/30	<0.050		mg/L	
8417670	MB5	RPD	Dissolved Ammonia (N)	2016/09/30	3.2		%	20
8417829	JHC	Matrix Spike	Dissolved Barium (Ba)	2016/10/01		112	%	80 - 120
			Dissolved Boron (B)	2016/10/01		104	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		NC	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		111	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		114	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		106	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		105	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		118	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		115	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		NC	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		NC	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		111	%	80 - 120
8417829	JHC	Spiked Blank	Dissolved Barium (Ba)	2016/10/01		105	%	80 - 120
			Dissolved Boron (B)	2016/10/01		97	%	80 - 120
			Dissolved Calcium (Ca)	2016/10/01		103	%	80 - 120
			Dissolved Iron (Fe)	2016/10/01		106	%	80 - 120
			Dissolved Lithium (Li)	2016/10/01		107	%	80 - 120
			Dissolved Magnesium (Mg)	2016/10/01		103	%	80 - 120
			Dissolved Manganese (Mn)	2016/10/01		103	%	80 - 120
			Dissolved Phosphorus (P)	2016/10/01		101	%	80 - 120
			Dissolved Potassium (K)	2016/10/01		107	%	80 - 120
			Dissolved Silicon (Si)	2016/10/01		100	%	80 - 120
			Dissolved Sodium (Na)	2016/10/01		109	%	80 - 120
			Dissolved Strontium (Sr)	2016/10/01		105	%	80 - 120
8417829	JHC	Method Blank	Dissolved Barium (Ba)	2016/10/01	<0.010		mg/L	
			Dissolved Boron (B)	2016/10/01	<0.020		mg/L	
			Dissolved Calcium (Ca)	2016/10/01	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/10/01	<0.060		mg/L	
			Dissolved Lithium (Li)	2016/10/01	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2016/10/01	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/10/01	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2016/10/01	<0.10		mg/L	
			Dissolved Potassium (K)	2016/10/01	<0.30		mg/L	
			Dissolved Silicon (Si)	2016/10/01	<0.10		mg/L	
			Dissolved Sodium (Na)	2016/10/01	0.50, RDL=0.50		mg/L	
			Dissolved Strontium (Sr)	2016/10/01	<0.020		mg/L	
			Dissolved Sulphur (S)	2016/10/01	<0.20		mg/L	
8417829	JHC	RPD	Dissolved Barium (Ba)	2016/10/01	0.047		%	20
			Dissolved Boron (B)	2016/10/01	0.55		%	20
			Dissolved Calcium (Ca)	2016/10/01	0.15		%	20
			Dissolved Iron (Fe)	2016/10/01	1.3		%	20
			Dissolved Lithium (Li)	2016/10/01	NC		%	20
			Dissolved Magnesium (Mg)	2016/10/01	0.13		%	20
			Dissolved Manganese (Mn)	2016/10/01	0.044		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Phosphorus (P)	2016/10/01	NC		%	20
			Dissolved Potassium (K)	2016/10/01	0.21		%	20
			Dissolved Silicon (Si)	2016/10/01	0.18		%	20
			Dissolved Sodium (Na)	2016/10/01	0.084		%	20
			Dissolved Strontium (Sr)	2016/10/01	0.045		%	20
			Dissolved Sulphur (S)	2016/10/01	0.25		%	20
8418320	MUK	Matrix Spike	Dissolved Organic Carbon (C)	2016/10/01		NC	%	80 - 120
8418320	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		99	%	80 - 120
8418320	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418320	MUK	RPD	Dissolved Organic Carbon (C)	2016/10/01	5.2		%	20
8418321	MUK	Matrix Spike [PQ0283-03]	Dissolved Organic Carbon (C)	2016/10/01		109	%	80 - 120
8418321	MUK	Spiked Blank	Dissolved Organic Carbon (C)	2016/10/01		97	%	80 - 120
8418321	MUK	Method Blank	Dissolved Organic Carbon (C)	2016/10/01	<0.50		mg/L	
8418321	MUK	RPD [PQ0283-03]	Dissolved Organic Carbon (C)	2016/10/01	NC		%	20
8419053	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		NC	%	80 - 120
8419053	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		93	%	80 - 120
8419053	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		105	%	80 - 120
8419053	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419053	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	8.0		%	20
8419222	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419222	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		106	%	80 - 120
8419222	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419222	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	2.6		%	20
8419223	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		NC	%	80 - 120
8419223	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		106	%	80 - 120
8419223	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419223	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	0.91		%	20
8419229	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/02		NC	%	80 - 120
8419229	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/02		106	%	80 - 120
8419229	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/02	<1.0		mg/L	
8419229	KP9	RPD	Dissolved Chloride (Cl)	2016/10/02	7.3		%	20
8419230	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/02		NC	%	80 - 120
8419230	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/02		105	%	80 - 120
8419230	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/02	<1.0		mg/L	
8419230	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/02	0.58		%	20
8419317	MB5	Matrix Spike	Total Kjeldahl Nitrogen	2016/10/03		100	%	80 - 120
8419317	MB5	QC Standard	Total Kjeldahl Nitrogen	2016/10/03		97	%	80 - 120
8419317	MB5	Spiked Blank	Total Kjeldahl Nitrogen	2016/10/03		109	%	80 - 120
8419317	MB5	Method Blank	Total Kjeldahl Nitrogen	2016/10/03	<0.050		mg/L	
8419317	MB5	RPD	Total Kjeldahl Nitrogen	2016/10/03	3.2		%	20
8419658	KP9	Matrix Spike	Dissolved Chloride (Cl)	2016/10/03		NC	%	80 - 120
8419658	KP9	Spiked Blank	Dissolved Chloride (Cl)	2016/10/03		105	%	80 - 120
8419658	KP9	Method Blank	Dissolved Chloride (Cl)	2016/10/03	1.6, RDL=1.0		mg/L	
8419658	KP9	RPD	Dissolved Chloride (Cl)	2016/10/03	0.93		%	20
8419661	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2016/10/03		NC	%	80 - 120
8419661	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2016/10/03		107	%	80 - 120
8419661	KP9	Method Blank	Dissolved Sulphate (SO4)	2016/10/03	<1.0		mg/L	
8419661	KP9	RPD	Dissolved Sulphate (SO4)	2016/10/03	1.8		%	20
8419725	RK3	Matrix Spike	Dissolved Mercury (Hg)	2016/10/03		93	%	80 - 120
8419725	RK3	Spiked Blank	Dissolved Mercury (Hg)	2016/10/03		91	%	80 - 120
8419725	RK3	Method Blank	Dissolved Mercury (Hg)	2016/10/03	<0.0020		ug/L	

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8419725	RK3	RPD	Dissolved Mercury (Hg)	2016/10/03	NC		%	20
8420469	RSA	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/10/04		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		121	%	70 - 130
			Benzene	2016/10/04		111	%	70 - 130
			Toluene	2016/10/04		107	%	70 - 130
			Ethylbenzene	2016/10/04		112	%	70 - 130
			m & p-Xylene	2016/10/04		110	%	70 - 130
			o-Xylene	2016/10/04		114	%	70 - 130
			F1 (C6-C10)	2016/10/04		84	%	70 - 130
8420469	RSA	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/10/04		110	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		106	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		119	%	70 - 130
			Benzene	2016/10/04		111	%	70 - 130
			Toluene	2016/10/04		108	%	70 - 130
			Ethylbenzene	2016/10/04		114	%	70 - 130
			m & p-Xylene	2016/10/04		113	%	70 - 130
			o-Xylene	2016/10/04		115	%	70 - 130
			F1 (C6-C10)	2016/10/04		102	%	70 - 130
8420469	RSA	Method Blank	1,4-Difluorobenzene (sur.)	2016/10/04		110	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/10/04		105	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/10/04		119	%	70 - 130
			Benzene	2016/10/04	<0.00040		mg/L	
			Toluene	2016/10/04	<0.00040		mg/L	
			Ethylbenzene	2016/10/04	<0.00040		mg/L	
			m & p-Xylene	2016/10/04	<0.00080		mg/L	
			o-Xylene	2016/10/04	<0.00040		mg/L	
			Xylenes (Total)	2016/10/04	<0.00080		mg/L	
			F1 (C6-C10) - BTEX	2016/10/04	<0.10		mg/L	
			F1 (C6-C10)	2016/10/04	<0.10		mg/L	
8420469	RSA	RPD	Benzene	2016/10/04	NC		%	40
			Toluene	2016/10/04	NC		%	40
			Ethylbenzene	2016/10/04	NC		%	40
			m & p-Xylene	2016/10/04	NC		%	40
			o-Xylene	2016/10/04	NC		%	40
			Xylenes (Total)	2016/10/04	NC		%	40
			F1 (C6-C10) - BTEX	2016/10/04	NC		%	40

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F1 (C6-C10)	2016/10/04	NC		%	40

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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Maxxam Job #: B685112
Report Date: 2016/10/19

STANTEC CONSULTING LTD
Client Project #: 110773396
Site Location: SPRINGBANK SR1
Sampler Initials: DN

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Janet Gao, B.Sc., QP, Supervisor, Organics

Harry (Peng) Liang, Senior Analyst

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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1274

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Edmonton: 9331-48 St. T6B 2R4. Toll Free (800) 386-7247
maxxam.ca

CHAIN OF CUSTODY RECORD

M031890

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information	
Company:	Stantec Consulting Ltd	Company:		Quotation #:	
Contact Name:	Dylan King	Contact Name:		P.O. #/ AFE#:	
Address:	10160 112 St, Edmonton AB, T5K 2L6	Address:		Project #:	110773396
Phone:	(780)969-2223	Phone:		Site Location:	Springbank SR1
Email:	Dylanking@stantec.com	Email:		Site #:	
Copies:	Dale.Nisbet@stantec.com	Copies:		Sampled By:	D. Nisbet

Turnaround Time (TAT) Required

☑ 5 - 7 Days Regular (Most analyses)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ Same Day ☐ 2 Days ☐ 1 Day ☐ 3-4 Days

Date Required:

Rush Confirmation #:

Laboratory Use Only

	YES	NO	Cooler ID			
Seal Present	✓		Temp	5	7	9
Seal Intact	✓					
Cooling Media	✓					
Seal Present	✓		Temp	6	5	6
Seal Intact	✓					
Cooling Media	✓					
Seal Present			Temp			
Seal Intact						
Cooling Media						

Depot Reception

Analysis Requested: # of containers; BTEX F1 ☐ VOC ☐; BTEX F1-F2; BTEX F1-F4; Routine Water; Regulated Metals Tot ☐ Diss ☒; Mercury Total ☒ Dissolved ☒; Salinity 4; Sieve (75 micron); Texture (% Sand, Silt, Clay); Basic Class II Landfill; Dissolved phosphorus; Phosphate; Dissolved Ammonia; TKN; DOC; Total Coliforms; E. Coli; Fecal Coliforms; Heterotrophic plate count; HOLD - DO NOT ANALYZE

Regulatory Criteria: ☑ AT1/CCME; ☑ Drinking Water; ☐ Saskatchewan; ☐ D50 (Drilling Waste); ☐ Other:

#	Sample Identification	Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1-F2	Routine Water	Regulated Metals	Mercury	Dissolved phosphorus	Phosphate	Dissolved Ammonia	TKN	DOC	Total Coliforms	E. Coli	Fecal Coliforms	Heterotrophic plate count		Special Instructions
1	MW16-27-9		2016/09/28	10:16	W	13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	5,7,7	Submitted same day as sampled
2	MW16-26-18		↓	10:58	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	8,8,6	Could not eliminate headspace in MW16-27-9 sample F2 bottle due to gas created from water reacting with preservative
3	MW16-3-7		↓	11:45	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	7,9,8	
4	MW16-15-30		↓	17:10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	6,6,6	
5	MW16-15-16		↓	17:11	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	5,5,6	
6	MW16-22-26		↓	14:34	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	6,5,6	
7																					
8																					
9																					
10																					

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)
[signature] / Dale Nisbet	2016/09/28	20:13	[signature]	2016/09/29	07:13

29-Sep-16 07:13
Wendy Sears
B685112

JBK INS-0074

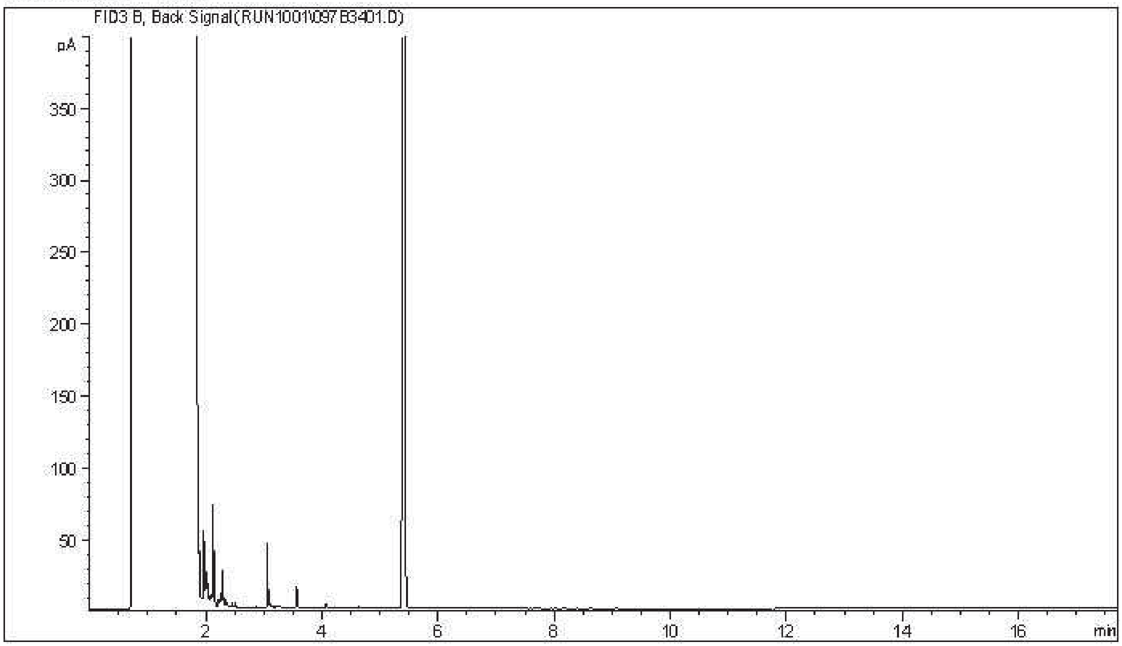
AB FCD-00331/6

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0280

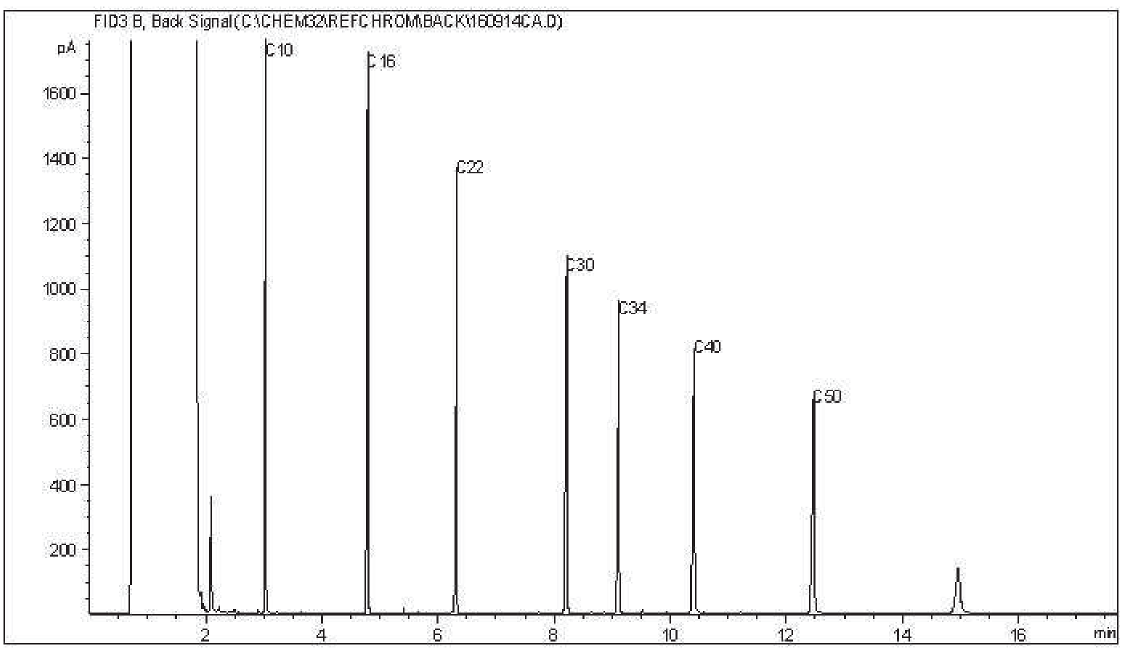
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-27-9

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

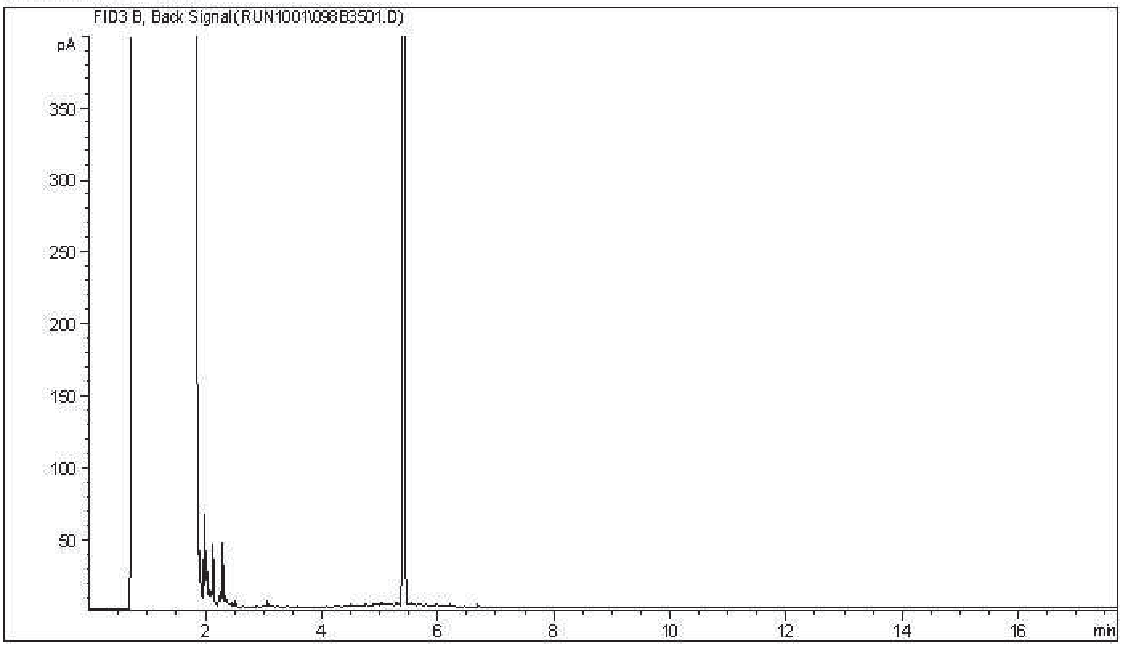
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0281

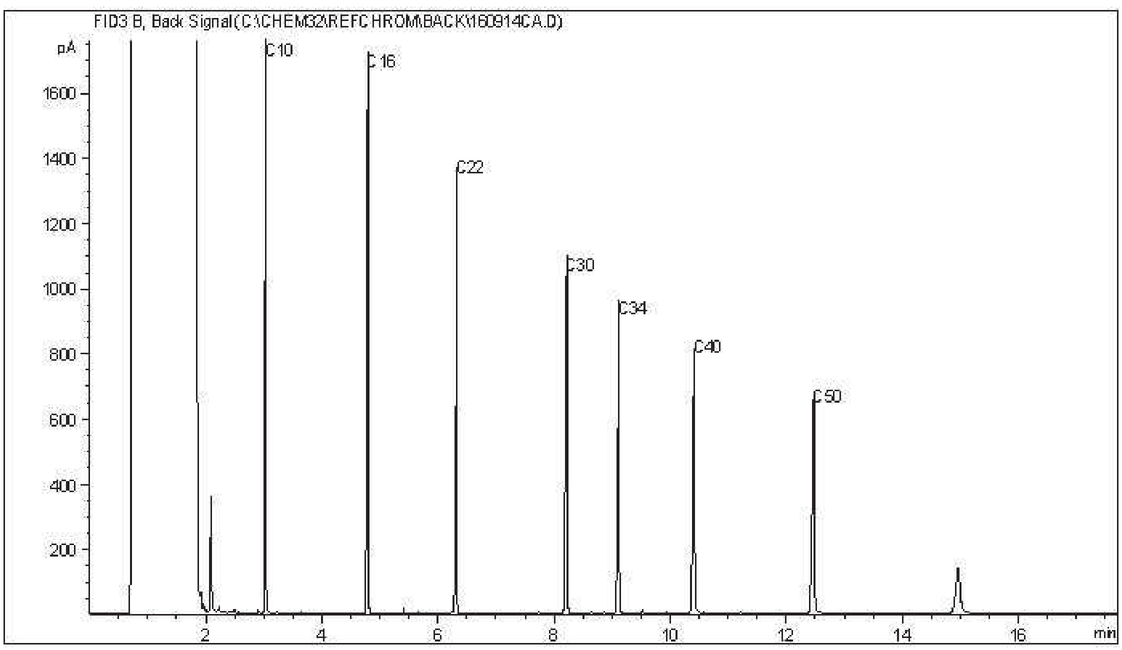
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-26-18

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

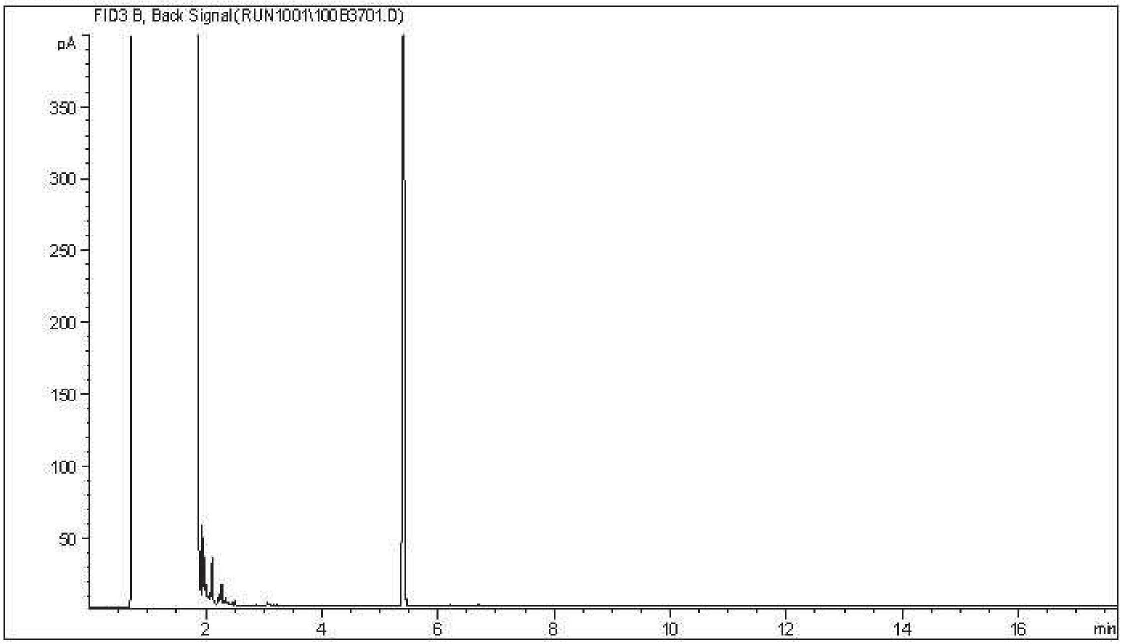
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0282

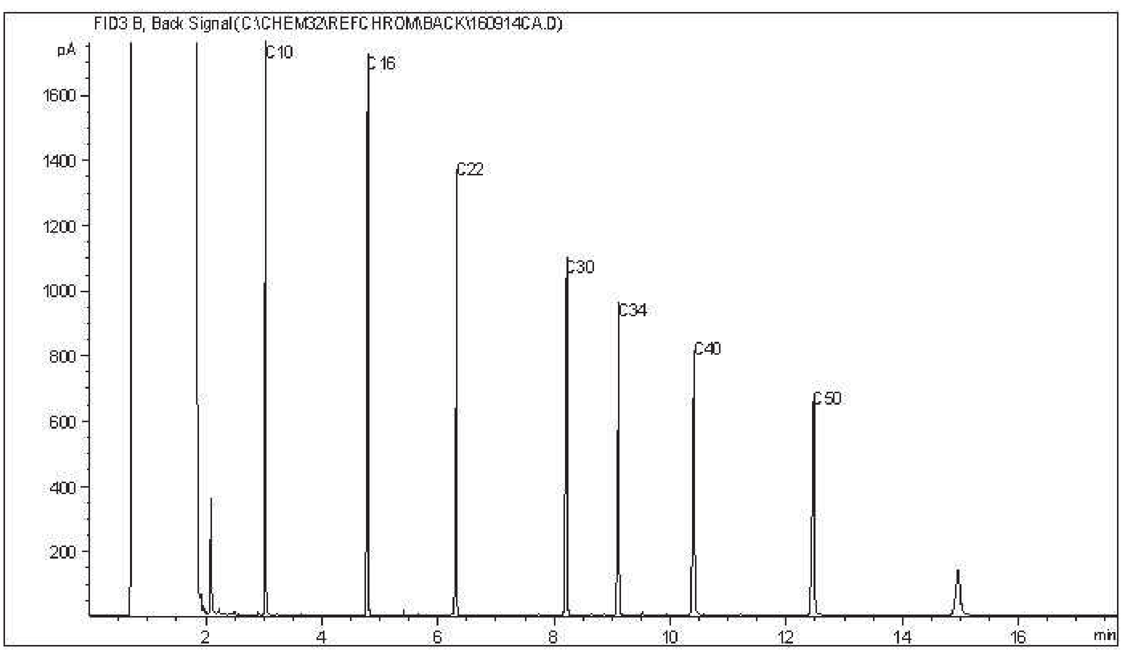
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-3-7

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

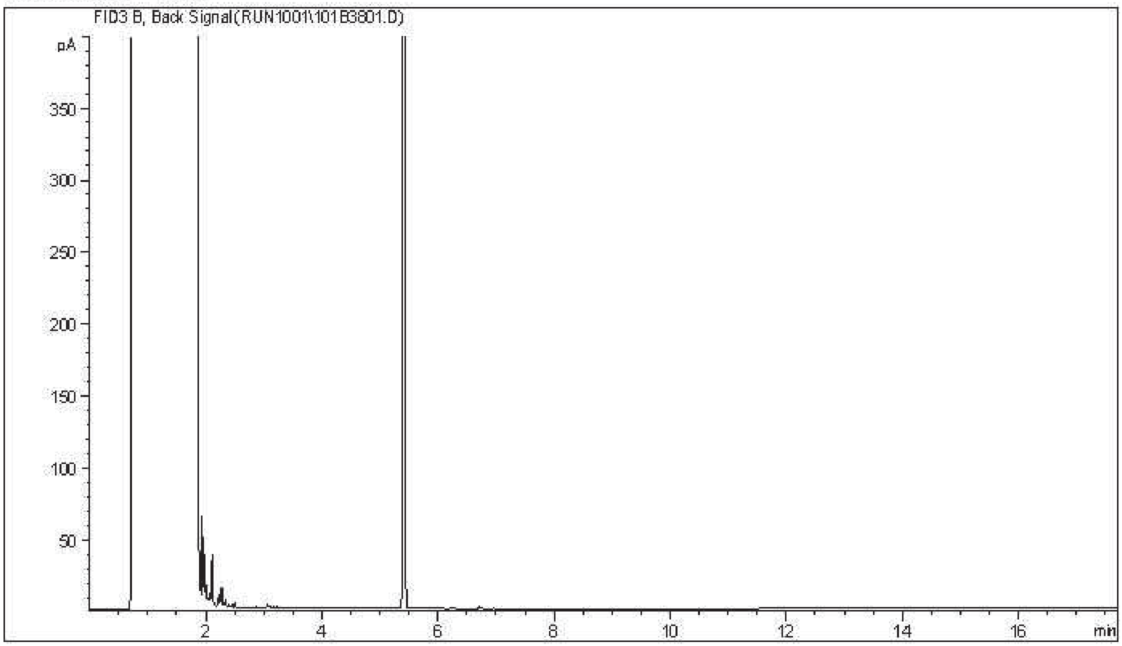
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0283

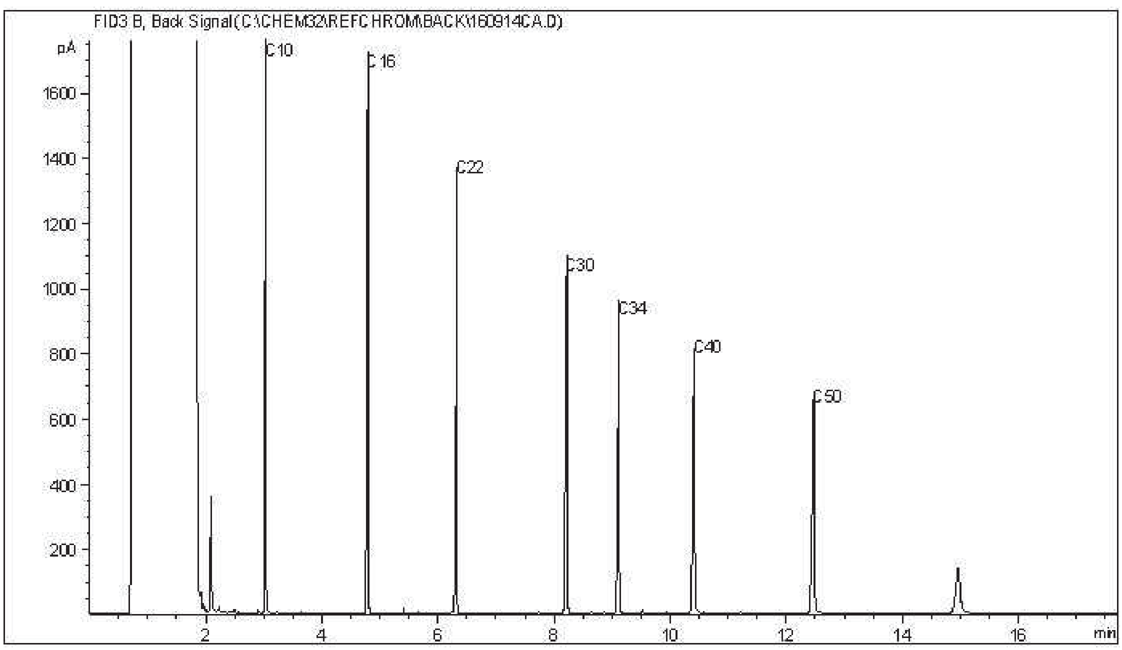
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-24-30

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

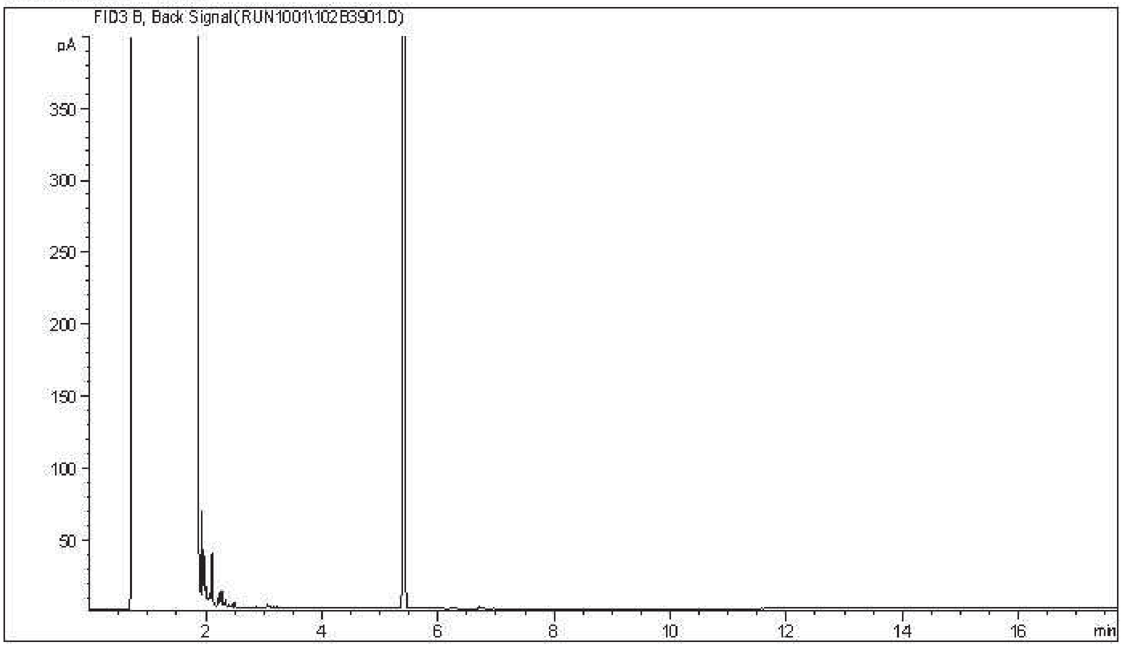
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B685112
Report Date: 2016/10/19
Maxxam Sample: PQ0284

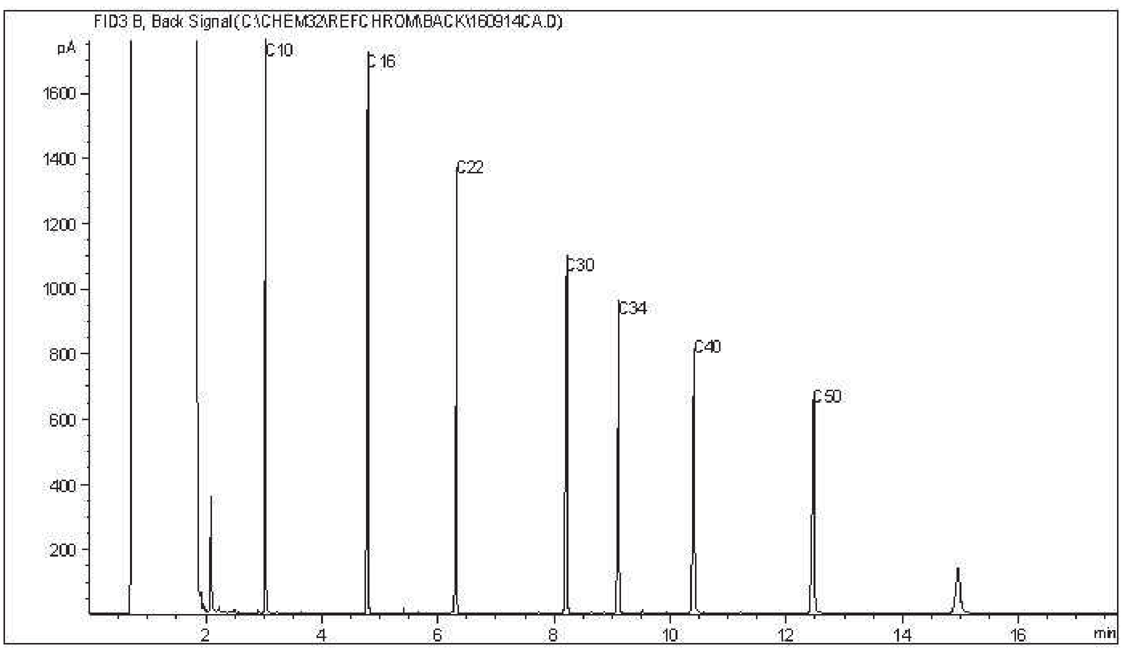
STANTEC CONSULTING LTD
Client Project #: 110773396
Site Reference: SPRINGBANK SR1
Client ID: MW16-15-16

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



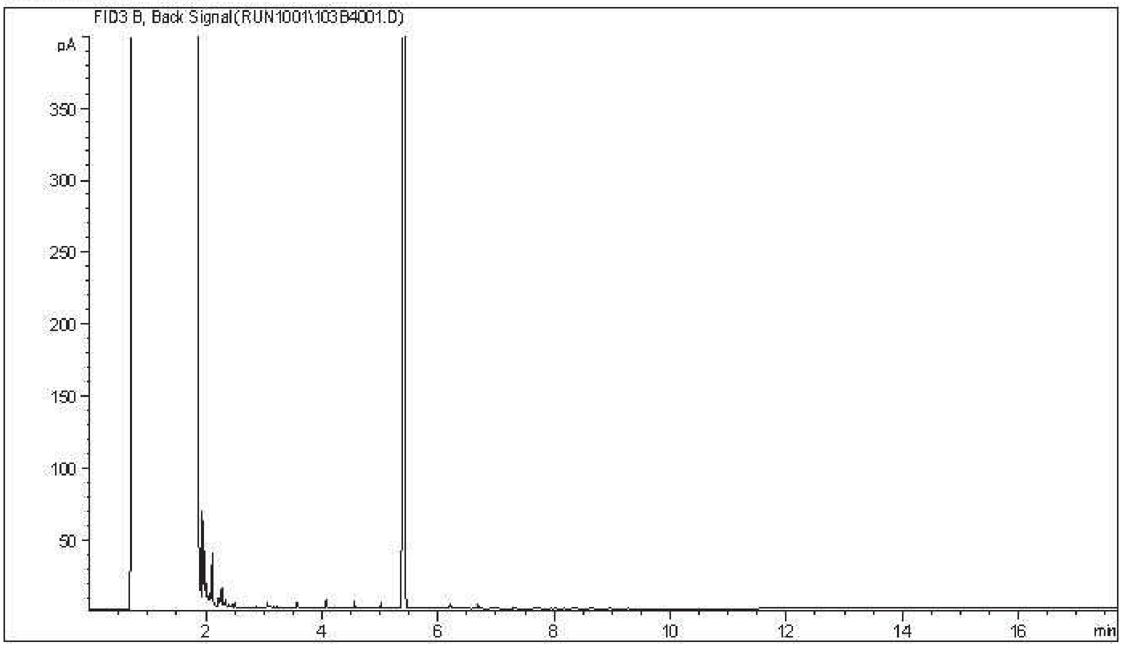
TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

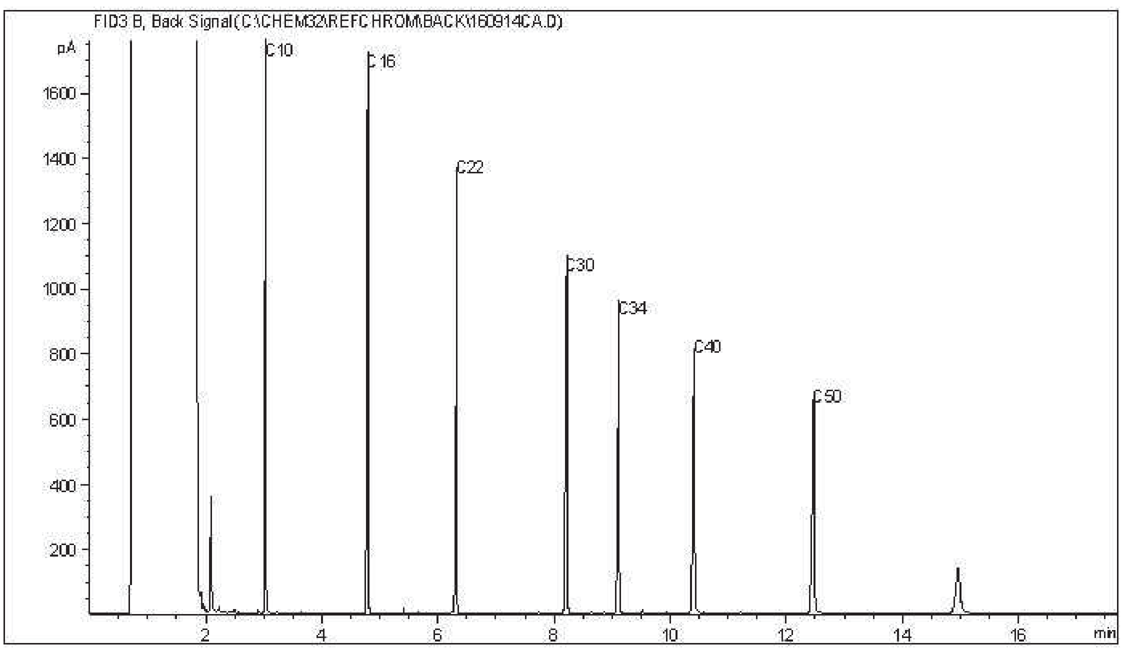
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: GC13



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Attachment D QA/QC DATA AND ANALYSIS

Groundwater Analytical QA/QC Results

Parameter	Units	RDL	MW16-04-20				MW16-24-30			
			Sample	Duplicate	RPD/AD		Sample	Duplicate	RPD/AD	
Anion Sum	meq/L	N/A	54	55	1.8	RPD	13	12	8.0	RPD
Cation Sum	meq/L	N/A	50	51	2.0	RPD	14	14	0.0	RPD
Hardness (as CaCO3)	mg/L	0.5	1700	1700	0.0	RPD	160	160	0.0	RPD
Ion Balance	none	0.01	0.94	0.94	0.0	RPD	1.1	1.1	0.0	RPD
Nitrate	mg/L	0.044	<0.044	0.045	<0.045	AD	<0.044	<0.044	<0.044	AD
Nitrate + Nitrite (as N)	mg/L	0.02	<0.020	<0.020	<0.020	AD	<0.020	<0.020	<0.020	AD
Nitrite	mg/L	0.033	<0.033	<0.033	<0.033	AD	<0.033	<0.033	<0.033	AD
Total Dissolved Solids	mg/L	10	3400	3400	0.0	RPD	730	720	1.4	RPD
Dissolved Organic Carbon (DOC)	mg/L	0.5	5.1	5.2	1.9	RPD	1.2	1.4	0.2	AD
Electrical Conductivity, Lab	µS/cm	1	4000	4000	0.0	RPD	1100	1100	0.0	RPD
pH	S.U.	N/A	7.52	7.45	0.9	RPD	8.19	8.18	0.1	RPD
BTEX and Petroleum Hydrocarbons										
Benzene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Toluene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Ethylbenzene	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Xylene, m & p-	mg/L	0.0008	<0.00080	<0.00080	<0.00080	AD	<0.00080	<0.00080	<0.00080	AD
Xylene, o-	mg/L	0.0004	<0.00040	<0.00040	<0.00040	AD	<0.00040	<0.00040	<0.00040	AD
Xylenes, Total	mg/L	0.0008	<0.00080	<0.00080	<0.00080	AD	<0.00080	<0.00080	<0.00080	AD
PHC F1 (C6-C10 range)	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
PHC F1 (C6-C10 range) minus BTEX	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
PHC F2 (>C10-C16 range)	mg/L	0.1	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
Anions										
Alkalinity (P as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Alkalinity, Total (as CaCO3)	mg/L	0.5	460	460	0.0	RPD	460	460	0	RPD
Alkalinity, Bicarbonate (as CaCO3)	mg/L	0.5	570	560	1.8	RPD	560	560	0	RPD
Alkalinity, Carbonate (as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Alkalinity, Hydroxide (as CaCO3)	mg/L	0.5	<0.50	<0.50	<0.50	AD	<0.50	<0.50	<0.50	AD
Sulfate	mg/L	1.0	2100	2200	4.7	RPD	160	150	6.5	RPD
Chloride	mg/L	1.0	3.0	3.0	0.0	AD	<1.0	2.4	<2.4	AD
Nutrients										
Ammonia (as N)	mg/L	0.05	0.96	1.0	4.1	RPD	0.86	0.84	2.4	RPD
Nitrite (as N)	mg/L	0.010	<0.010	<0.010	<0.010	AD	<0.010	<0.010	<0.010	AD
Nitrate (as N)	mg/L	0.010	<0.010	0.010	<0.010	AD	<0.010	<0.010	<0.010	AD
Orthophosphate(as P)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Phosphorus, Total (Dissolved)	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	0.0069	<0.069	AD
Total Kjeldahl Nitrogen	mg/L	0.05	1.1	1.1	0.0	RPD	0.88	0.81	8.3	RPD
Metals, Dissolved										
Aluminum	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Antimony	mg/L	0.00060	<0.00060	<0.00060	<0.00060	AD	<0.00060	<0.00060	<0.00060	AD
Arsenic	mg/L	0.0002	0.0017	0.0019	11.1		0.0023	0.0022	4.4	RPD
Barium	mg/L	0.010	<0.010	<0.010	<0.010	AD	0.019	0.018	0.001	AD
Beryllium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Boron	mg/L	0.02	0.11	0.11	0.0	RPD	0.089	0.089	0.0	AD
Cadmium	mg/L	0.000020	<0.000020	<0.000020	<0.000020	AD	<0.000020	<0.000020	<0.000020	AD
Calcium	mg/L	0.3	380	380	0.0	RPD	38	38	0.0	RPD
Chromium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Cobalt	mg/L	0.0003	0.00034	0.00031	0.00003	AD	<0.00030	<0.00030	<0.00030	AD
Copper	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Iron	mg/L	0.06	2.2	2.2	0.0	RPD	0.14	0.15	0.01	AD
Lead	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Lithium	mg/L	0.02	0.070	0.074	0.004	AD	0.054	0.053	0.001	AD
Magnesium	mg/L	0.2	180	180	0.0	RPD	16	15	6.5	RPD
Manganese	mg/L	0.004	0.60	0.60	0.0	RPD	0.067	0.066	1.5	RPD
Mercury	µg/L	0.0020	<0.0020	<0.0020	<0.0020	AD	<0.0020	<0.0020	<0.0020	AD
Molybdenum	mg/L	0.0002	0.0016	0.0015	6.5	RPD	0.0014	0.0015	6.9	RPD
Nickel	mg/L	0.00050	<0.00050	<0.00050	<0.00050	AD	<0.00050	<0.00050	<0.00050	AD
Phosphorus	mg/L	0.10	<0.10	<0.10	<0.10	AD	<0.10	<0.10	<0.10	AD
Potassium	mg/L	0.3	8.2	8.5	3.6	RPD	4.0	3.9	2.5	RPD
Selenium	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Silicon	mg/L	0.1	4.3	4.4	2.3	RPD	3.6	3.6	0.0	RPD
Silver	mg/L	0.00010	<0.00010	<0.00010	<0.00010	AD	<0.00010	<0.00010	<0.00010	AD
Sodium	mg/L	0.5	370	390	5.3	RPD	240	230	4.3	RPD
Strontium	mg/L	0.02	6.0	5.9	1.7	RPD	0.66	0.65	1.5	RPD
Sulfur	mg/L	0.2	730	720	1.4	RPD	51	50	2.0	RPD
Thallium	mg/L	0.00020	<0.00020	<0.00020	<0.00020	AD	<0.00020	<0.00020	<0.00020	AD
Tin	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Titanium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Uranium	mg/L	0.0001	0.0023	0.0022	4.4	RPD	0.00022	0.00020	0.00002	AD
Vanadium	mg/L	0.0010	<0.0010	<0.0010	<0.0010	AD	<0.0010	<0.0010	<0.0010	AD
Zinc	mg/L	0.0030	<0.0030	<0.0030	<0.0030	AD	<0.0030	<0.0030	<0.0030	AD
Metals, Total										
Mercury	µg/L	0.002-6	<2.0	<6.	<6	AD	<0.0020	<0.0020	<0.0020	AD
Microbiological Parameters										
Escherichia coli (E.Coli)	pn/100n	1-2	<2.0	<2.	<2	AD	<1.0	<1.0	<1	AD
Fecal Coliform	pn/100n	1-2	<2.0	<2.0	<2	AD	<1.0	<1.0	<1	AD
Heterotrophic Plate Count	cfu/mL	1	550	630	13.6	RPD	48	120	85.7	RPD
Total Coliforms	pn/100n	1-2	<2.0	<2.0	<2.0	AD	2.0	1.0	1	AD

RDL - Laboratory reportable detection limit

RPD - Relative Percent Difference

AD - Absolute Difference

Shaded RPD/AD values are outside of reproducibility criteria limits

Attachment E NUMERICAL MODEL SENSITIVITY ANALYSIS

Following steady state calibration of the numerical groundwater flow model and completion of subsequent simulations as were described in Section 5, a sensitivity analysis was conducted to better understand potential uncertainty in the model results that could be caused by uncertainty in the calibrated model parameters used. The objective of the sensitivity analysis is to determine which parameters used in the model have the greatest effect on the modelled heads and the degree to which those simulated heads would change as a result. Model parameters for which relatively small changes in values cause a relatively large change in simulated heads are considered sensitive parameters. Conversely, model parameters that can be changed by relatively large amounts without causing relatively large, corresponding changes in simulated heads are considered less sensitive parameters.

E.1 SENSITIVITY ANALYSIS METHODS

Three simulation scenarios were developed to support the sensitivity analysis. Two transient simulations with changes in hydraulic parameters were considered together with a third steady-state simulation with changed boundary conditions in the off-stream reservoir area. The three simulation scenarios are summarized in Table E.1-1.

Scenario 1 examines the effect of increasing the permeability of the till and bedrock layers within the model. Hydraulic conductivity values for these units were increased by a factor of 1,000 (well beyond the respective range of natural variability of these geologic materials).

Scenario 2 examines the effect of increasing the storativity and specific yield parameters to values that are reflective of a more porous and elastic geologic material. Again, changes to these parameters were increased well beyond the respective range of natural variability for these geologic materials.

Scenario 3 is a steady-state simulation that examines the effect of turning on specified heads around the perimeter of the off-stream reservoir and assigning them values based on the elevation of water when the reservoir is full. This would simulate the conditions of storing water around the perimeter of the reservoir indefinitely (which is not how the Project will operate). Boundary conditions were only set around the perimeter of the reservoir in this scenario to allow for an understanding how the model responds in both an inward direction and radially outward direction from the reservoir area. While this is not a physical reality, this simulation was prepared to confirm that the model can simulate progression of a phreatic water table surface away from the boundary of the reservoir in both inward and outward directions.

Table E.1-1 Sensitivity Analysis Scenarios

Sensitivity Scenario	Original Scenarios	Changes to K values relative to calibrated values	Changes to storativity values relative to calibrated values	Simulation Mode
1	PPX1/EEX1	Increased K in the low conductivity till and bedrock layers by a factor of 1,000	None	Transient
2	PPX1/EEX1	None	Increased storativity to represent more compressible units and specific yields to a more porous unit	Transient
3	PPX0/EEX0	None	None	Steady-state with specified head boundary conditions turned on around the perimeter of the off-stream reservoir

The parameter values for the calibrated model and the values used in the sensitivity analysis scenarios are presented in Table E1.2.

Table E.1-2 Modelled Parameter Values

Hydrostratigraphic Unit	Steady State Calibration				Changes in Sensitivity Run 1		Changes in Sensitivity Run 2	
	XY Hydraulic Conductivity (m/s)	Z Hydraulic Conductivity (m/s)	Specific Storage (1/m)	Specific Yield (volume/ volume)	XY Hydraulic Conductivity (m/s)	Z Hydraulic Conductivity (m/s)	Specific Storage (1/m)	Specific Yield (volume/ volume)
Clay	5.1E-06	5.1E-07	3.5E-03	0.07	5.1E-06	5.1E-07	1.0E-02	0.14
Fluvial sand and gravel	2.8E-03	2.8E-04	2.3E-05	0.25	2.8E-03	2.8E-04	1.0E-03	0.35
Grouped Bedrock layer 6	1.4E-06	1.4E-07	1.1E-05	0.17	1.4E-03	1.4E-04	1.0E-04	0.30
Grouped Bedrock layer 7	2.7E-07	2.7E-09	1.1E-05	0.17	2.7E-04	2.7E-05	1.0E-04	0.25
Lower silt, sand and gravel	8.3E-05	8.3E-06	2.3E-05	0.2	8.3E-05	8.3E-06	1.0E-03	0.35
Till North	7.2E-08	7.2E-08	4.0E-03	0.04	7.2E-05	7.2E-05	1.0E-02	0.10
Till South	7.2E-07	7.2E-07	4.0E-03	0.04	7.2E-04	7.2E-04	1.0E-02	0.10
Till-high conductivity North	8.3E-05	8.3E-05	3.8E-03	0.04	8.3E-05	8.3E-05	1.0E-02	0.10
Till-high conductivity East	1.0E-04	1.0E-04	3.8E-03	0.04	1.0E-04	1.0E-04	1.0E-02	0.10

E.2 SENSITVITY ANALYSIS RESULTS

The results of Scenario 1, which used the higher hydraulic conductivity values, are presented in Figure E.1-1. Increasing the hydraulic conductivity of the low conductivity till and bedrock units resulted in increased lateral extent of net change for a design flood (PPX1-EEX1) in some areas. Hydraulic head increases are observed up to 150 m farther from the northern portion of the dam structure (relative to the original PPX1/EEX1 simulations) and north of the reservoir near Range Road 40. Scenario 1 also resulted in net changes in head extending farther from the diversion channel near the outlet of the channel into the reservoir. Increases are observed up to an additional 600 m from the diversion channel as a result of the higher hydraulic conductivity compared to the calibrated model for net change results.

Additional water level decreases are also observed in Scenario 1 near the south end of the diversion channel where the base of the channel is below the existing water table. The higher hydraulic conductivity results in drawdowns that extend up to an additional 150 m from the channel compared to the calibrated model for net change results. Despite these changes in the lateral extent of effects, the effects are still limited to the LAA and north of Elbow River.

The results of the Scenario 2, which used the higher storativity values, are presented in Figure E.1-2. The net change (PPX1-EEX1) for this sensitivity scenario was very similar to the transient model run for a design flood. The results of Scenario 2 indicate that the model is not sensitive to changes in storativity or specific yield based on a comparison of simulated heads at the 650 timestep (at the point in time when the reservoir has just been filled).

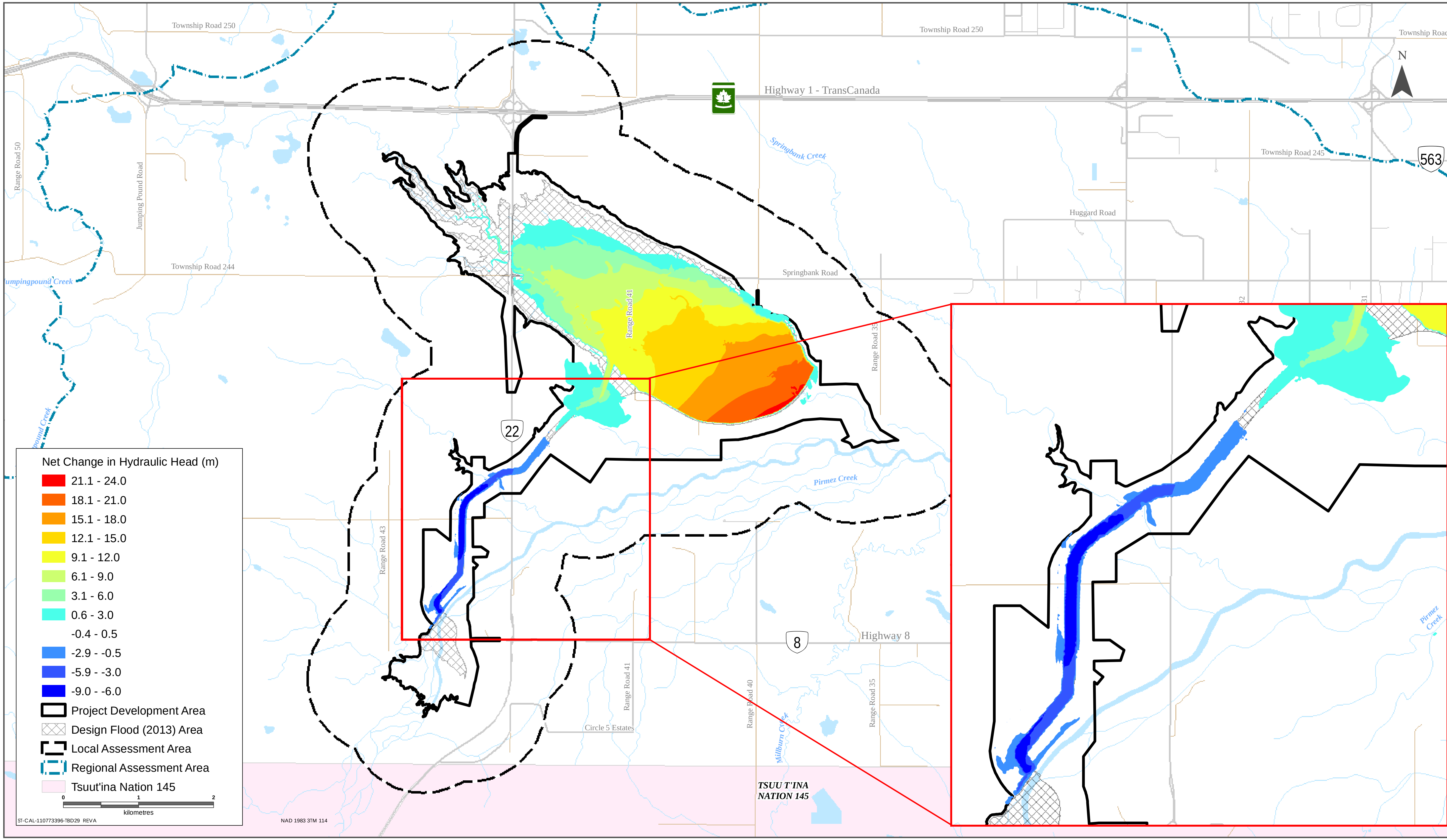
The results of the Scenario 3 are presented in Figure E.1-3, which shows the extent of the net change resulting from hydraulic head values being applied around the perimeter of the wetted area of the reservoir, in perpetuity (this is not the actual operating condition of the reservoir). Net change in head propagates farther away from the reservoir area in all directions except for the northwest.

Net change to the northeast extends approximately 1.5 km from the PDA in most areas, this distance corresponds to the local groundwater discharge feature (Springbank Creek) in that area. The farthest propagation of net effects to the northeast is approximately 3.1 km from the PDA. Similar propagation of net change is observed to the southwest of the reservoir, where it propagates approximately 2 km from the edge.

The net change effects propagate southeast from the reservoir to Elbow River but don’t extend beyond the edge of the fluvial deposits. This hypothetical scenario indicates that given enough time, the effects would propagate to Elbow River, but not beyond.

The sensitivity analysis results suggest that the model simulations are most affected by parameterization of hydraulic conductivity values. However, even when increasing the hydraulic conductivity values of the low conductivity units, the modelled effects remain within the LAA and north of Elbow River.

The results also show that given enough time (i.e. long enough to reach steady-state conditions), the effects of water retention in the reservoir could propagate up to 3.1 km away; however, this scenario is provided for illustrative purposes and is unrealistic considering the retention time for water in the reservoir for a design flood is approximately 20 days.



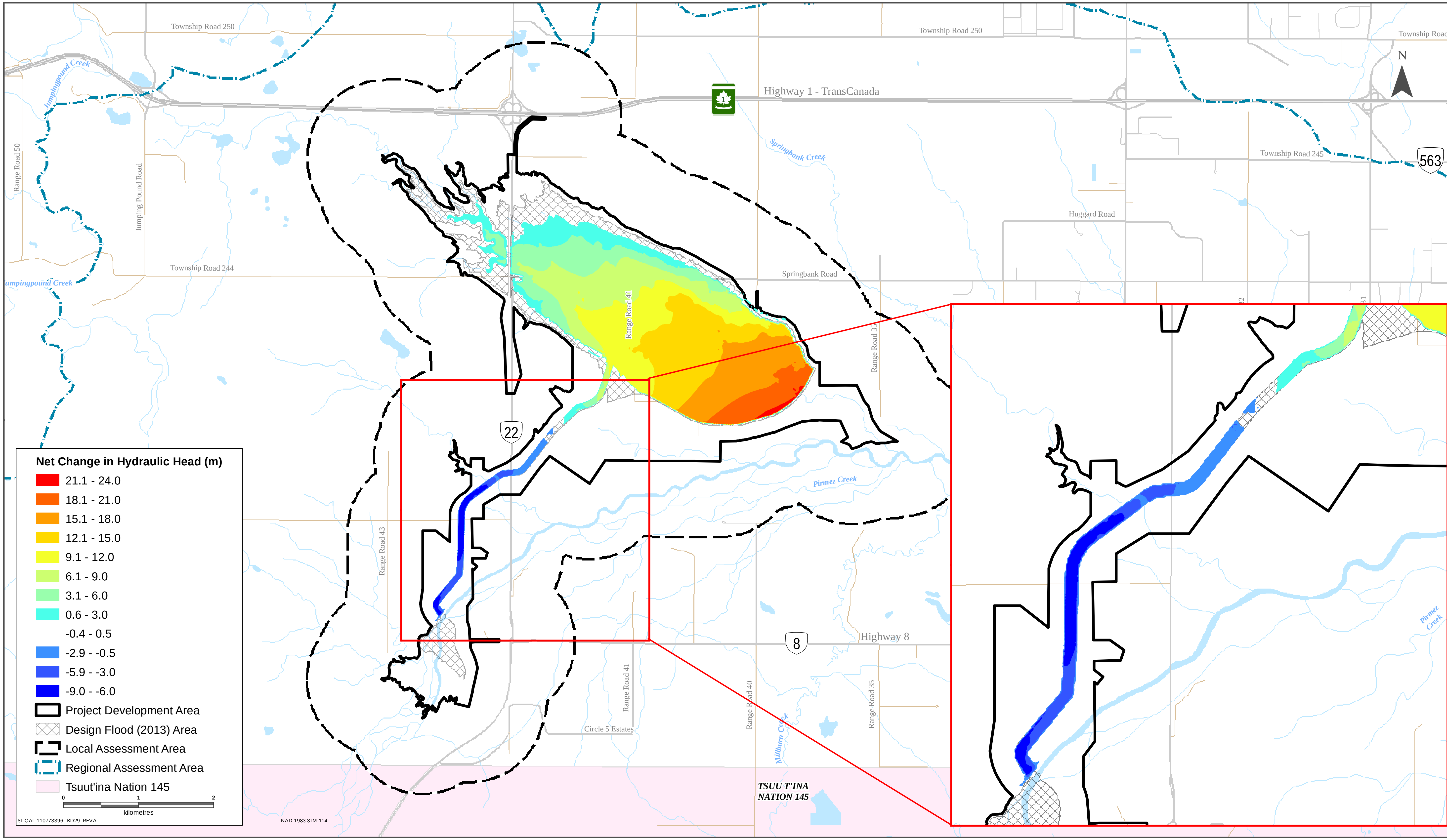
Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Simulated Net Change in Head for the PPX1/EEX1 Sensitivity Scenario 1 at Timestep 650

Figure E.1-1



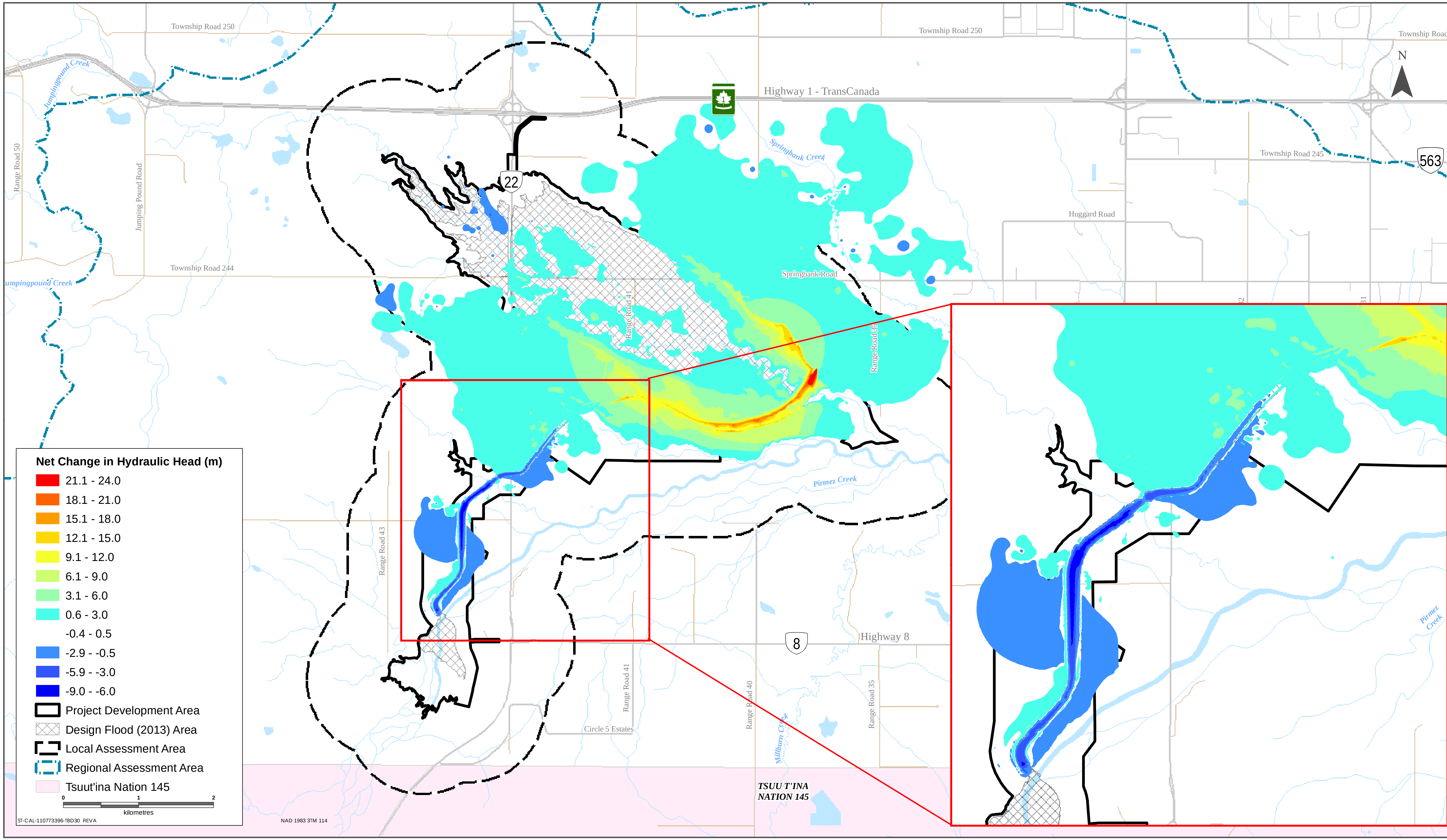
Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Simulated Net Change in Head for the PPX1/EEX1 Sensitivity Scenario 2 at Timestep 650

Figure E.1-2



Sources: Base Data - Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Simulated Net Change in Head for the PPX0/EEX0 Sensitivity Scenario 3

Figure E.1-3