CHRISTINA LAKE REGIONAL PROJECT HYDROGEOLOGY ENVIRONMENTAL SETTING REPORT

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prepared for:

MEG ENERGY CORP.

prepared by:

Westwater ENVIRONMENTAL LTD.

Executive Summary

MEG Energy Corp. (MEG) proposes the use of steam assisted gravity drainage technology to develop their oil sands lease near Conklin, Alberta. This environmental setting report addresses the baseline geologic and hydrogeologic conditions from which environmental changes will be assessed. These geologic and hydrogeologic conditions include surficial drift and bedrock geology, hydrostratigraphy, hydraulic parameters, groundwater flow regimes, groundwater-surface water interaction, groundwater chemistry, and groundwater resources and use within regional and local study areas. Sources of information utilized to determine baseline conditions include regional scale Quaternary stratigraphy and surficial geology reports by Alberta Geological Survey, groundwater monitoring and use reports for the EnCana Corporation Christina Lake project, geologic and hydrogeologic databases constructed and maintained by International Datashare Corporation and Alberta Environment (respectively), baseline hydrogeology reports primarily from EnCana Corporation's Christina Lake Thermal project, Devon Canada Corporation's Jackfish Project, Orion Oil Limited's Whitesands Experimental Pilot Project with selected information from ConocoPhillips Surmont project and the postponed (now Canadian Natural) Kirby project.

Geological mapping of the Lower Cretaceous Mannville Group resulted in the McMurray Formation as the preferred saline groundwater source and preferred wastewater disposal zone. Deep surficial drift sediments associated with a tributary of the Christina Channel is the preferred potable groundwater source. Groundwater exploration targets have been selected for testing in 2005. Bedrock groundwater quality has been determined regionally from drill stem tests and from well (pumping) tests. In the vicinity of the MEG Lease, available information indicates total dissolved solids concentration of the Grand Rapids Formation is approximately 4,500 mg/L, Clearwater Formation is 4,000 to 4,200 mg/L, and the McMurray Formation is 10,300 mg/L. Groundwater quality varies significantly and the Base of Groundwater Protection is the Grand Rapids Formation or the Clearwater Formation.

Major groundwater users in the Regional Study Area (RSA) are limited to one potable water diversion at EnCana's Christina Lake Thermal project. No current oil recovery operations use saline water as a source water for steam injection, although several operators are planning for the use of saline water from the Grand Rapids and Clearwater Formations. Domestic users do not utilize any bedrock aquifers for domestic purposes. Six surficial drift domestic water wells were identified from Alberta Environment records with the closest being approximately four kilometres from MEG's proposed potable water well. Groundwater monitoring wells at Devon's Jackfish, EnCana's Christina Lake projects, and Alberta Geological Survey's wells provide a record of water levels as a results of groundwater use. Groundwater chemistry in surficial drift aquifers has been evaluated at existing or proposed oil sands projects including MEG's project. Additional groundwater data including water sampling and analyses are required on the MEG Lease to provide a suitable amount of hydrogeological data; a groundwater monitoring program proposal will be submitted to Alberta Environment to collect the necessary data.

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Section One
Introduction

MEG Energy Corp. (MEG) is a Calgary-based, private energy company focused on the development and recovery of bitumen, shallow gas reserves and the generation of power in northeast Alberta. MEG is proposing to develop the Christina Lake Regional Project (the Project) on part of the 52 sections of oil sands leases that it holds in the area of Christina Lake, Alberta. The Project would be located within the Regional Municipality of Wood Buffalo in northeast Alberta, approximately 15 km southeast of local Secondary Highway 881 and 20 km northeast of Conklin.

MEG is proposing to develop their oil sands lease area by building and operating the Project utilizing a steam assisted gravity drainage (SAGD) oil recovery technology. The Project would consist of a central processing facility, SAGD wells, co-generation facilities and additional infrastructure. The proposed central processing facility and the co-generation unit would be located adjacent to MEG's Pilot facilities located in NE¼ 9 and SE¼ 16, Township 77, Range 5, W4M. The Project would be designed and built to produce 22,000 barrels per day of bitumen (approximately 3,500 cubic metres per day). This production, which would be in addition to the 3,000 barrels of bitumen per day from the pilot operation, would result in a total production of 25,000 barrels of bitumen per day (approximately 4,000 cubic metres per day).

Section Two

Hydrogeology

Objective

The objective of this environmental setting (baseline) report is to provide geologic and hydrogeologic conditions within the MEG project area prior to the commencement of the proposed Commercial operation of the Project. Environmental changes from the project will be assessed from these baseline conditions. The project is to be located northeast of Conklin, Alberta. The lease area includes a portion of the lands contained in Township 76 to 78 and Ranges 4 to 6, inclusive (Figure 2-1).

Westwater Environmental Ltd. (Westwater) was retained to compile baseline geology and hydrogeology for the existing conditions in the Commercial project area and to assess the potential impacts on the water resources of the area. The project will require a combination of groundwater from overburden aquifers and from the McMurray Formation for both the Pilot and Commercial operations for the project. Wastewater disposal into the McMurray Formation is proposed for the projects. The project's groundwater use (potable and saline) and water disposal volumes are presented in Table 1-1.

Groundwater withdrawal from the drift aquifers and the McMurray Formation will result in water level declines at the well bore and at distances from the pumping wells. Water quality in the McMurray Formation will also be affected by wastewater disposal. Hence, groundwater levels and groundwater quality are thus chosen as key indicator parameters. Mapping of the surficial drift and bedrock geology is important as there may be a degree of hydraulic communication given that down-cutting has occurred into the bedrock surface (the Grand Rapids Formation). The Grand Rapids may contain bitumen and/or gas and the bedrock formations dip upwards from the project site and outcrop at the Athabasca River and Clearwater Rivers.

Study Areas

The Hydrogeology scope of work includes the compilation and assessment of available hydrogeology information in the vicinity of the Commercial project. Two study areas were selected; the local study (LSA) and the regional study area (RSA). The LSA includes the MEG Oil Sands lease and the local surface water drainage basin surrounding Christina Lake. The LSA includes the Central Plant, the proposed water source and disposal wells, associated pipelines and other facilities. This is the area most likely to receive direct impacts from MEG's operations.

The Hydrogeology RSA is based on the Christina Lake sub-watershed drainage and the Winefred Lake watershed drainage area. The RSA is large enough to provide a regional description of the hydrogeology and it also incorporates other approved projects in the area that use groundwater for source water or have wastewater disposal into the deeper bedrock formations. RSA boundaries include township 72 to 84, ranges 1 to 13, W4M inclusive.

Existing or planned projects within the RSA include the EnCana Corporation (EnCana) Christina Lake, Devon Canada Corporation (Devon) Jackfish and Orion Oil (Orion) Whitesands project. The assessment of cumulative effects will include these projects.

ConocoPhillips Canada Surmont project is located outside of the RSA. However, selected hydrogeological data from the Surmont project are included as part of the baseline hydrogeological information. The Rio Alto (later Canadian Natural Resources Limited) Kirby Project located at Township73, Ranges 7 and 8 has been postponed; hence the Kirby project is not included in the impact analysis but some of the hydrogeological data has been utilized in this report.

EnCana's Foster Creek project was not included as part of this baseline report as it lies outside of the Mostoos Uplands physiographic area. The Foster Creek project is located on the southern portion of the Mostoos Uplands and surface water and groundwater flows are to the south toward the Beaver River drainage basin.

Methodology

Available hydrogeological information was collected, reviewed and assessed primarily from the following sources:

- EIA and Supplemental Information on EnCana's Christina Lake Thermal project;
- EIA and Supplemental Information on Devon's Jackfish project;
- EIA information on ConocoPhillips' Surmont project;
- EIA information on Rio Alto (now Canadian Natural) Kirby project;
- Environmental assessment of Orion's Whitesands project;
- Alberta Geological Survey's (AGS) report, Quaternary Geological Setting in the Athabasca Oil Sands (In-Situ) Area, Northeast Alberta;
- Alberta Environment (AENV) groundwater information service database;
- Alberta Research Council (ARC) hydrogeology reports and AGS observation wells located within the Christina Lake area;
- Well log database information from International Datashare Corporation (IDC);
- Consultants reports on water source and water disposal testing for the oil sands; project within the study area; and
- Alberta Energy and Utility Board (EUB) databases of wells and water production.

The geology of the project area was mapped using well logs from the IDC database (IDC, 2005), testholes and wells from MEG's recent drilling and water well records from Alberta Environment's database. Top of bedrock and the top of the Grand Rapids, Clearwater and McMurray Formation surfaces were prepared as were isopach maps of the bedrock formations. Approximately 670 well logs from the IDC Database were evaluated or approximately 1 per section over the entire RSA and all available logs within Townships 75 to 78, Ranges 4 to 6, W4M.

Similarly, the surficial drift thickness and drift formations were mapped using gamma responses, as applicable. Definition of the lower coarser-grained formations throughout the overburden was discernable below the bottom of the casing. However, the upper aquifers behind the casing were not well defined and difficult to correlate. Spontaneous potential and apparent resistivity geophysical logs, (electric logs or e-log) of Quaternary Formations were used from ARC, AGS and AENV databases and consultants reports, as available. Stratigraphic cross-sections prepared by AGS and hydrogeological cross-section by AENV for the Base of Groundwater Protection were used to provide regional bedrock surface and regional stratigraphy (Tokarsky and Epp 1986).

Regional geology was been cited from a number of sources including Green (1972), Glass (1990), Bachu et al. (1992, 1993 and 1996) and Hitchon et al. (1989).

Section Three

Regional Study Area

Physiography

The physiography of the areas has been studied by Pettapiece (1986) who subdivided the area into seven regions and minor subdivisions based on elevation and drainage. Figure 3-1 shows the regional topography of the area and indicates lowlands ranging from 250 metres above sea level (masl) at the Athabasca River to 850 masl at the May Hills. Two major Upland areas that flank the MEG project areas are the Stony Mountain Uplands to the west and the Mostoos Uplands to the south. The MEG project area lies within the Christina Lake Plain at elevations of approximately 600 masl. The LSA lies within the Christina Lake Plain. The RSA lies in the Mostoos Uplands, the Stony Mountain Uplands and the Methy Portage Plains.

Surface water drains radially from the Stony Mountain Uplands flowing north into the Hangingstone, House, Horse and Christina rivers. The northern flank of the Mostoos Uplands is the next highest area at approximately 600 to 700 masl with water draining to the north toward the along the Christina and Winefred rivers in the Christina Lake Plain. The lowest point is the Athabasca and Clearwater rivers which also constitutes a natural groundwater flow divide with groundwater flow discharge into these two rivers.

The major water bodies are Christina and Winefred lakes situated approximately 6 and 14 km from the Central Plant area, respectively. The major drainage of Christina Lake is the Jackfish River that flows to the north.

Bedrock Geology

The regional bedrock geology has been adapted from several sources including Green (1972) and Mossap and Shetsen's Geology of the Western Canadian Sedimentary Basin (1994). Regional scale geology is emphasized due to the need to portray geology at areas outside of the MEG project to assess groundwater water use and wastewater disposal. On a local scale, MEG has provided detailed geological and reservoir quality assessment as part of the Pilot and Commercial applications.

The bedrock framework in the RSA can be summarized into three main groups:

- Upper Devonian Beaverhill Lake Group – lower most formations encountered and a potential wastewater disposal zone;
- Lower Cretaceous Mannville Group - hydrocarbon reservoir and sources of saline and non-saline source water and wastewater disposal zone, and Joli Fou Formation cap rock; and
- Upper Cretaceous LaBiche, Lea Park and Wapiti formations – relatively impervious uppermost bedrock surface within the RSA, where present.

Figure 3-2 presents the regional stratigraphic column of the RSA.

Bedrock Formations

The top of formation structure and ispoach maps prepared for this EIA are based on recent well logs available from MEG 2004 winter drilling program and non-confidential well logs available through the IDC well log and database system. Figure 3-3 presents the well location providing geologic control for the RSA.

The Devonian period formations consist of dolomitized fossilerous limestones and argillaceous limey muds of the Woodbend Group and the Beaverhill Lake Group. Figure 3-4 shows the Paleozoic surface structure within the RSA. Several topographical lows exist that correspond to the valley structure of the McMurray Formation and increased thickness of McMurray sands.

Figures 3-5 to 3- 12 present the McMurray (Figure 3-5 and 3-8), Clearwater (Figure 3-9 and 3-10) and Grand Rapids (Figure 3-11 and 3-12) formations surface structures and isopach thicknesses. Net sand isopach mapping was based on (approximately) a greater than 30 % porosity and gamma value of 60 API. The following is a general geologic description of the bedrock formations, adapted from Glass (1990).

The McMurray Formation is composed of sand (saturated with bitumen and/or water), siltstone, shale and mudstone. The upper unit consists of horizontally bedded, argillaceous very fine-grained sands and shale, and is usually finer-grained compared to the middle and lower units. The middle unit has two distinct facies – a lower massive to thick-bedded interval of well sorted fine-grained sand and an upper interval consisting of inclined strata of fine-grained sand separated with thin partings of argillaceous silt. The lower unit, which is commonly present in the depressions in the underlying unconformable Devonian surface, consists of unconsolidated fine- to coarse-grained grain fluvial sandstones. Regionally, the McMurray Formation is 160 to 300 masl and ranges from 20 to 140 m in thickness.

The basal McMurray watersand is the target zone for a saline water supply and also for wastewater disposal. Within the Central Plant area, the thickness of the basal watersand ranges from 0 to 20 m. Further to the northwest, thick valley filled sediment of the McMurray Formation occurs and therefore, other locations beyond the Central Plant have been selected for source and disposal well sites. Regionally, the McMurray watersand is present from 0 to 250 masl and ranges from 0 to approximately 65 m in thickness.

The overlying Clearwater Formation consists of soft black and greenish-grey shale with interbedded grey and green sandstones, and ironstone concretions. The Wabiskaw Member, which lies at the base of the formation, is regionally thin and consists of glauconitic, upward cleaning, transgressive marine silty sandstones. Regionally, the Clearwater Formation is 260 to 400 masl and ranges from 20 to 120 m in thickness.

The Grand Rapids Formation comprises three major sandstone units (A, B and C) separated by siltstone and shale. The upper A unit is a fine- to medium-grained sandstone. The middle B unit is a fine- to medium-grained sandstone capped by coal. The lower C sandstone unit contains shale or shale with minor siltstone beds. Regionally, the Grand Rapids Formation is 340 to 420 masl; its depositional edge is in the northeast corner of the RSA and thicknesses range from 0 to 90 m in thickness. The Joli Fou is the uppermost unit of the Lower Cretaceous formations and is comprised of dark grey, calcareous shale with minor interbedded fine- and medium-grained sandstone.

The Viking, LaBiche, Lea Park and Wapiti formations comprise the Upper Cretaceous rocks. The Viking Formation is generally described as being composed of relatively well-washed and variably shaley, fine- to coarse-grained sandstone. However, within the RSA, the Viking Formation is comprised of predominately shale and siltstone. The LaBiche strata are made up of shale with subordinate shaley conglomerates, sandstones and siltstones. Much of the Upper Cretaceous formations have been eroded away, including some of the Joli Fou Formation.

Figure 3-13 is a south to north orientation hydrogeological cross-section located to the west of the MEG lease area. The figure shows the slightly upward dipping McMurray, Clearwater and Grand Rapids formations. These are overlain by the Joli Fou and Upper Cretaceous Colorado Group, which are indicated to have less thickness beneath the buried bedrock Wiau and Christina channels as shown; the Christina Channel is intersected by well #20 on Figure 3-13. At these locations, the Joli Fou is the uppermost bedrock formation with a thickness of approximately 15 m. The Colorado Group and Viking Formation have undergone substantial erosion.

Bedrock Structure and Channels

Figure 3-14 presents an updated interpretation of the bedrock surface structure as mapped for the Project and incorporates the work of AGS in identifying the regional network of buried bedrock channels throughout the area (Andriashek 2003). In addition, recent well logs from MEG's drilling program and new wells available since the AGS 2003 work have been incorporated.

Two bedrock upland areas are the Leismer Uplands, which are mapped as two lobes of bedrock highs separated by a distance of approximately 20 km. These are located on both sides of the Leismer Channel, a buried bedrock valley which trends east from the Wiau Channel before turning due north at 78-9 W4M (Figure 3-14). The Christina and Kirby channels tends generally west to east through the RSA and connect to the Wiau Channel in a northwest orientation. Other bedrock uplands are the May Hills and Caribou Uplands located south of the Wiau Channel.

An additional tributary channel has been mapped based on available data and shows a north orientation from the Christina Channel. The presence of thick basal or terrace coarser-grained sediments in and around 19-77-5 and 24-77-6 indicates basal sediments overlying the bedrock surface. One or both of these locations will be the subject of future groundwater exploration and testing during the winter of 2005.

Surficial Drift Geology

Drift thickness (Figure 3-15) has been mapped from well logs provided from IDC database, MEG wells and wells from other water well drilling programs. In the vicinity of the MEG lease in Township 77, Range 5, approximately 100 to 120 m of drift material overlies the bedrock surface. The nomenclature developed by Andriashek and Fenton (1989) in the Cold Lake area is presented in Table 3-1 and used also in the RSA. The stratigraphy consists of, from youngest to oldest, the Grand Centre to Empress formations.

Correlation of stratigraphy from the southern channel system to the northern channels such as the Christina Channel had been made through a comparison of e-logs as shown in Figure 3-16 (CH2M 1999). A more recent and detailed stratigraphic evaluation conducted by AGS included seven testholes drilled by AGS at:

- WEPA99-1 at 3-8-77-14;
- WEP99-1 at 7-36-77-15;
- WEPA99-2 at 13-12-74-17;
- WEPA00-1 at 6-33-74-9;
- WEPA00-2 at 7-31-76-5;
- WEPA00-3 at 16-4-75-5; and
- WEPA00-4 at 8-4-79-4.

The closest testholes for reference to the surficial drift stratigraphy at the MEG project are WEPA00-3 and WEPA00-2 (Figure 3-17). WEPA00-2 is located approximately 4 km to the south of the Central Plant area. The reference testholes provide information on petrology, geophysics, geochemistry, water analyses and also the natural presence of oil emulsion in the sediments. WEPA00-2 well log indicated a significant

difference in geology at this location, located just to the north of the thalweg of the Christina Channel as compared to the 9-17-76-6 location that was centered over the thalweg.

Hydrogeology

Hydrostratigraphy

The hydrostratigraphy is presented in Figure 3-2. In a water well context, an aquifer is a saturated permeable geologic unit that can provide water in significant quantities, whereas an aquitard cannot provide water in quantities that are deemed to be economic but they do provide significant quantities of water on a regional basis. Aquicludes are saturated geologic units that don't transmit significant quantities of water.

The Lower Cretaceous Mannville Group consists of aquifers within each of the McMurray, Clearwater and Grand Rapids formations. The Clearwater is also indicated to be an aquitard due to the presence of the uppermost shale member capping the Clearwater Formation, which is present throughout much of northeast Alberta. The Colorado Group and specifically within the RSA, the Joli Fou Formation is classified as an aquitard.

Within the Quaternary and Pleistocene-aged, the Empress, Muriel Lake, Bonnyville Unit 1 (sand and gravel) and the Ethel Lake formations are potential groundwater exploration targets. The silts, clays and tills of the drift sediments of the Bronson Lake, Bonnyville till, Grand Centre and Marie Creek formations represent less permeable units. Table 3-2 indicates the hydrostatigraphic units within the drift formations, based on the work conducted in the Cold Lake area. The hydrostratigraphic units within the Pleistocene drift deposits consist of alternating aquifers and aquitards.

Regional correlation of the aquifers is presented in Figures 3-18 and 3-19; these cross-sections interpret subsurface conditions along those particular cross-section lines. Figure 3-18, Cross-section A-A' extends south to north through the MEG lease area with geologic control points at 7-31-76-5 and 11-21-77-5. Figure 3-19, Cross-section E-E', also within the RSA extends west to east then south to north along the Leismer Channel and shows relatively flat lying Empress, Muriel Lake, Bonnyville Unit (sand and gravel) along the Channel. The Ethel Lake Formation is mapped as sometimes consisting of thick deposits in deepened scours. Due to the nature of Pleistocene geology, variations in stratigraphy are common and expected at other locations.

Hydraulic Head Distribution and Groundwater Flow

Bedrock aquifers

Figures 3-20, 3-21 and 3-22 presents the hydraulic head distribution within the McMurray, Clearwater and Grand Rapids aquifers, respectively. The hydraulic head distribution figures were based on drill stem tests and absolute open flow tests within each of three formations. Hydraulic head values within the McMurray Formation range from 360 to 500 masl with regional flows predominately to the north along the valley trend. Within the Clearwater Formation, the hydraulic head values ranged from 410 to 520 masl with groundwater flow to the southwest. Within the Grand Rapids Formation, the hydraulic head values ranged from 470 to 550 masl with groundwater flow to the northwest.

Hydraulic head values were available from individual aquifer testing from wells drilled and tested to determine the feasibility of providing a water source for industrial (steam) demands. Non-pumping water levels were measured prior to pump testing; MEG provided head values in the McMurray Formation, EnCana for the Clearwater Formation and Devon for the Grand Rapids Unit C Formation (Devon 2003) during aquifer evaluations for water sources for their perspective operations. These water levels were measured in March 2004 (Table 3-3).

Surficial Drift Aquifers

Regional water levels within the surficial drift aquifers are available from a few locations where monitoring wells or source and observation wells have been completed for oil recovery operations. These include the EnCana Christina Lake project at 17-76-6 and the proposed Devon Jackfish operation at 15-75-6. Appendix A (Water Well Records from AENV database) did not note any long-term pumping tests that may provide information on aquifer tests and hydraulic parameter estimations elsewhere in the RSA.

EnCana Christina Lake Project

Several monitoring wells have been completed on the EnCana Christina Lake plant site and general vicinity as required under both the *Water Act* and *Environmental Protection and Enhancement Act* (EPEA) approvals. Two large capacity water source wells (one main and one stand-by well), two camp wells for domestic supply and 15 monitoring wells are provided under Water Act Approval No. 0082524-00-00 requirements (Westwater 2004a). Table 3-4 presents hydraulic head distribution in several of the deeper aquifers on the Christina Lake project site. Appendix B contains a site plan showing the locations of the three nests on monitoring wells, a hydrogeological cross-section through the site that shows the relative completion intervals of the source and monitoring wells and the formations encountered.

Other shallow groundwater monitoring wells completed in the uppermost sediments in the water table aquifer and the next stratigraphically lower aquifer were completed under the EPEA Approval No. 48522-00-00 and -01 requirements. These monitoring wells are located on the Plant Site near the 8-17 wells. As regional monitoring wells at the 8-17 location provide hydrogeological data for the baseline report, the shallow well data have not been provided herein.

Devon Jackfish Project

Monitoring wells completed on the Devon Jackfish project site (Devon 2004) include two deeper wells (one source well and one observation well) drilled to a depth of approximately 110 m). Thirteen shallow monitoring wells were also completed on the site and were drilled from 5 to 24 m in depth. Appendix C shows the location of the wells, groundwater flow directions, well completion intervals and hydraulic heads measured in March 2004.

AGS WEPA Series Observation Well

Table 3-5 summarizes monitoring well installations conducted by AGS. Three nested monitoring well sites were completed in the general area with one of the sited located relatively close to the MEG project. Three nested well were completed in the Marie Creek, Bonnyville Formation Unit 2 and the Empress Formation Interfluve Sand at WEPA00-3 site at 16-04-75-5. Hydraulic heads are presented in presented in Table 3-6.

Hydraulic Parameters

Bedrock Aquifers

Hydraulic parameters derived from pumping tests were conducted during 2004 to determine aquifer capacity and the potential as an industrial water source. Devon conducted a well test with a source well and an observation well both completed in the Grand Rapids Formation Unit C at 12-15-75-6. A pumping test was conducted for 72 hours at an average rate of 1000 m^3/d (Devon 2004). The Conoco Surmont project (outside of the MEG RSA) was also reviewed to provide additional information of aquifer capacity of the Grand Rapids Formation. Pumping tests using wells at 8-25-83-7 indicated transmissivity (T) values ranging from 33 to 155 m^2/d and storativity (S) values of 3.1×10^{-6} to 3.1×10^{-4} (Conoco Phillips 2001).

EnCana tested the Clearwater Formation at 3-16 and 13-16 of-76-6 and reported tentative T values of 6 to 13 m^2/d. Pumping test rates ranged from 250 to over 500 m^3/d. These tests were affected by the presence of formation gas and the results were not definitive enough to provide a long-term deliverability of the Clearwater Formation as a water source for industrial demands (EnCana 2003). S values were not available as there was no response to pumping noted in the nearby observation well.

In March 2004, MEG pumped a proposed wastewater disposal well at 10-29-77-5 completed in the basal McMurray Formation (watersand). Water pumped from the 10-29 well was stored in on-site tanks and then re-injected into the same well to determine fracture pressure and disposal capacity. Water was pumped from the well in three step-rate tests from 600 to 1,670 m^3/d for 60 to 220 minutes in duration. The aquifer T value ranged from 44 to 88 m^2/d, with 44 m^2/d determined from late-time pumping test data (Westwater 2004b).

Table 3-7 summarizes the hydraulic parameters derived from pumping tests of well drilled and completed in the Grand Rapids, Clearwater and basal McMurray formations.

Surficial Drift Aquifers

Specific pumping test evaluations of industrial source wells in the area appears to be limited to the Empress Formation which is the basal aquifer overlying the bedrock surface in the Christina Channel. PanCanadian Resources drilled and completed the 9-17-76-6 well into the basal aquifer in 1998. The well was tested at 3540 m^3/d for 48 hours; aquifer T and S values were reported as T=800 m^2/d and S= 2.4 $x10^{-3}$ (CG&S 1998).

Other pumping tests by Stein et al. reported that the Terrace sand aquifers reported a T value of 345 to 514 m^2/d from a single well test at 12-1-73-6 which is located in the southern most portion of the RSA.

No well completions or pumping tests have been conducted for the Devon Jackfish project as per the Supplemental Information Request of May 2004 (Devon 2004); this is likely due to the fact that strong flowing artesian conditions exist at the 12-28-75-5 well site.

Several surficial drift wells completed on the EnCana Christina Lake Thermal Project were tested and provide hydraulic conductivity (K) values as presented in Appendix B. Table 3-8 summarizes the K values of the more permeable portions of the drift materials encountered by the various monitoring wells on the Christina Lake project site. The monitoring wells have been interpreted as being completed in the various formations based on the geophysical log of testhole 9-17-76-6 (Figure 3-16) and on WEPA00-2 type log.

Devon (2004) identified data gaps that would be completed as part of the groundwater monitoring program proposal to be submitted to AENV for the Jackfish project; K values from the stratigraphic units are parameters yet to be determined.

Groundwater-Surface Water Interaction

Regional groundwater flow occurs from areas of higher potential (higher elevations) to areas of lower potential (lower elevations). The Stony Mountain and the Mostoos Uplands (Figure 3-1) are therefore deemed to be major recharge areas within the RSA. The shallow groundwater discharge areas within the RSA may be the lower elevation areas that include a portion of the Christina Lake Plain and the Garson Plain (Figure 3-1).

Monitoring wells located in the area can provide an indication of the vertical component of groundwater flow, provided the wells were completed as a nest of wells at one location and the water levels were collected at the same time. Nests of wells are completed on some of the oil sands project sites such as EnCana Christina Lake project and the Devon Jackfish project. Other sites include AGS WEPA monitoring well sites.

Regional wells such as the WEPA monitoring wells may be suitable for regional analysis of hydraulic head distribution. At the WEPA00-1 site at 6-33-74-9, four wells are completed at depths of 15, 41, 76 and 120 metres below ground surface (mbgs) and reported a vertical downward groundwater flow on all measurement dates since November 21, 2000. At the WEPA 00-3 location at 16-04-75-5 three wells were completed at 17, 79, 158 mbgs and reported a vertical downward groundwater flow on all measurement dates since November 10, 2000.

Data for the EnCana Christina Lake project site (Appendix B) indicates both downward and upward components of vertical groundwater flow. Several flowing wells are noted on the Christina Lake project site with the aquifer utilized by Camp Well #2 having an upward component of groundwater flow. This well was completed in aquifer 2B which was correlated to the Ethel Lake Formation. Therefore, an upward groundwater flow appears to occur from the Ethel Lake Formation to the Marie Creek Formation. A downward component of groundwater flow was noted from aquifer 2A to the Empress Formation.

At Devon's proposed Plant Site area, thirteen monitoring wells were completed. There were two nested well sets, BH 21 and BH10 at 11-27-75-6 and 9-28-75-6, respectively that provided an assessment of the vertical component of groundwater flow. Both BH10 well series reported a downward vertical component of groundwater flow (Appendix C). The BH10 series were completed from 600.9 to 611.70 masl. The BH21 series wells reported a downward vertical component of groundwater flow from three of the shallowest wells but a slight upward flow from the deepest well completed from 588.38 to 589.88 masl.

Of particular note are the two wells, 12-28OBS and 12-28PW located at 12-28-75-6 which were completed in gravel of the Muriel Lake Formation (Devon 2004). These wells have a strong upward component of vertical groundwater flow with flowing artesian wells and hydraulic heads estimated at approximately 20 m above ground surface. These wells are now sealed and capped (Matrix Solutions 2005).

Water Balance

A detailed water balance is presented in the section on Hydrology. In summary, the average total annual precipitation is estimated at 441.1 mm, the mean average run-off is 66 mm or 15 % of the total annual precipitation and the combined evaporation and evapotranspiration is 355 mm or 80.5%. Therefore, the mean annual groundwater infiltration is estimated as 20 mm per year, or 4.5 % of the total annual precipitation. This groundwater recharge estimate is in agreement with other studies conducted elsewhere including the Conoco Surmont EIA study (ConocoPhillips 2001) and the Canadian Natural Resources Limited PAW Project EIA (CNRL 2000).

Groundwater Quality

Bedrock Aquifers

Bedrock groundwater quality has been determined from a number of methods including drill stem tests, absolute open flow tests and groundwater sampling during pumping tests within the RSA. These tests have been conducted by MEG, EnCana, Devon and ConocoPhillips as part of their project work to understand the local and regional hydrogeology. Historical information has also been provided from other EIA studies which have included a regional database of bedrock formation water quality in the western Canadian sedimentary basin (Rakhit Petroleum Consulting Limited [RPCL], 1996).

The salinity of the McMurray Formation was evaluated for the RSA (Figure 3-23). This figure indicates the calculated salinity values in mg/L based on DST information. These salinity values are associated with the lower water portion of the McMurray Formation and range from 10,000 to 45,000 mg/L expressed as total dissolved solids (TDS) of fresh water equivalent. Areas to the northeast of the Central Plant which are of acceptable water quality for recycling (approximately 10,000 mg/L of TDS) were identified.

Table 3-9 summarizes other McMurray Formation groundwater sampled within the MEG RSA and groundwater samples were reported to have been taken within the upper 30 m of the McMurray Formation (ConocoPhillips 2001).

EnCana's Christina Lake project conducted two pumping tests from wells completed in the Clearwater Formation. Conoco in their Surmont EIA did not report groundwater quality of the Clearwater Formation. A summary table of available Clearwater Formation water quality is presented in Table 3-10 from the EnCana Christina Lake project EIA (CG&S, 1999) with data provided from the RCPL GEOFLUIDS database. Similarly, Grand Rapids Formation summary tables from the GEOFLUIDS database are also provided in Table 3-11.

Groundwater quality from wells drilled as water source wells (Jackfish and Christina Lake projects) or as a well completed for pumping and later disposal injection tests (MEG well test) are provided below. These groundwaters pumped from completed source wells are considered to be more representative of actual formation groundwater quality as they represent non-stagnant groundwater conditions. In summary, groundwater quality determined from pumping tests within the RSA includes:

- MEG CLRP testing of the McMurray Formation at 10-29-77-5 with groundwater quality of 10,300 mg/L of TDS concentration (March 2004);
- MEG CLRP testing of the McMurray Formation at 4-29-77-4 with groundwater quality of 11,000 mg/L of TDS concentration (March 2005);
- EnCana Christina Lake testing of the Clearwater Formation with groundwater quality of 4,000 to 4,200 mg/L TDS; and
- Devon Jackfish testing of the Grand Rapids Formation with groundwater quality of 4,600 mg/L TDS.

A groundwater sample and chemical analysis from a bedrock formation at Total et al. Devenish well at 6-4-75-08 completed in the Colorado Group indicated sodium, chloride and TDS concentrations of 936, 897 and 2,905 mg/L, respectively (ConocoPhillips 2001).

Surficial Drift Aquifer Water Quality

Groundwater quality within the surficial drift aquifers are presented in Appendices B and C for the EnCana and Devon project sites. From the EnCana site, water source well and regional monitoring wells completed on and in the vicinity of the Central Plant site provide baseline groundwater quality. On the Devon project site, source and monitoring wells provide background and baseline water quality as no oil recovery operation has occurred to date; the proposed Jackfish project is to be a commercial operations with no planned pilot work. Selected chemical analyses data that have been included for the EnCana project are routine water quality, dissolved and total metal concentrations, dissolved arsenic concentrations, selected indicator parameters - chloride, phenols and dissolved organic carbon. Chemical analyses data included for the Devon project are routine and indicator parameters (phenols), total and dissolved metal analyses, dissolved hydrocarbons and poly aromatic hydrocarbons and naphthenic acids.

Drift groundwater quality was determined at 6-19-77-5 in March 2005 as a result of groundwater exploration and development for the Project. A groundwater sample was collected and analyzed for routine, total and dissolved metals, organic and indicator parameters. The groundwater was potable, was a sodium-bicarbonate type groundwater and had a TDS concentration of 737 mg/L.

Groundwater Resources and Major Users

Bedrock Aquifers

Bedrock aquifers that have been evaluated as source water for industrial purposes include the basal McMurray watersand, Clearwater sand and the Grand Rapids sands. Bedrock groundwater quality is not

acceptable for drinking or other domestic water uses due to high TDS concentration, does not meet the criteria of Canadian Drinking Water Quality, would not meet aesthetic objectives and in some cases contains hydrocarbons. As a result, there are no known water wells completed in the McMurray, Clearwater and/or Grand Rapids formations that supply water for domestic needs.

To date, there is no known groundwater production for industrial uses within the RSA from bedrock aquifers, although use of saline water is proposed. Devon proposes to use the Grand Rapids Formation Unit C and EnCana proposes to use the Clearwater sand as a source water for steam generation needs. Outside of the RSA the Surmont project has utilized Grand Rapids Formation water from a well at 8-25-083-07. MEG plans to use saline water from the McMurray Formation from proposed wells located northeast of the Central Plant.

Surficial Drift Aquifer

Table 3-12 summarizes the list of 26 well entries of known or reported groundwater use. Numbers 1 to 8 inclusive are water wells known to exist through reports and documents reviewed for the baseline report. A 10-km well search from the proposed water source well at 6-19-77-5 was conducted using AENV groundwater information database. Table 3-12 indicates that 7 of the 18 entries are seismic shot holes that do not have any well casing, hence are not considered wells. Five of the 18 entries are industrial wells with total depths of greater than 400 m and are not reported to be water source wells.

Of the remaining six domestic wells, two are owned by Canadian Worldwide Energy and one is owned by Benson Construction. The Canadian World Wide well located at 8-04-077-05 is owned and operated by AltaGas Limited. Of the three other domestic wells, two are owned by Alberta Housing (31-76-6) and the other well is owned by Jose Lapointe at SW 31-76-5. The residents of Conklin are supplied with treated water from Christina Lake that is trucked to residents' individual holding tanks. Hence there are few individual water wells.

Figure 3-24 indicates the location of the wells. Observation wells installed by AGS are also shown and consist of nested monitoring wells at two locations, at 6-33-74-9 and 16-4-75-5. Water wells at EnCana Christina Lake, Devon's Jackfish and Orion's Whitesands project sites are also shown.

Major industrial water use from surficial drift aquifers for steam generation needs is limited to EnCana's Christina Lake Thermal project. One source well provides groundwater from wells completed in the Empress/Muriel Lake Formations. In 2003, a total of 592,582 m^3 or 1,624 m^3/d was pumped. Devon has two wells at 12-28-75-6. However, these wells have been drilled and tested only and no on-going water use has occurred (Devon, 2005). Orion's Whitesands project has drilled and completed a water source well into the surficial drift aquifer; minor water use has commenced from this well from their Temporary Diversion Licence to supply groundwater for oil well drilling needs.

Existing Impacts from Groundwater Production

Surficial Drift Aquifers

The existing impacts due to water use are expressed in terms of current hydraulic heads. Current data have been presented from available information on local and regional water wells that are in close proximity to the MEG Plant Site and the proposed groundwater wells at 6-19-77-5 (potable source well) and 3-29-77-4 (saline source well). Hydraulic heads measured at key regional monitoring wells installed by AGS are presented in Figures 3-25 to 3-31 and represent baseline conditions prior to the Project operations. These monitoring wells water levels have been measured since approximately November 2000 and document the hydraulic heads in the various stratigraphic units including the Marie Creek, Sand River, Bonnyville Unit 2, Bonnyville Unit 1 and Empress formations. Other water levels have been

reported for existing oil sands operations where data are collected and reported through the public records, specifically, Tables 3-3, 3-4 and 3-6.

Groundwater chemistry is also documented and assessed from available reports and public records on file through other EIA and Supplemental Information documents, through annual groundwater monitoring and use reports (*Water Act* and EPEA reports) and through personal communication with well owners. Included in the baseline data are chemical analyses data in Tables 3-9,3-10 3-11 and supporting documents found in Appendices B and C.

Bedrock Aquifers and Deep Drift Aquifers

Figure 3-32 indicates the location of disposal wells provided by the January 21, 2005 search of the IDC database. Operating oil sands disposal wells at the EnCana Christina Lake project are located at 16-76-6 and account for the majority of wastewater disposal into the designated McMurray Formation disposal zone. Approximately 1.44 million m^3 has been injected at the 3-16-76-6 well location. Current monthly injection is over 67,060 m^3 per month. A total of 463,474 m^3 has been re-injected into the McMurray Formation at 7-16-76-6 by EnCana; current monthly volume is approximately 23,730 m^3 per month. Table 3-13 also identifies other injection zones including the Grand Rapids, Clearwater, Wabiskaw Member, Beaverhill Lake, Keg River and Winnipegosis formations. Eight of the wells listed are noted as abandoned, suspended or re-completed.

Figure 3-32 also incorporates the base of groundwater protection (BGWP). Alberta Environment (1995) has defined the base of groundwater protection as any formation that has groundwater quality of less then 4,000 mg/L of TDS. Within the MEG RSA, the BGWP is either the Grand Rapids or the Clearwater formations. To comply with the BGWP means that no activities shall occur that degrade the water quality in these formations. Alberta Energy and Utilities Board disposal wells from a recent search are indicated on Figure 3-32 with the specific disposal zone being utilized. It is noted that two wells in township 77, ranges 7 and 8 are disposing of wastewater into formations within the BGWP.

The MEG disposal well at 10-29-77-5 underwent an injectivity tested in March 2004 to determine safe disposal rates and maximum injection pressure. If the pressures of water injection are too high, the rock matrix can be pushed apart causing fracturing in consolidated rocks, or failure in unconsolidated rocks such as the McMurray Formation. Hence, the safe injection rate is designed to prevent rock failure and the EUB licensing regulations permit injection of disposal liquids at pressures that must be less than 90 percent of the receiving formation fracturing pressure. Details are presented in the following section.

Section Four

Local Study Area

Introduction

The LSA encompasses the majority of the MEG lease boundaries (Figure 4-1). The Commercial Project footprint is shown in Figure 4-2 and includes the Central Plant, Production Pads A to I, Disposal Well 10-29 and the groundwater exploration drilling targets for both potable and saline water source wells. The location of shallow monitoring wells on the plant site are also indicated.

The LSA is consistent with the area chosen by other disciplines, namely Aquatics and Hydrology. As the plant sites for the Pilot and Commercial operations are the same, the information provided in the Pilot Application is applicable to the Commercial report.

Bedrock Geology and Hydrogeology

Regional geology and hydrogeology has been provided in Section Three of this report. The bedrock surface structure maps and isopach maps of the McMurray, Clearwater and Grand Rapids formations within Townships 75 to 78, Ranges 4 to 6 W4M are provided in this section to provide more details not found in the regional description of the RSA. Section 4 provides additional information and details of the geology and hydrogeology within the LSA from drilling, hydraulic testing from shallow boreholes and monitoring wells completed on the proposed Central Plant.

Geology

The elevation of the bedrock surface within the area shown on Figure 4-3 ranges generally from 420 to 510 masl; one exception is a depression in the bedrock surface (380 masl contour interval) associated with the Christina Channel located to the south of the MEG lease. The thalweg (deepest part) of the buried bedrock Christina Channel extends in a west to east trend through the EnCana Christina Lake Thermal project. Within the Central Plant, the bedrock surface elevation ranges from approximately 440 to 500 masl (Figure 4-3).

Within the LSA, the uppermost bedrock strata include the Upper Cretaceous LaBiche and the Lower Cretaceous Joli Fou formations. The combined thickness of the LaBiche Formation and Joli Fou Formation ranges from 0 to approximately 90 m (Figures 3-13 and 3-18). The 0 m thickness is due to down-cutting of the Christina Channel into the top of the Grand Rapids Formation.

The Viking and Joli Fou formations occur in the lower portion of the Colorado Group. The Viking Formation is indicated to be a thin marker bed unit as indicated by the line on Figure 3-18, and is predominately fine-grained cemented sandstone, silt and shale. The Joli Fou Formation is indicated to be approximately 30 m thick.

The Grand Rapids Formation comprises three major sandstone units (A, B and C) separated by siltstone and shale. The upper A unit is a fine- to medium-grained sandstone. The middle B unit is a fine- to medium-grained sandstone capped by coal. The lower C sandstone unit contains shale or shale with minor siltstone beds. As shown on Figure 4-4, the elevation of the Grand Rapids surface ranges from approximately 400 to 420 masl on the MEG lease with a thickness of generally 75 to 80 m (Figure 4-5).

The underlying Clearwater Formation consists of soft black and greenish-grey shale with interbedded grey and green sandstones and ironstone concretions. The Wabiskaw Member, which lies at the base of the formation, is regionally thin and consists of glauconitic, upward cleaning, transgressive marine silty sandstones. Within the MEG lease, the elevation of the Clearwater surface ranges from 320 to 340 masl (Figure 4-6) and has a thickness of 85 to 90 m (Figure 4-7). There are also three areas of minimal thickness of the Clearwater Formation within the lease; one is south of the Central Plant site and has a thickness of approximately 60 m.

In general, the McMurray Formation is composed of sand (saturated with bitumen and/or water), siltstone, shale and mudstone. The upper unit consists of horizontally bedded, argillaceous very fine-grained sands and shale, and is usually finer-grained compared to the middle and lower units. The middle unit has two distinct facies – a lower massive to thick-bedded interval of well sorted fine-grained sand and an upper interval consisting of inclined strata of fine-grained sand separated with thin partings of argillaceous silt. The lower unit, which is commonly present in the depressions in the underlying Devonian surface, consists of poorly sorted sand, silt and clay. Figure 4-8 shows the McMurray Formation surface structure with elevations ranging from 215 to 260 masl. The thickness of the McMurray Formation on the MEG lease is 55 to 105 m thick (Figure 4-9).

Hydrogeology

Hydraulic head distributions of the Grand Rapids, Clearwater and McMurray formations are presented in Figures 4-10, 4-11 and 4-12, respectively. On a local sale, the Grand Rapids Formation flows to the northwest, the Clearwater Formation flows to the northeast and the McMurray Formation flows to the west and southwest. Given that the McMurray Formation is controlled by flow within the major valley structure located to the east of the MEG RSA, the local flow within the McMurray Formation to the west and southwest is likely minor compared to the overall regional northern flow as seen in Figure 3-20.

Evaluation of the McMurray Formation

MEG conducted an assessment of the bedrock formations for potential water disposal and water source zones for the Pilot and Commercial operations. The McMurray Formation was selected as the preferred disposal zone due to the overall thickness of the formation in the vicinity of the MEG lease and the precedence set by other operations in the immediate vicinity of MEG's lease. Shallower zones were not considered due to the BWGP which includes the Clearwater and Grand Rapids formations.

The preferred water source target was also the McMurray Formation. This selection was based on water quality of approximately 10,000 mg/L TDS and the overall thickness of the valley filled basal watersand (in excess of 50 thick). From initial mapping of the McMurray Formation isopach mapping (Figure 3-13) and TDS concentration (Figure 4-14), the area to the north and northeast of the MEG lease was selected as test locations for water disposal and water source well, respectively.

The proposed water disposal well location (s) were close to the Central Plant facility, in a thick section of the McMurray watersand and not in close proximity to the proposed saline water source wells.

10-29-77-5 Location

Pumping Test

During March 2004, MEG conducted drilling and completion of a water disposal well at the 10-29-77-5 location (Westwater 2004b). A pumping test was conducted to pump water for an injectivity test in addition to determining the actual groundwater quality. The injectivity test was to determine the formation pressure and to provide test data in support of a licence to dispose of wastewater into the McMurray Formation at this location. Figure 4-15 is the well completion diagram for the 10-29 well.

The results of a step-rate drawdown test that extracted groundwater from the formation indicated a T value of 48 to 88 m^2/d based on three drawdown periods and two water level recovery periods. The corresponding hydraulic conductivity (K) value was 2 x 10^{-5} m/s. Groundwater was extracted at rates of 600 to 3,000 m^3/d during the step-test and the production yield of the McMurray Formation at this location was estimated to be at least 1,670 m^3/d.

Groundwater quality at 10-29-77-5 was determined from three groundwater samples that were collected during pumping. Results are presented in Appendix D, MEG Supporting Data. The groundwater is a sodium-chloride type groundwater with TDS concentrations of 10,000 to 10,300 mg/L.

Injection Test

Using the water from the pumping test which was stored in on-site tanks, twelve injection periods were conducted at rates of 389 to 2,800 m^3/d. The objective of the testing was to determine the formation fracture pressure. However, the results of the testing indicted that, as expected, that fracturing did not occur. According to AEUB Guide 51 criteria, the maximum allowable wellhead pressure was determined to be 2,753 kPa. At the end of the injectivity test with water disposal at rate of 3,200 m^3/d rate, this maximum allowable well head pressure was not reached. Therefore, 3,200 m^3/d of water disposal was considered feasible for the 10-29 well.

Due to weather related time constraints, the planned testing of the McMurray Formation at sections 20 and/or section 29 of 77-4 to determine the capacity of a water source well (s) could not be completed. Additional tests are planned in 2005.

4-29-77-5 Location

During March 2005, MEG conducted drilling and completion of a test water source well (100/04-29-077-04 W4/00) completed in the basal McMurray Formation at 4-29-77-5. The well was pumped for over 10 hours with the final 2 hours of pumping at a rate of 4,000 m^3/d. Six groundwater samples were collected for chemical analyses; the sixth sample laboratory results are provided in Appendix D, MEG Supporting Data. The groundwater is a sodium-chloride type groundwater with TDS concentrations of 11,000 mg/L. Drilling, completion and testing details are provided in Volume 4, Section 4.3.1 of the MEG Christina Lake Regional Project Environmental Impact Assessment.

Surficial Drift Geology

Central Plant

The distribution of surficial drift units in the vicinity of the Central Plant was determined during a geotechnical investigation that commenced on March 3, 2004 (JWL 2004). Five boreholes were drilled and six monitoring wells were installed. The maximum depth of drilling for the boreholes was 18.8 m bgs. The borehole records are provided in Appendix D. Each of the six monitoring wells was constructed with 50-mm diameter PVC pipe and screen. PSB 03 and PSB 03A are nested wells installed

to obtain data for determining the vertical component of groundwater flow. Completion details for the six wells are summarized in Table 4-1.

The shallowest sediment is a thin mantle of muskeg/organic root mat and/or silty sand. These sediments are underlain by sandy clay till that correlates to the Grand Centre Formation. The sandy clay till contains sand pockets and lenses, and is interbedded with a sand layer that may be continuous beneath the investigated area.

The geologic sequence is illustrated on the Plant Site cross-section (Figure 4-16) and extends through the Central Plant site in a northwest trend. Completion information for each monitoring well is summarized as follows:

- PSB 01 was completed in the upper part of the sandy clay till and in the underlying sand layer. It was screened from 4.3 to 7.3 mbgs.
- PSB 02 was completed in the upper part of the sandy clay till with the screen positioned from 2.4 to 5.5 mbgs.
- PSB 03 was completed in the lower (grey) part of the sandy clay till with the screen positioned from 16.8 to 18.3 mbgs.
- PSB 03A was completed in the upper part of the sandy clay till. It was screened from 2.0 to 5.0 mbgs.
- PSB 04 was completed in the upper part of the sandy clay till and screened from 2.3 to 5.3 mbgs.
- PSB 05 was completed in the upper part of the sandy clay till and in a lens of poorly-graded sand. The screen was positioned in the 2.3 to 5.3 mbgs depth interval.

Hydrogeology

Based on observations during drilling and groundwater level readings, two piezometric surfaces may exist. One is the shallow water table within the more permeable sand layers. The second is the lower and possible more regional groundwater surface observed in PSB03A. The depths to these water tables range from 1.2 to 6.1 mbgs (Figure 4-16).

Hydraulic Conductivity

Hydraulic response testing was carried out on March 17 and 18, 2004 (JWL 2004). Rising head tests were conducted on monitoring wells PSB 01, PSB 03A and PSB 04 to obtain data for calculating hydraulic conductivity values. The results are summarized in Table 4-2 and the test results are presented in Appendix D.

The hydraulic conductivity of the clay till deposits beneath the Central Plant range between a low of 3.54×10^{-8} m/s and a high of 7.81×10^{-7} m/s. The sand layers in the clay till were assigned a K value of 3.00×10^{-4} m/s. Based on the cross-section through the Central Plant, the sands may be continuous.

Groundwater Flow Directions and Gradients

The water levels in the six wells were measured on March 17 and 18, and on May 26, 2004 (Table 4-3). The water levels measured on March 17 and 18 were contoured to provide an assessment of the groundwater flow direction with respect to the Central Plant layout (Figure 4-17). As indicated, the groundwater flow direction is to the north. The additional measurements made on May 26, 2004 confirmed the northerly flow direction (Figure 4-18).

The water table has a relatively low gradient of 0.001 to 0.005. Due to the relatively flat gradient, the horizontal flow direction may change depending on seasonal groundwater level changes. The vertical hydraulic gradient was monitored at nested wells PSB 03 and PSB 03A. Water levels measured in these two wells on May 26, 2004 indicate a downward component of groundwater flow at this location.

6-19-77-5 Location

Groundwater exploration and development was conducted at the 1AB/06-19-77-5 W4M location to determine the feasibility of the surficial drift sediments to provide water for the Project. Figure 1 (Appendix D, Groundwater Exploration) indicates the stratigraphy between an existing water source well location, stratigraphic testholes conducted by AGS and the MEG Project site at 6-19-77-5; the cross-section and geophysical logs indicate a continuation of the Empress Formation in four of the five testholes. A groundwater exploration target was chosen based on oil petrophysical logs and from soil samples collected by MEG staff at some of these testholes during the Winter 2005 drilling program

Drilling and Well Completion Details

A 174.6 mm diameter testhole was drilled to a depth of 121 mbgs. Sand and gravel was encountered from 101.8 to 117.0 mbgs and shale bedrock was encountered at 117 mbgs. The testhole was reamed to a final diameter of 279.4 mm and steel water well casing (diameter of 219 mm) was inserted into the testhole to a depth of 100 mbgs. Cement was pumped from the bottom of the hole and forced up to surface along the annular space of the well to ground surface. The cement was allowed to set before continuation of drilling to the well's total depth of 112.8 mbgs. The bottom portion of the testhole was reamed to 200 mm in diameter to accept the 152.4 mm diameter steel water well screen that was placed in the hole from 101.8 to 112.8 m. Development by air and water was conducted to rid the screen area of fine-grained formation sediment. After well development, the water source well was clear and free of fines.

The static (non-pumping) water level in WSW 6-19 was 11.5 m bgs on March 10, 2005. Therefore, the total available drawdown in the well, measured from the static water level to the top of the well screen is 90.3 m (11.5 minus 101.8 m).

An observation well (OBS 6-19) located 40 m south of WSW6-19 was completed from 100.6 to 112.8 mbgs in the same formation as WSW 6-19 and therefore measures the response due to pumping. Sand, silty clay till and gravel was intersected from 104.9 to 113.8 mbgs. Shale bedrock was encountered at 116.4 mbgs.

Pumping Test Details and Results

A pumping test was conducted with both WSW 6-19 and OBS 6-19 instrumented with pressure transducers and dataloggers. A step-drawdown test pumping test was conducted to determine the well loss per pumping rate and to determine the rate of a continual (constant-rate) pumping test. However, the response to pumping at the initial rate of 490 m^3/d (75 igpm) resulted in excessive drawdown. A rate of 327.5 m^3/d (50 igpm) was chosen after a rate of 393 m^3/d (60 igpm) also produced excessive drawdown.

A constant-rate pumping test was commenced on March 12, 2005 and continued for 240 minutes before the pump failed. Due to excessively warm spring weather conditions and impending road bans, a replacement pump was not obtained and the pumping test was terminated. The following results were obtained from the pumping test at the 6-19 location.

Aquifer Parameters

Aquifer transmissivity (T) for WSW 6-19 was determined to be 19 m^2/d (2.23 x 10^{-4} m^2/sec) based pumping test data from 80 to 200 minutes of pumping; the rate of drawdown was 2.5 m per log cycle. Observation well data from OBS 6-19 indicated that the T values determined from both the Theis and the Cooper- Jacobs analytical solutions were 23 m^2/d (2.7 x 10^{-4} m^2/s).

However, from 200 to 240 minutes of pumping, an increase in the rate of drawdown (to 23.75 m per log cycle) was noted in WSW 6-19 which corresponded to a T value 8 m^2/d (9.02 x 10^{-5} m^2/s) and signifies that a barrier boundary was intersected. Based on the latest period of pumping, the corresponding aquifer transmissivity is considered to be 8 m^2/d. An aquifer storativity (S) value of 1.5 x 10^{-4} was determined from OBS 6-19 data.

Figure 2 (Appendix D, Groundwater Exploration) indicates the water level had declined to approximately 50 m below the top of casing after 200 minutes of pumping and that from 200 to 240 minutes of pumping the rate of drawdown had increased significantly (to 23.75 m /log cycle). Pumping for one more log cycle of time, from 200 to 2,000 minutes, would likely decrease the water level in the well from 50 to 73.75 m, or 82 % of the total available drawdown. Therefore, any long-term pumping from the well appears to be unsustainable.

The pumping test indicated that the aquifer and the well at the 6-19 location are unable to meet the 1370 m^3/d water demand of the Pilot operation. Additional groundwater exploration is needed, likely further to the south and closer to the Christina buried bedrock valley. Known groundwater sources completed within the Christina Channel include the drift aquifer utilized by EnCana Corporation at 9-17-76-6.

Groundwater Quality

Central Plant Site

Groundwater samples were collected from shallow monitoring well PSB 04 in March 2004. The samples were submitted to Norwest Labs for the following analyses:

- Benzene, toluene, ethylbenzene and xylenes (BTEX);
- F1 (C_6-C_{10}) and F2 (C_{10}-C_{16}) hydrocarbon fractions;
- Polycyclic Aromatic Hydrocarbons (PAH);
- Dissolved organic carbon (DOC);
- Routine water quality parameters; and
- Total and dissolved metals.

The analytical results are summarized in Table 4-4. For assessment purposes, the analytical results were compared to the criteria listed in the Canadian Environmental Quality Guidelines (CCME 2002). The chemical analysis report issued by Norwest Labs is provided in Appendix D.

The groundwater is a calcium-magnesium/bicarbonate type with a TDS concentration of 324 mg/L. Total manganese, iron, chromium and lead concentrations exceed the CCME criteria. BTEX concentrations were less than the laboratory method detection limit of 0.001 mg/L which is lower than the CCME criteria.

Included in the lab report (Attachment D) is an analysis of groundwater sampled from a borehole/monitoring well (BH2B) located in section 8-77-5. The well is not located at the proposed Central Plant and is therefore provided for baseline information only.

6-19-77-5 Location

A groundwater sample was collected in March 2005 from the test well drilled at 6-19-77-5. The test well was completed from 100.6 to 112.8 m bgs in basal sediments believed to be the Empress Formation (Westwater 2005. The groundwater sample was submitted to Enviro-Test Labs for the following analyses:

- Benzene, toluene, ethylbenzene and xylenes (BTEX);

- F1 (C_6-C_{10}) and F2 (C_{10}-C_{16}) hydrocarbon fractions;
- Dissolved organic carbon (DOC);
- Routine water quality parameters; and
- Total and dissolved metals.

The groundwater is a sodium-bicarbonate type groundwater with concentrations (total) of sodium and bicarbonate of 279 and 761 mg/L, respectively. The total dissolved solids concentration was 737 mg/L which were higher than the Guidelines of Canadian Drinking Water Quality (GCDWQ). Individual constituents including total iron and sodium concentrations of 0.990 and 279 mg/L are greater than the GCDWQ limits (aesthetic objectives) of 0.3 and 200 mg/L, respectively. Full details of the chemical analyses results are provided in Appendix D.

Section Five

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Tables

Table 1-1
CLRP Water Use and Disposal Volumes

	Pilot - Baseline Normal Operations	Commercial Initial Start-up (Commissioning)	Commercial Normal Operations	Commercial Subsequent Start-ups (Turnaround)
Potable Water (m^3/d)	1,370	1,980	50	2,900
Saline Water (m^3/d)	665	149	1,693	0
Disposal (m^3/d)	2,027	1,600	1,600	1,600
Duration (d/yr)	365	172	365	14
Timeline	Year 1	Year 1 to 1.5	Year 1.5 to 26	Emergency only

Notes:
MEG anticipates using a total of 100 m^3/d for domestic, sanitary and equipment flushing/backwashing etc;
50 m^3/d relates to industrial process needs.

Table 3-1
Description of Surficial Drift Formations

Formations	Description
Grand Centre	Till: very coarse sand, rich in igneous and metamorphic rock fragments and poor in quartz and carbonate fragments. Vilna Member: clayey till commonly contains incorporated masses of glacially displaced sediment. Kehiwin Member: silty-sand till overlain by stratified sand and gravel in places. Reita Lake Member: clayey-sand till. Hilda Lake Member: clayey till. Commonly contains incorporated masses of glacially displaced sediment.
Sand River	Stratified sand and gravelly sand, some silt and clay; glacio-lacustrine or glacio-fluvial.
Marie Creek	Till: very coarse sand rich in carbonate fragments. Unit 2: Silty-sand till. Unit 1: Clayey till.
Ethel Lake	Stratified silt and clay: some sand and gravel; glacio-lacustrine origin.
Bonnyville	Till: very coarse sand rich in igneous and metamorphic rock fragments and poor in quartz and metamorphic and carbonate fragments. Unit 2: Sandy diamicton. Unit 1: Clayey diamicton overlain by stratified sediment in some places.
Muriel Lake	Silt, sand and gravel of glacio-fluvial origin.
Bronson Lake	Clayey till: mixed with clay of undetermined origin.
Empress	Stratified sediments overlying bedrock. Unit 3: Stratified sand and gravel: contains clasts derived from the Canadian shield; glacio-fluvial origin. Unit 2: stratified silt and clay: fluvial or lacustrine origin. Unit 1: Stratified sand and gravel: mainly chert and quartzite derived from the Cordilleran Mountains; pre-glacial fluvial origin.

Table 3-2
Surficial Drift Hydrostratigraphic Units

Formation	Aquifer/Aquitard
Grand Centre	Aquitard
Sand River	Aquifer
Marie Creek	Aquitard
Ethel Lake	Aquifer
Bonnyville	Unit 2 - Aquitard Unit 1 (sand and gravel) - Aquifer Unit 1 (till) - Aquitard
Muriel Lake	Aquifer
Bronson Lake	Aquitard
Empress	Unit 3: Aquifer Unit 2: Aquitard Unit 1: Aquifer

Table 3-3
Bedrock Aquifers - Hydraulic Head Values, Existing Wells

Company/Well	Formation	Ground Surface		Completion Interval (m asl)	Hydraulic Head (m asl)	Date
		Location (W4M)	Elevation (m asl)			
Devon Canada Devon ARL 100/12-15-75-06	Grand Rapids (C)	12-15-75-06	628.85	314.8 - 337.6	499.43	March 3/04
EnCana Corporation 3A-16-76-6	Clearwater	3-16-76-6	569.63	255.8 - 289.8	379.95	March 19/04
MEG Energy MEG Hardy 10-29-77-5	McMurray D4 (Basal)	10-29-77-5	573.50	176.9 - 209.4	384.20	March 26/04

Table 3-4
Surficial Drift Aquifers - Hydraulic Head Values, EnCana and Devon Project Sites
EnCana Christina Lake Project

Well Name	Location (W4M)	Ground Surface Elevation (m asl)	Completion Interval (m asl)	Top of Casing Elevation[1] (m asl)	Formation [2]	Water Level Elevations (m asl)						
						Oct 17/01	Nov 13/01	Jul 25/02	Oct 21/02	Jul 07/03	Oct 27/03	Dec 31/04
MW01	11-08-076-06	575.08	436.08 - 442.18	575.66	Empress/Muriel Lake	551.47	551.49	550.84	550.55	549.06	548.43	-
MW02	11-08-076-06	575.29	491.79 - 497.89	575.95	Bonnyville Unit 2	574.52	575.63	575.90	575.67	575.24	575.77	-
MW03	11-08-076-06	575.28	521.68 - 527.78	575.88	Marie Creek	572.72	572.65	572.88	573.19	inaccessible	573.39	-
MW04	11-08-076-06	575.13	550.73 - 556.83	575.71	Marie Creek	570.45	570.25	571.19	571.70	571.82	572.17	-
MW05	11-08-076-06	575.28	568.58 - 571.58	575.92	Marie Creek	570.45	573.80	574.75	573.72	572.86	574.33	-
MW06	08-17-076-06	564.57	421.27 - 427.37	564.93	Empress	557.44	557.39	555.15	554.56	551.65	549.52	-
MW07	08-17-076-06	564.50	448.10 - 454.20	564.95	Muriel Lake	555.81	555.79	554.27	553.78	564.95	549.97	-
MW08	08-17-076-06	566.96	490.76 - 496.86	567.46	Bonnyville Unit 2	567.46	567.46	566.96	567.46	567.46	inaccessible	-
MW09	08-17-076-06	567.54	505.04 - 511.14	568.04	Bonnyville Unit 2	568.04	568.04	567.54	Frozen	568.04	inaccessible	-
MW10	08-17-076-06	567.18	521.48 - 530.58	567.83	Marie Creek	567.83	567.83	567.18	567.83	inaccessible	565.39	-
MW11	08-17-076-06	563.99	540.79 - 546.89	564.97	Marie Creek	564.18	564.18	564.23	564.12	564.26	564.16	-
MW12	07-16-076-06	566.38	411.88 - 422.48	566.95	Empress	554.13	554.15	553.47	553.06	551.31	550.56	-
MW13	07-16-076-06	566.49	447.59 - 453.69	567.14	Empress	554.33	554.25	553.53	553.14	551.45	550.70	-
MW14	07-16-076-06	566.68	542.28 - 548.38	567.32	Marie Creek	566.38	566.57	558.87	566.55	566.47	566.56	-
MW15	07-16-076-06	566.87	554.67 - 560.77	567.41	Marie Creek	565.95	566.12	566.22	566.18	566.13	566.02	-
WSW-CAMP-01	11-08-076-06	576.70	492.60 - 497.50	577.28	Bonnyville Unit 2	-	-	-	-	-	-	-
WSW-CAMP-02	11-08-076-06	576.70	540.70 - 546.70	577.20	Marie Creek	-	-	-	-	-	-	-
WSW-09-17B	09-17-076-06	562.60	426.70 - 438.90	563.13	Empress & Muriel Lake	-	-	-	-	-	-	541.15
WSW-09-17A	09-17-076-06	562.60	423.00 - 435.20	563.15	Empress & Muriel Lake	-	-	-	-	-	-	539.69
OBW09-17	09-17-076-06	562.31	423.31 - 440.41	563.07	Empress & Muriel Lake	-	-	-	-	-	-	-

[1] Elevation at time of drilling
[2] Based on WEPAOO-2 as type log (Andriashek 2003) and Figure 3-16
- not available

Devon Jackfish Project

Well Name	Location (W4M)	Ground Surface Elevation (m asl)	Completion Interval (m asl)	Top of Casing Elevation (m asl)	Formation [1]	Water Level Elevations (m asl)[2]	
						Mar 06/04	Mar 11/04
12-28 OBS	12-28-075-06	604.00	499.50 - 502.50	unknown	Muriel Lake	-	623.70
12-28 PW	12-28-075-06	604.00	498.50 - 503.10	unknown	Muriel Lake	-	624.40
BH-10 S-7C	27-75-06	615.50	610.20 - 611.70	616.40	Grand Centre/Marie Creek	613.72	-
BH-10 S-7B	27-75-06	615.30	605.40 - 606.90	615.90	Grand Centre/Marie Creek	613.38	-
BH-10 S-7A	27-75-06	615.40	600.90 - 602.40	616.50	Grand Centre/Marie Creek	613.05	-
BH-21 S-3C	28-75-06	622.06	616.76 - 618.46	622.86	Grand Centre/Marie Creek	619.23	-
BH-21 S-3B	28-75-06	622.18	612.28 - 613.78	622.78	Grand Centre/Marie Creek	618.85	-
BH-21 S-3A	28-75-06	622.05	607.55 - 609.15	623.05	Grand Centre/Marie Creek	618.64	-
BH-21A S-3D	-	622.18	588.38 - 589.88	623.08	Grand Centre/Marie Creek	619.01	-

[1] Based on Devon (2004)
[2] both 12-28 OBS and 12-28 PW are flowing wells
- not available

Table 3-5
Alberta Geological Survey Well Completion Details

Well Name	Casing Elevation (m asl)	Casing Stick-up (m)	Latitude	Longitude	Location (W4M)	Base of Borehole Elevation (m asl)	Screen Bottom Elevation (m asl)	Screen Top Elevation (m asl)	Screen Length (m)
WEPA 00-1-15(WT)	667.64	0.81	55° 27' 05.09818" N	111° 19' 47.39254" W	06-33-74-09	587.63	591.38	594.43	3.05
WEPA 00-1-41	667.77	0.67	55° 27' 04.95580" N	111° 19' 47.36799" W	06-33-74-09	545.20	546.79	549.84	3.05
WEPA 00-1-76	667.76	0.77	55° 27' 04.97877" N	111° 19' 47.85091" W	06-33-74-09	625.99	625.99	629.04	3.05
WEPA 00-1-120	667.68	0.76	55° 27' 04.95449" N	111° 19' 47.60280" W	06-33-74-09	651.38	651.48	657.58	6.10
WEPA 00-3-17(WT)	648.78	0.61	55° 28' 22.94421" N	110° 42' 26.27401" W	16-04-75-05	488.17	489.70	492.75	3.05
WEPA 00-3-79	648.84	0.58	55° 28' 22.82440" N	110° 42' 26.34634" W	16-04-75-05	568.26	568.62	571.67	3.05
WEPA 00-3-158	648.87	0.67	55° 28' 22.71083" N	110° 42' 26.40223" W	16-04-75-05	630.53	630.85	636.95	6.10
WR 99-1-8(WT)	663.77	0.62	55° 42' 51.83139" N	112° 11' 16.34102" W	03-08-77-14	432.35	432.55	435.60	3.05
WR 99-1-230	663.75	0.68	55° 42' 51.76583" N	112° 11' 16.49312" W	03-08-77-14	654.71	654.88	657.93	3.05

Table 3-6
Surficial Drift Aquifers - Hydraulic Head Values, AGS WEPA Series Monitoring Wells

Well Name	WEPA 00-1-15(WT)		WEPA 00-1-41		WEPA 00-1-76		WEPA 00-1-120		WEPA 00-3-17(WT)		WEPA 00-3-79		WEPA 00-3-158	
Formation	Sand River Fm		Bonnyville Fm Unit 2		Bonnyville Fm Unit 2		Bonnyville Fm Unit 1		Marie Creek		Bonnyville Fm Unit 2		Empress Fm Interfluve	
Casing Elevation (m asl)	667.644		667.768		667.757		667.678		648.781		648.840		648.869	
Water Level	(m btoc)	(m asl)	(m btoc)	(m asl)	(m btoc)	(m asl)	(m btoc)	(m asl)	(m btoc)	(m asl)	(m btoc)	(m asl)	(m btoc)	(m asl)
2-Nov-00					10.190	657.567								
3-Nov-00					10.220	657.537								
4-Nov-00	5.170	662.474			10.160	657.597	11.920	655.758						
5-Nov-00	4.710	662.934	9.020	658.748	10.190	657.567	11.940	655.738						
9-Nov-00													40.530	608.339
10-Nov-00									11.930	636.851	28.440	620.400	40.520	608.349
21-Nov-00	4.700	662.944	9.020	658.748	10.190	657.567	11.930	655.748	11.750	637.031	24.290	624.550	40.470	608.399
6-Dec-00	4.750	662.894	9.020	658.748	10.180	657.577	11.900	655.778	11.720	637.061	24.290	624.550	40.460	608.409
5-Feb-01	4.980	662.664	9.160	658.608	10.290	657.467	11.980	655.698	11.790	636.991	24.290	624.550	40.480	608.389
19-Mar-01	5.140	662.504	9.225	658.543	10.350	657.407	12.020	655.658	11.830	636.951	24.250	624.590	40.450	608.419
24-Apr-01	5.220	662.424	9.300	658.468	10.420	657.337	12.090	655.588	11.865	636.916	24.280	624.560	40.510	608.359
7-May-01	5.210	662.434	9.290	658.478	10.410	657.347	12.090	655.588						
10-May-01									11.880	636.901	24.280	624.560	40.500	608.369
22-May-01	5.190	662.454	9.270	658.498	10.390	657.367	12.070	655.608						
23-May-01									11.870	636.911	24.340	624.500	40.490	608.379
21-Jun-01	5.030	662.614	9.160	658.608	10.320	657.437	12.040	655.638	11.770	637.011	24.320	624.520	40.480	608.389
25-Jul-01	4.290	663.354	9.050	658.718	10.240	657.517	11.980	655.698	11.600	637.181	24.310	624.530	40.420	608.449
27-Aug-01	4.530	663.114	9.070	658.698	10.240	657.517	11.990	655.688	11.390	637.391	24.340	624.500	40.450	608.419
25-Sep-01	4.730	662.914	9.100	658.668	10.260	657.497	11.990	655.688	11.200	637.581	24.320	624.520	40.480	608.389
25-Oct-01	4.860	662.784	9.130	658.638	10.290	657.467	12.030	655.648	11.270	637.511	24.340	624.500	40.550	608.319
26-Nov-01	4.960	662.684	9.150	658.618	10.300	657.457	12.020	655.658	11.220	637.561	24.340	624.500	40.570	608.299
3-Jul-02	5.290	662.354	9.240	658.528	10.390	657.367	12.100	655.578	11.360	637.421	24.290	624.550	40.510	608.359
10-Jun-03	4.980	662.664	9.020	658.748	10.190	657.567	11.940	655.738	11.260	637.521	24.260	624.580	40.520	608.349
10-Sep-04	3.400	664.244	8.525	659.243	9.740	658.017	11.565	656.113	10.545	638.236	24.290	624.550	40.585	608.284

m btoc - metres below top of casing

Table 3-7
Bedrock Aquifers - Hydraulic Parameters Derived From Pumping Tests

Grand Rapids Formation				
Well Name	**Location (W4M)**	**Transmissivity (m^2/d)**	**Storativity (unitless)**	**Source**
Surmont 8-25	8-25-83-7	33 to 155	3.1×10^{-6} to 3.1×10^{-4}	Stanley Associates, 1981
(basal sand)				Sentar, 1997
				Conoco Phillips, 2001
Devon 12-15	12-15-75-6	54	9.5×10^{-5}	Devon, 2004

Clearwater Formation				
Well Name	**Location (W4M)**	**Transmissivity (m^2/d)**	**Storativity (unitless)**	**Source**
EnCana 3-16	3-16-76-6	6 to 11	NA	Westwater, 2004 (c)

McMurray Formation				
Well Name	**Location (W4M)**	**Transmissivity (m^2/d)**	**Storativity (unitless)**	**Source**
MEG Hardy 10-29	10-29-77-5	44 to 88	NA	Westwater, 2004 (b)

NA - not available

Table 3-8
Surficial Drift Aquifers - Hydraulic Parameters

Derived from Pumping Tests

Well Name	Location (W4M)	Formation*	Ground Surface Elevation (m asl)	Completion Interval (m asl)	Transmissivity (m^2/d)	Storativity (unitless)	Reference
EnCana WSW 9-17	09-17-076-06	Empress & Muriel Lake	562.60	423.00 - 435.20	800	2.4×10^{-3}	CG&S,1999
EnCana Camp 1	11-08-076-06	Bonnyville Unit 2	576.70	492.60 - 497.50	5.8	6.0×10^{-5}	CH2M, 2001
EnCana Camp 2	11-08-076-06	Marie Creek	576.70	540.70 - 546.70	1.9	-	CH2M, 2001
AEC 12-1	12-01-073-06	Terrace Sand		- -	345 - 514	-	Stein et.al.,1993

* based on correlation to WEPA00-2 type log (Andriashek 2003)
- not available

Derived from Bail Tests

Well Name	Location (W4M)	Formation*	Ground Surface Elevation (m asl)	Completion Interval (m asl)	Hydraulic Conductivity (m/s)
MW05	10-08-076-06	Marie Creek	575.28	568.58 - 571.58	4.38×10^{-8}
MW11	08-17-076-06	Marie Creek	563.99	540.79 - 546.89	7.96×10^{-7}
MW03	10-08-076-06	Marie Creek	575.28	521.68 - 527.78	1.14×10^{-7}
MW10	08-17-076-06	Marie Creek	567.18	521.48 - 530.58	7.18×10^{-6}
MW15	07-16-076-06	Marie Creek	566.87	554.67 - 560.77	4.13×10^{-6}
MW02	10-08-076-06	Bonnyville Unit 2	575.29	491.79 - 497.89	6.86×10^{-6}
MW08	08-17-076-06	Bonnyville Unit 2	566.96	490.76 - 496.86	6.73×10^{-5}
MW09	08-17-076-06	Bonnyville Unit 2	567.54	505.04 - 511.14	1.43×10^{-5}
MW07	08-17-076-06	Muriel Lake	565.50	448.10 - 454.20	2.79×10^{-6}
MW06	08-17-076-06	Empress	564.57	421.27 - 427.37	4.03×10^{-6}
MW12	07-16-076-06	Empress	566.38	411.88 - 422.48	1.38×10^{-6}
MW13	07-16-076-06	Empress	566.49	447.59 - 453.69	3.93×10^{-6}

* based on correlation to WEPA00-2 type log (Andriashek 2003) and e-log at 9-17-76-6

- not available

Reference: CH2M, 2001

Table 3-9
McMurray Formation Water Quality Within MEG's RSA

Location (W4M)	Date Sampled	Sodium (mg/L)	Chloride (mg/L)	TDS Calculated (mg/L)
6-22-78-4	13-Jan-86	5,730	9,400	16,564
9-10-81-4	18-Jan-93	7,470	13,640	22,296
12-20-80-4	16-Nov-91	10,400	16,700	29,290
11-30-81-4	16-Mar-81	3,858	5,310	10,424
10-27-82-2	6-Feb-79	2,712	4,340	7,494
15-14-80-5	16-Nov-91	7,900	12,100	21,865
3-11-80-8	12-Mar-91	2,640	3,450	7,491
6-7-78-11	8-Mar-58	3,266	4,375	8,922
10-27-78-7	9-Feb-81	3,356	4,847	9,452
10-23-81-9	9-Feb-75	2,436	3,400	6,811
5-20-78-10	26-Jan-92	2,130	2,950	6,169
7-21-81-5	23-Mar-89	7,445	12,490	22,149
7-22-77-13	7-Mar-75	1,399	880	4,697
5-23-79-4	17-Dec-82	7,650	13,000	22,415
10-31-79-8	7-Mar-70	2,893	3,930	8,072
11-18-77-5	22-Feb-93	3,200	4,367	8,892
7-13-77-6	-	2,990	4,270	8,544
13-1-78-6	18-Mar-85	1,950	2,700	5,634
7-32-80-6	9-Feb-86	3,450	4,564	9,770
6-8-80-9	19-Feb-75	1,327	620	4,701
10-27-80-6	22-Feb-70	2,546	3,360	7,261
16-15-81-8	12-Jan-91	2,950	4,380	8,690
6-30-78-5	22-Mar-83	3,170	4,275	9,226
10-6-82-8	9-Feb-70	1,366	1,300	3,970
10-22-77-9	27-Jan-74	2,577	3,502	7,407
10-14-80-8	18-Jan-71	3,520	4,863	9,690
6-11-82-2	4-Mar-78	4,725	8,477	14,576
10-5-77-6	3-Feb-67	3,592	5,156	9,878
11-8-79-7	28-Jan-80	2,993	4,160	8,344
6-16-80-4	16-Nov-91	10,600	18,000	30,804
15-10-80-10	16-Jan-85	3,400	4,805	9,861
7-34-81-5	16-Nov-91	9,100	16,200	27,135
6-34-79-6	9-Feb-78	3,987	5,450	11,014
12-27-78-4	-	4,585	6,853	12,605
9-1-80-8	26-Jan-59	3,701	5,250	10,356
6-28-78-13	6-Mar-80	4,461	6,750	12,486
5-15-78-4	25-Feb-93	5,330	8,496	15,340
7-29-80-4	16-Nov-91	8,800	15,200	25,650
11-3-80-5	1-Oct-92	4,140	6,550	11,985
8-33-81-7	27-Feb-81	350	219	1,307
3-20-79-8	12-Mar-94	4,200	5,900	11,698
8-18-80-11	7-Feb-91	2,350	2,920	6,876
5-14-80-12	14-Feb-90	1,560	1,510	4,787

- not available

Reference: Conoco, 2001

Table 3-10
Clearwater Formation Water Quality Within MEG's RSA

Location	Date	Na	K	Ca	Mg	Cl	HCO_3	SO_4	CO_3	TDS	Resistivity	pH	Formation
100/11-01-074-05-W4/00	6/23/80	1830	23	17	23	2495	885	255	12	5540	1.12	8.8	Wabiskaw Mbr.
100/07-05-074-05-W4/00	2/1/79	6775	-	110	116	10240	1240	31	-	18512	0.364	8.2	Wabiskaw Mbr.
100/11-23-074-07-W4/00	2/17/80	2837	20	34	34	3140	2309	14	50	8438	0.88	8.4	Wabiskaw Mbr.
100/10-17-074-08-W4/00	1/23/81	2721	23	67	50	3127	2222	86	-	8296	0.741	7.5	Wabiskaw Mbr.
100/09-13-075-04-W4/00	2/2/93	3350	149	37.6	12.3	5230	1130	4.2	-	9913	0.62	7.74	Wabiskaw Mbr.
100/09-13-075-04-W4/00	1/8/93	8230	25.9	110	145	12500	390	13.8	-	21414	0.25	7.69	Clearwater
100/06-17-075-05-W4/00	2/2/78	9496	-	215	191	15470	163	28	-	25563	0.282	7.3	Clearwater
100/11-33-075-05-W4/00	1/19/93	3610	23.4	54.2	23	6000	223	38.2	-	9974	0.51	7.2	Clearwater
100/16-35-075-06-W4/00	3/9/81	2468	60	120	7	3027	1777	47	-	7506	0.849	7.9	Wabiskaw Mbr.
100/16-35-075-06-W4/00	3/9/81	2624	16	48	47	2309	1812	29	-	7785	0.81	7.7	Wabiskaw Mbr.
100/06-29-075-07-W4/00	2/24/77	1844	-	4	10	2309	859	1	53	5090	1.2	8.6	Clearwater
100/06-04-075-08-W4/00	3/11/79	3326	-	50	39	4500	1425	6		9346	0.653	7.9	Wabiskaw Mbr.
100/07-06-076-04-W4/00	1/13/92	3200	19	65	33	4800	651	105	26	8899	0.687	8.6	Clearwater
100/13-10-076-04-W4/00	1/26/93	805	20.5	17.4	7.1	704	986	177	30	2746	2.05	8.64	Wabiskaw Mbr.
100/13/10-076-04-W4/00	1/26/93	1970	14.7	15.3	6.2	2780	848	7.7	18	5659	1.01	8.33	Clearwater
100/01-01-076-05-W4/00	3/11/93	6320	26	160	157	10160	581	33	-	17437	0.398	7.7	Clearwater
100/09-20-076-05-W4/00	1/5/92	1650	9	14	12	1750	954	354	38	4781	1.33	8.6	Clearwater
100/15-02-076-06-W4/00	2/9/80	1774	11	24	20	2155	1000	43	66	5093	1.3	8.8	Clearwater
100/11-14-076-06-W4/00	2/16/77	1450	-	15	7	1830	771	6	-	4079	2.22	8.3	Clearwater
100/07-19-076-06-W4/00	2/15/76	1266	-	26	8	1575	704	31	13	3623	1.73	8.8	Clearwater
100/06-26-076-06-W4/00	2/27/78	1355	-	47	33	1626	839	195	10	4105	1.69	8.5	Clearwater
100/11-30-076-07-W4/00	2/4/78	4189	-	14	6	5820	537	140	228	10934	0.655	9.5	Clearwater
100/11-30-076-07-W4/00	2/4/78	2660	-	-	-	3410	507	156	240	6973	0.872	9.5	Clearwater
100/10-32-076-08-W4/00	3/16/76	2143	-	24	14	2992	635	12	14	5834	0.975	8.4	Clearwater
100/02-18-077-04-W4/00	1/8/86	3420	12	105	35	4810	1235	362	-	9979	0.573	8.3	Wabiskaw Mbr.
100/11-18-077-05-W4/00	2/22/93	3200	14	44	33	4367	1233	1	-	8892	0.81	8	Wabiskaw Mbr.
100/10-03-077-06-W4/00	2/15/76	1857	-	16	9	2390	830	19	27	5148	1.25	8.6	Clearwater
100/10-05-077-06-W4/00	2/3/67	3592	-	84	24	5156	866	56	-	9878	0.678	7.6	Wabiskaw Mbr.
100/07-13-077-06-W4/00		2990	19	38	30	4270	1180	1	15	8544	0.7	8.2	Wabiskaw Mbr.
100/06-16-077-06-W4/00	2/17/77	1940	-	25	13	2600	815	-	-	5393	1.18	8.1	Clearwater
100/06-16-077-06-W4/00	2/17/77	1822	-	14	10	2401	791	-	-	5038	1.2	8	Clearwater
100/06-24-077-07-W4/00	1/28/76	1014	-	8	2	1063	792	49	20	2948	2.27	8.7	Clearwater
100/10-03-077-08-W4/00	2/7/78	1490	-	17	6	2002	344	3	120	3982	1.5	8.8	Clearwater
100/10-20-077-08-W4/00	1/22/78	2105	-	20	9	2912	625	37	5	5713	1.16	8.4	Clearwater
100/05-15-078-04-W4/00	2/25/93	5330	68	115	114	8496	1187	30	-	15340	0.427	7.3	Wabiskaw Mbr.
100/06-22-078-04-W4/00	1/13/86	5730	24	200	176	9400	771	263	-	16564	0.365	8.2	Wabiskaw Mbr.
100/12-27-078-04-W4/00		4585	-	53	120	6853	800	74	120	12605	0.594	9.4	Wabiskaw Mbr.

Table 3-10
Clearwater Formation Water Quality Within MEG's RSA

Location	Date	Na	K	Ca	Mg	Cl	HCO_3	SO_4	CO_3	TDS	Resistivity	pH	Formation
100/06-30-078-05-W4/00	3/22/83	3170	21	76	46	4275	1547	91	-	9226	0.621	8	Wabiskaw Mbr.
100/13-01-078-06-W4/00		1950	31	37	14	2700	836	21	44	5634	1.18	8.6	Wabiskaw Mbr.
100/11-14-078-06-W4/00	1/15/80	1610	2	24	18	2175	830	156	12	4827	1.34	8.5	Clearwater
100/06-16-076-07-W4/00	2/10/77	1301	-	15	5	1678	547	23	29	3598	1.74	8.6	Clearwater
100/13-10-076-04-W4/00	1/26/93	1910	11.6	17.8	7.3	2740	933	32.7	-	5652	0.94	8.07	Wabiskaw Mbr.
100/05-22-078-07-W4/00		2030	150	16	13	3020	523	6	47	5805	1.14	8.8	Clearwater
100/10-27-078-07-W4/00	2/9/81	1698	12	32	3	2178	844	37	-	4804	1.34	8	Clearwater
100/10-27-078-07-W4/00	2/9/81	3356	20	73	58	4847	1053	45	-	9452	0.622	7.8	Wabiskaw Mbr.
100/10-01-078-08-W4/00	3/10/74	1936	-	31	7	2640	698	18	-	5330	1.08	8.2	Clearwater
100/10-01-078-08-W4/00	3/11/74	1027	-	36	12	1247	639	88	-	3049	2.007	8.2	Clearwater
100/10-01-078-08-W4/00	3/11/74	1930	-	31	4	2624	693	20	-	5302	1.1	8.1	Clearwater
100/10-13-078-08-W4/00	2/23/76	2010	-	24	10	2735	624	21	50	5474	1.12	9.1	Clearwater
100/10-13-078-08-W4/00	2/1/76	1850	-	17	9	2495	650	33	10	5064	1.2	8.6	Clearwater
100/10-21-078-08-W4/00	3/20/76	2073	-	19	11	2758	830	14	12	5717	1.07	8.5	Clearwater
100/10-21-078-08-W4/00	3/16/76	1956	-	19	6	2574	723	35	41	5354	1.12	8.6	Clearwater

- not available

Reference: CG&S 1999 and RPCL Geofluids Database

Table 3-11
Grand Rapids Formation Water Quality Within MEG's RSA

Location	Date	Na	K	Ca	Mg	Cl	HCO_3	SO_4	CO_3	TDS	Resistivity	pH
100/07-19-074-04-W4/00		1519	17	31	11	1970	801	14		4363	1.37	8.3
100/07-05-074-05-W4/00	3/11/77	4000	-	56	34	5970	654	25	-	10739	0.704	8.1
100/08-21-074-05-W4/00		3833	-	136	35	5580	494	527	-	10605	0.58	7.7
100/10-09-074-07-W4/00	3/13/77	1332	-	32	-	1560	507	272	48	3751	1.61	9.2
100/11-23-074-07-W4/00	2/18/80	367	5	9	4	69	763	117		1334	7.21	8.3
100/06-30-074-08-W4/00	1/25/78	877	-	5	2	951	354	109	110	2408	2.41	8.9
100/06-30-074-08-W4/00	1/25/78	539	-	5	2	152	1125	19	22	1864	4.66	8.7
100/16-27-075-04-W4/00	1/14/93	199	6.1	6.8	16.6	59.5	466	45.6	6	805	8.26	8.29
100/06-17-075-05-W4/00	2/4/78	584	-	6	2	300	927	86	12	1917	4.21	8.8
100/11-33-075-05-W4/00	1/19/93	538	11.3	12.4	2	418	447	199	10	1638	2.73	8.3
100/06-10-075-06-W4/00	2/11/78	882	-	8	3	1055	439	91	5	2483	2.67	8.4
100/10-04-075-07-W4/00	9/10/77	209	-	62	12	36	379	41	5	1044	9.95	8.5
100/10-11-075-07-W4/00	2/21/78	556	-	22	38	66	1447	74	38	2241	5.36	9.1
100/06-16-075-07-W4/00	3/3/81	432	16	7	2	15	807	292	-	1571	8.83	7.9
100/06-16-075-07-W4/00	3/3/81	370	23	9	14	16	856	182	-	1470	8.83	8.3
100/06-29-075-07-W4/00	2/25/77	472	-	12	17	85	776	238	72	1672	8	8.8
100/06-04-075-08-W4/00	3/12/79	524	-	6	3	261	844	91	7	1736	3.1	8.6
100/12-08-075-08-W4/00	1/28/94	386	39.3	13.1	10.7	130	778	105	-	1481	5.43	8.18
100/10-08-076-05-W4/00	3/5/81	521	43	19	4	101	878	288	54	1908	6.2	8.7
100/10-20-077-08-W4/00	1/24/78	460	-	6	5	153	691	163	50	1528	5.9	8.6
100/06-16-078-07-W4/00	2/10/77	356	-	2	1	72	705	31	43	1210	7.09	9
100/11-17-078-07-W4/00	1/30/78	466	-	10	1	297	-	136	279	1195	4.3	10.5

- not available

Reference: CG&S 1999 and RPCL Geofluids Database

Table 3-12
Domestic Wells[1] and Industrial Water Source Wells

Well No.	Owner	Location (W4M)	Use	Total Drilled Depth (m bgs)	Year Completed	Completion Interval (m bgs)	Water Level (m bgs)	Date Measured
1	EnCana	09-17-076-06	Industrial- source	152.4	1998	127.40 - 139.60	21.45	31-Dec-04
2	EnCana	09-17-076-06	Industrial stand-by	138.4	2001	123.70 - 135.40	22.91	31-Dec-04
3	EnCana	11-08-076-06	Domestic- camp	86.9	2001	79.20 - 84.10	-	-
4	EnCana	11-08-076-06	Domestic- camp	42.6	2001	30.00 - 36.00	-	-
5	Conoco	08-25-083-07	Industrial- source		1997	180.40 - 199.20	105.5 m btoc	1997
6	Paramount	12-02-081-06	Industrial			-	-	-
7	Orion	12-077-09	Industrial -drilling	152.4	2004	116.15 - 120.70	7.19	27-Nov-04
8	Devon	12-28-075-06	Industrial-source	109.1	2004	100.90 - 105.50	(Flowing, >19.7 m ags)	11-Mar-04
9	Can Worldwide	08-04-077-05	Domestic	66.4	1986	62.48 - 64.01	7.92	1986
10	Bailey Selburn Oil	10-29-077-06	Industrial	426.7	1975	-	-	1975
11	Home Oil Co.	03-03-078-06	Industrial	426.7	1967	-	-	1967
12	Bailey Selburn Oil	07-15-078-05	Industrial	442.0	1974	-	-	1974
13	Bailey Selburn Oil	10-29-076-05	Industrial	410.9	1974	-	-	1974
14	Can Worldwide	05-31-076-05	Domestic	56.7	1986	54.86 - 56.39	6.40	1986
15	Venture Seismic Ltd.	09-31-076-05	Industrial (SSH)	9.8	1990	-	-	1990
16	Venture Seismic Ltd.	09-31-076-05	Industrial (SSH)	9.8	1990	-	-	1990
17	Venture Seismic Ltd.	09-31-076-05	Industrial (SSH)	9.8	1990	-	-	1990
18	Venture Seismic Ltd.	09-31-076-05	Industrial (SSH)	9.8	1990	-	-	1990
19	Lapointe, Jose	SW-31-076-05	Domestic	30.5		-	-	-
20	Venture Seismic Ltd.	09-31-076-05	Industrial (SSH)	9.8	1990	-	-	1990
21	Alta Housing	00-31-076-06	Domestic	44.2	1984	19.81 - 21.34	18.29	1984
22	Alta Housing	00-31-076-06	Domestic	54.9	1981	22.86 - 24.38	12.80	1981
23	Venture Seismic Ltd.	12-36-076-06	Industrial (SSH)	9.8	1990	-	-	1990
24	Venture Seismic Ltd.	12-36-076-06	Industrial (SSH)	9.8	1990	-	-	1990
25	Home Oil Co.	10-05-077-06	Industrial	414.5	1967	-	-	1967
26	Benson Construction	02-17-077-06	Domestic	85.3	1993	-	-	1993

Notes:
[1] Source: Alberta Environment Water Well Database (Well Nos. 9-26 inclusive)
- Not Available
SSH Seismic Shot-hole
m bgs metres below ground surface
m ags metres above ground surface
m btoc metres below top of casing

Table 3-13

Summary of Disposal Well Search*

Legal Location	Well Name	Current Status	License Number	Licensee	Injection Zone	Injection Start Date	License Date	Completion Top (m KB)	Cumulative Injection Volume (m^3)	Current Monthly Injection Volume (m^3)
100/09-25-073-05 W4/00	AMOCO KIRBY 9-25-73-5	WATER DISPOSAL	0083059	BP CANADA ENERGY COMPANY	WINNIPEGOSIS FM	11/1/1983	27/05/1980	785.0	34,633	238
103/12-01-073-06 W4/00	AEC 08 KIRBY 12-1-73-6	WATER DISPOSAL	0100818	ENCANA CORPORATION	BEAVERHILL LAKE FM	2/1/1993	3/1/1983	548.0	33,554	0
100/10-11-073-06 W4/02	AEC AMOCO IPIATIK KIRBY 10-11-73-6	SUS POT WAT DISP	0082319	ENCANA CORPORATION	NOT AVAILABLE	5/1/1984	23/04/1980	323.0	218,357	3,455
100/12-08-074-05 W4/00	AMOCO ET AL KIRBY 12-8-74-5	WATER DISPOSAL	0175930	BP CANADA ENERGY COMPANY	MCMURRAY FM	6/1/1995	2/9/1995	453.0	122,370	1,153
100/07-08-075-05 W4/00	ARL 7D KIRBY 7-8-75-5	WATER INJECTOR	0245520	DEVON ARL CORPORATION	MCMURRAY FM	3/9/2001	12/1/2000	452.0	108,027	116
100/05-24-075-05 W4/00	TALISMAN KIRBY 5-24-75-5	WATER INJECTOR	0196745	TALISMAN ENERGY INC.	MCMURRAY FM	2/1/1998	15/01/1997	327.5	9,221	84
100/12-05-076-06 W4/00	ANDERSON LEISMER 12-5-76-6	WATER DISPOSAL	0210118	DEVON CANADA CORPORATION	CLEARWATER FM	26/03/1998	12/10/1997	307.0	149,481	3,226
100/03-16-076-06 W4/00	PCP PCR LEISMER 3-16-76-6	WATER DISPOSAL	0249290	ENCANA CORPORATION	NOT AVAILABLE		18/01/2001	398.3	1,439,502	67,054
100/04-16-076-06 W4/00	CS LEISMER 4-16-76-6	WATER DISPOSAL	0212041	ENCANA CORPORATION	MCMURRAY FM		15/01/1998	403.5	263,496	3,647
102/07-16-076-06 W4/00	PCP PCR 7B LEISMER 7-16-76-6	WATER DISPOSAL	0249293	ENCANA CORPORATION	MCMURRAY FM	5/11/2002	18/01/2001	405.7	463,474	23,730
100/12-11-076-10 W4/00	PARA SWD LEISMER 12-11-76-10	WATER DISPOSAL	0207356	PARAMOUNT ENERGY OPERATING CORP.	DEVONIAN SYSTEM	4/3/1998	17/10/1997	474.0	4,161	614
100/07-22-076-12 W4/00	RAX CLYDEN 7-22-76-12	WATER INJECTOR	0185032	CANADIAN NATURAL RESOURCES LIMITED	CLEARWATER SD	6/1/1996	25/01/1996	428.0	14,293	173
100/03-07-077-07 W4/00	HOME LEISMER 3-7-77-7	WATER DISPOSAL	0080199	DEVON CANADA CORPORATION	MANNVILLE GRP	8/1/1982	1/3/1980	210.0	280,605	1,470
100/12-21-077-08 W4/03	PARA ET AL LEISMER 12-21-77-8	WATER DISPOSAL	0176350	BP CANADA ENERGY COMPANY	MANNVILLE GRP	2/10/1999	23/02/1995	191.3	40,720	443
100/15-23-077-09 W4/02	AMOCO LEISMER 15-23-77-9	WATER DISPOSAL	0068587	BP CANADA ENERGY COMPANY	KEG RIVER FM	7/9/1979	27/02/1978	788.0	445,565	1,588
100/05-15-078-04 W4/00	TRANSWEST HARDY 5-15-78-4	WATER DISPOSAL	0119980	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	2/1/1992	12/3/1985	311.0	223,488	993
102/10-22-078-05 W4/00	RAX 102 HARDY 10-22-78-5	WATER DISPOSAL	0233812	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	27/02/2000	16/02/2000	340.0	105,208	1,113
100/03-18-079-07 W4/00	RAX SWD LEISMER 3-18-79-7	WATER DISPOSAL	0175569	CANADIAN NATURAL RESOURCES LIMITED	GLAUCONITIC SS	4/1/1995	31/01/1995	207.0	326,942	4,160
102/11-15-079-09 W4/00	PARA 102 LEISMER 11-15-79-9	WATER DISPOSAL	0276508	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	8/1/2003	22/11/2002	447.5	32,073	843
102/11-16-079-09 W4/00	PARA ETAL 102 SWD LEISMER 11-16-79-9	WATER DISPOSAL	0265434	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	8/1/2002	31/12/2001	458.0	38,959	728
100/10-36-079-12 W4/00	LOGAN ET AL THORNBURY 10-36-79-12	SUS POT WAT DISP	0148015	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	3/1/1992	15/02/1991	435.0	40,661	704
100/12-20-080-04 W4/00	RAX GRAHAM 12-20-80-4	SUSPENDED GAS	0147155	CANADIAN NATURAL RESOURCES LIMITED	WABISKAW-MCMURRAY	1/10/1998	27/12/1990	254.0	3,046	1,132
100/12-20-080-04 W4/02	RAX GRAHAM 12-20-80-4	WATER DISPOSAL	0147155	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	15/10/1998	27/12/1990	203.0	314,472	2,913
100/10-14-080-08 W4/02	NORTHSTAR ET AL PONY 10-14-80-8	WATER DISPOSAL	0164938	NORTHSTAR ENERGY CORPORATION	CLEARWATER FM	4/1/1996	2/10/1994	286.0	51,905	352
100/06-06-080-11 W4/00	RAX ET AL THORNBURY 6-6-80-11	WATER INJECTOR	0150979	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	8/1/2002	12/11/1991	430.3	3,232	86
102/15-02-081-06 W4/00	PARA ET AL SWD NEWBY 15-2-81-6	WATER DISPOSAL	0209109	PARAMOUNT ENERGY OPERATING CORP.	DEVONIAN SYSTEM	14/03/1998	24/11/1997	283.3	123,384	1,865
102/14-04-081-09 W4/02	PARA 102 SWD CORNER 14-4-81-9	SUS POT WAT DISP	0243725	PARAMOUNT ENERGY OPERATING CORP.	BEAVERHILL LAKE FM	7/4/2001	28/10/2000	483.0	11,167	681
100/15-08-081-09 W4/03	PARA ET AL CORNER 15-8-81-9	WATER DISPOSAL	0163239	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	7/1/2001	15/12/1993	278.7	13,408	0
102/12-16-081-09 W4/00	PARA ET AL 102 SWD CORNER 12-16-81-9	WATER DISPOSAL	0265417	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	26/05/2002	28/12/2001	471.0	48,253	358
100/12-06-082-06 W4/00	NORTHSTAR ET AL RESDELN 12-6-82-6	SUS POT WAT DISP	0143523	NORTHSTAR ENERGY CORPORATION	MCMURRAY FM	1/1/1995	3/1/1990	333.5	48,884	439
102/15-17-082-08 W4/02	NORTHSTAR 02 HANGINGSTONE 15-17-82-8	WATER DISPOSAL	0212001	NORTHSTAR ENERGY CORPORATION	CLEARWATER FM	23/02/1999	14/01/1998	338.4	54,628	593
100/15-14-083-05 W4/02	RAX NEWBY 15-14-83-5	WATER DISPOSAL	0138542	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	20/03/1994	30/01/1989	205.0	119,344	677
100/10-02-083-06 W4/00	PARA ET AL NEWBY 10-2-83-6	WATER DISPOSAL	0153267	PARAMOUNT ENERGY OPERATING CORP.	MCMURRAY FM	10/1/1992	28/07/1992	239.0	189,883	2,551
100/02-30-083-06 W4/00	NORTHSTAR ET AL SURMONT 2-30-83-6	ABANDONED,RECOMPLETED	0052721	NORTHSTAR ENERGY CORPORATION	KEG RIVER FM	19/02/1981	31/01/1975	349.3	8,846	4,753
102/03-31-083-06 W4/00	GULF 102 RESDELN 3-31-83-6	OBSERVATION	0191540	CONOCOPHILLIPS CANADA RESOURCES CORP.	MCMURRAY FM	8/1/1997	19/09/1996	335.0	39,216	1,497
103/03-31-083-06 W4/00	GULF 103 RESDELN 3-31-83-6	WATER DISPOSAL	0209186	CONOCOPHILLIPS CANADA RESOURCES CORP.	MCMURRAY FM	3/1/1998	24/11/1997	341.0	139,240	3,263
103/10-31-083-06 W4/00	GULF RESDELN 10-31-83-6	WATER DISPOSAL	0191538	CONOCOPHILLIPS CANADA RESOURCES CORP.	MCMURRAY FM	8/1/1997	19/09/1996	339.0	437,719	11,948
104/10-31-083-06 W4/00	GULF 104 RESDELN 10-31-83-6	WATER DISPOSAL	0209735	CONOCOPHILLIPS CANADA RESOURCES CORP.	MCMURRAY FM	1/1/2002	12/3/1997	313.0	148,554	4,166
100/09-25-083-07 W4/00	CONOCO RESDELN 9-25-83-7	WATER DISPOSAL	0266204	CONOCOPHILLIPS CANADA RESOURCES CORP.	KEG RIVER FM	9/1/2003	18/01/2002	581.0	166,553	11,411
100/07-09-084-10 W4/00	NORTHSTAR HANGINGSTONE 7-9-84-10	WATER DISPOSAL	0136040	NORTHSTAR ENERGY CORPORATION	UPPER MANNVILLE FM	30/07/1990	31/08/1988	293.0	43,922	169
100/15-14-084-11 W4/00	JACOS WD HANGST 15-14-84-11	WATER DISPOSAL	0143168	JAPAN CANADA OIL SANDS LIMITED	MCMURRAY FM	10/1/1990	2/8/1990	325.0	168,369	1,281
100/16-14-084-11 W4/00	JAPAN CANADA HANGST 16-14-84-11	WATER DISPOSAL	0219953	JAPAN CANADA OIL SANDS LIMITED	MCMURRAY FM	6/9/2001	17/12/1998	350.0	1,540	5,762
100/01-23-084-11 W4/00	JAPAN CANADA HANGINGSTONE 1-23-84-11	WATER DISPOSAL	0219496	JAPAN CANADA OIL SANDS LIMITED	NOT AVAILABLE	6/8/2001	12/7/1998	334.5	17,562	4,980
1F1/02-23-084-11 W4/00	JACOS HANGST WW 2-23-84-11	WATER DISPOSAL	0138981	JAPAN CANADA OIL SANDS LIMITED	MCMURRAY FM	13/09/1993	24/02/1989	299.0	182,887	6,690
100/01-34-084-11 W4/00	JACOS C2 HANGST EX 1-38-84-11	WATER DISPOSAL	0131674	JAPAN CANADA OIL SANDS LIMITED	NOT AVAILABLE	24/09/1999	25/01/1988	306.5	4,468	24,267
100/08-05-085-04 W4/00	RAX NEWBY 8-5-85-4	SUS POT WAT DISP	0233342	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	3/8/2000	2/8/2000	179.0	16,234	104
100/07-01-085-06 W4/00	RAX NEWBY 7-1-85-6	WATER DISPOSAL	0175595	CANADIAN NATURAL RESOURCES LIMITED	MCMURRAY FM	4/1/2003	2/1/1995	191.5	7,464	108
100/06-30-083-06 W4/00	NORTHSTAR SURMONT 6-30-83-6	ABANDONED	0045359	NORTHSTAR ENERGY CORPORATION	WABISKAW MBR	21/07/1979	3/7/1973	282.0	760	0

* Search conducted on January 21, 2005

Table 4-1
Monitoring Well Completion Details

Well Name	Location (W4M)	Ground Elevation (m asl)	Completion Interval (m bgs)	Formation*	Installation Date	Water Levels[1] (m btoc)	Groundwater Elevation (m asl)
PSB 01	2-16-77-5	586.295	4.3 – 7.3	Marie Creek	March 5, 2004	6.88	580.445
PSB 02	2-16-77-5	586.670	2.4 – 5.5	Marie Creek	March 3, 2004	dry	-
PSB 03	2-16-77-5	584.405	16.8 – 18.3	Marie Creek	March 4, 2004	17.25	568.065
PSB 03A	2-16-77-5	584.500	2.0 – 5.0	Marie Creek	March 4, 2004	3.96	581.460
PSB 04	2-16-77-5	583.025	2.3 – 5.3	Marie Creek	March 3, 2004	2.43	581.475
PSB 05	2-16-77-5	585.225	2.3 – 5.3	Marie Creek	March 5, 2004	5.33	580.895

(1) Water levels measured on March 17 and March 18, 2004.
* based on correlation to WEPA 00-2 type log (Andriashek 2003)

Table 4-2
Estimates of Hydraulic Conductivity for Shallow Stratigraphy

Monitoring Well	Analytical Method	Lithology	Hydraulic Conductivity (m/s)
PSB 01	Theis & Jacob	Sand	3.00×10^{-4}
PSB 03A	Hvorslev	Clay (Till)	3.54×10^{-7}
PSB 04	Hvorslev	Clay (Till)	7.81×10^{-7}

Source: Jacques Whitford Limited 2004

Table 4-3
Groundwater Elevations – Central Plant Site

Well ID	Ground Elevation (m asl)	Elevation[1] 18-March-04 (m asl)	Elevation[2] 26-May-04 (m asl)
PSB 01	586.295	580.445	580.30
PSB 02	586.670	dry	dry
PSB 03	584.405	568.065	567.40
PSB 03A	584.500	581.460	581.408
PSB 04	583.025	581.475	582.479
PSB 05	585.225	580.895	580.775

1 Conducted by Jacques Whitford Limited
2 Conducted by Westwater Environmental Ltd.

Table 4-4
Chemical Analysis Results

Parameters	Units	PSB 04 March 17, 2004	GCDWQ
Major Water Quality Parameters			
Total Dissolved Solids	mg/L	324	≤500
pH	-	7.51	6.5 – 8.5
Conductivity	μS/cm	557	
Hardness ($CaCO_3$)	mg/L	319	
Turbidity	NTU	1740	
Alkalinity (PP as $CaCO_3$)	mg/L	<5	
Alkalinity (Total as $CaCo_3$)	mg/L	329	
Apparent Colour	PtCo Units	>60	
Ion Balance	%	99	
Major Cations			
Calcium	mg/L	80.4	
Magnesium	mg/L	28.8	
Sodium	mg/L	6.5	≤200
Potassium	mg/L	1.4	
Major Anions			
Bicarbonate	mg/L	402	
Carbonate	mg/L	<5	
Sulphate	mg/L	9.2	≤500
Chloride	mg/L	<0.5	≤250
Hydroxide	mg/L	<5	
Other Inorganics			
Fluoride	mg/L	0.30	1.5
Dissolved Nitrate	mg/L	0.1	45
Dissolved Nitrite	mg/L	<0.05	
Nitrate plus Nitrite	mg/L	0.1	

GCDWQ – Guideline for Canadian Drinking Water Quality

Table 4-4
Chemical Analysis Results

Parameters	Units	PSB 04 March 17, 2004	GCDWQ
Dissolved Metals			
Aluminum	mg/L	<0.005	
Antimony	mg/L	<0.0002	
Arsenic	mg/L	0.0002	
Barium	mg/L	0.108	
Beryllium	mg/L	<0.0001	
Bismuth	mg/L	<0.0005	
Boron	mg/L	0.016	
Cadmium	mg/L	0.00006	
Chromium	mg/L	<0.0005	
Cobalt	mg/L	0.0008	
Copper	mg/L	0.002	
Iron	mg/L	0.02	
Lead	mg/L	<0.0001	
Lithium	mg/L	0.009	
Manganese	mg/L	0.114	
Molybdenum	mg/L	0.001	
Nickel	mg/L	0.0021	
Selenium	mg/L	0.0005	
Silver	mg/L	<0.0001	
Strontium	mg/L	0.116	
Thallium	mg/L	<0.00005	
Tin	mg/L	<0.001	
Titanium	mg/L	<0.0005	
Uranium	mg/L	0.0016	
Vanadium	mg/L	0.0002	
Zinc	mg/L	0.088	

GCDWQ – Guideline for Canadian Drinking Water Quality

Table 4-4
Chemical Analysis Results

Parameters	Units	PSB 04 March 17, 2004	GCDWQ
Total Metals			
Aluminum	mg/L	38.3	
Antimony	mg/L	<0.002	
Arsenic	mg/L	0.016	0.025
Barium	mg/L	0.520	1.0
Beryllium	mg/L	0.0014	
Bismuth	mg/L	<0.005	
Boron	mg/L	0.042	5.0
Cadmium	mg/L	0.00070	0.005
Chromium	mg/L	**0.0629**	0.05
Cobalt	mg/L	0.0213	
Copper	mg/L	0.043	≤1.0
Iron	mg/L	**46.0**	≤0.3
Lead	mg/L	**0.0313**	0.01
Lithium	mg/L	0.043	0.3
Manganese	mg/L	**1.20**	≤0.05
Mercury	mg/L	<0.0002	
Molybdenum	mg/L	<0.01	
Nickel	mg/L	0.037	
Selenium	mg/L	0.0020	0.01
Silicon	mg/L	59.0	
Silver	mg/L	<0.001	
Strontium	mg/L	0.204	
Sulphur	mg/L	2.62	
Thallium	mg/L	0.00075	
Tin	mg/L	<0.01	
Titanium	mg/L	1.14	
Uranium	mg/L	<0.005	0.1
Vanadium	mg/L	0.110	
Zinc	mg/L	0.131	≤5.0

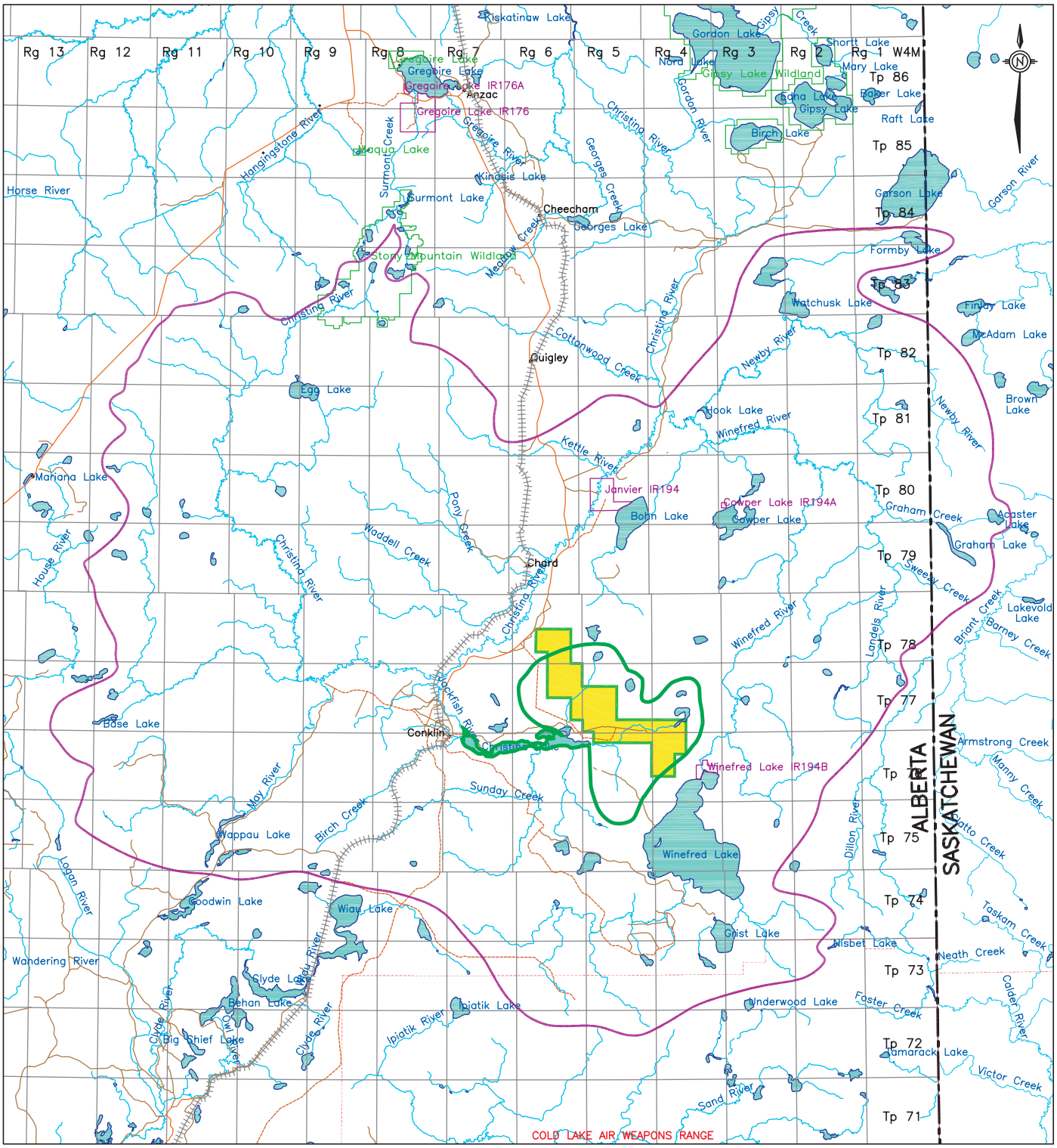
Highlighted and Bolded number exceeds or equals the *Guidelines for Canadian Drinking Water Quality (GCDWQ) or Canadian Environmental Quality Guidelines(CCME)*

Table 4-4
Chemical Analysis Results

Parameters	Units	PSB 04 March 17, 2004	GCDWQ
General Organic Parameters			
Dissolved Organic Carbon	mg/L	3.3	
Total Organic Carbon	mg/L	3.6	
Volatile and Extractable Hydrocarbons			
Benzene	mg/L	<0.001	0.005
Toluene	mg/L	<0.001	≤0.024
Ethylbenzene	mg/L	<0.001	≤0.0024
Xylenes	mg/L	<0.001	≤0.3
F1 C6 – C10	mg/L	<0.01	
F1 – BTEX	mg/L	<0.01	
F2 C10 – C16	mg/L	<0.1	
F3 C16 – C34	mg/L	<0.1	
Polycyclic Aromatic Hydrocarbons			
Benzo(a)anthracene	µg/L	<0.01	
Benzo(b)fluoranthene	µg/L	<0.01	
Benzo(j)fluoranthene	µg/L	<0.01	
Benzo(k)fluoranthene	µg/L	<0.01	
Benzo(a)pyrene	µg/L	<0.01	0.01
CB(a)P	µg/L	<0.01	
Chrysene	µg/L	<0.1	
Dibenzo(a,h)pyrene	µg/L	<0.01	
Indeno(1,2,3-cd)pyrene	µg/L	<0.1	

GCDWQ – Guideline for Canadian Drinking Water Quality

Figures



LEGEND

- MEG OIL SANDS LEASE
- REGIONAL STUDY AREA
- LOCAL STUDY AREA

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM GEOMATICS CANADA, AUGUST 2001. DATUM: NAD 83 PROJECTION: UTM ZONE 12

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

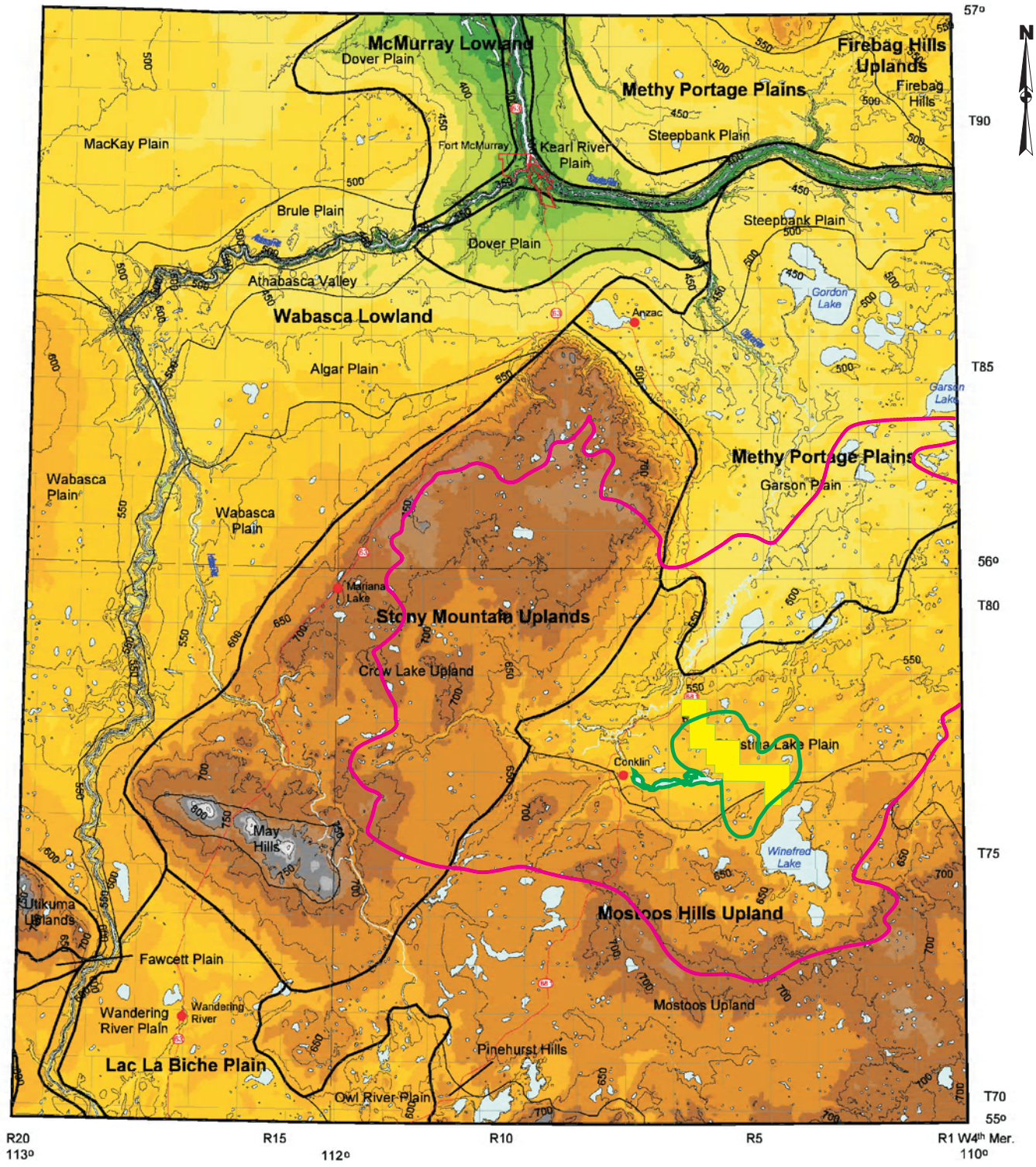
TITLE

PROJECT SITE AND HYDROGEOLOGY LOCAL AND REGIONAL STUDY AREAS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	

FIGURE 2-1



Scale 1:500 000

5 0 5 10 15 20 25 30 35 40 kilometres

5 0 5 10 15 20 25 30 miles

Digital Elevation Model (DEM) in metres asl

800 750 700 650 600 550 500 450 400 350 300 250

Physiographic boundary:

- Unit
- Subdivision
- Contour (50 m)
- Road - paved
- Lake and river

MEG RSA

MEG LSA

MEG OIL SANDS LEASE

Reference: Andriashek, 2003

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

SURFACE TOPOGRAPHY AND PHYSIOGRAPHY

MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: DC

REVIEWED: EG

SCALE AS SHOWN

FIGURE 3-1

PERIOD	STRATIGRAPHIC UNITS	HYDROSTRATIGRAPHY
HOLOCENE	Recent Sediments	Unit
QUATERNARY	Grand Centre Formation	Aquitard/Aquifer
	Sand River Formation	Aquifer
	Marie Creek Formation	Aquitard/Aquifer
	Ethel Lake Formation	Aquifer
	Bonnyville Formation	Aquitard/Aquifer
	Muriel Lake Formation	Aquitard/Aquifer
	Bronson Lake Formation	Aquitard
TERTIARY	Empress Formation	Aquitard/Aquifer
UPPER CRETACEOUS	Wapiti Formation	Aquifer
	Lea Park Formation	Aquitard
	La Biche Formation	Aquitard/Aquifer
	Viking Formation	Aquifer
LOWER CRETACEOUS	Joli Fou Formation	Aquitard
	Grand Rapids Formation	Aquifer
	Clearwater Formation	Aquitard
	Wabiskaw Member	Aquifer
	McMurray Formation	Aquitard/Aquifer
	Cretaceous Unconformity	
UPPER DEVONIAN	Woodbend Group	Aquitard/Aquifer
	Beaverhill Lake Group	

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

REGIONAL STRATIGRAPHIC COLUMN

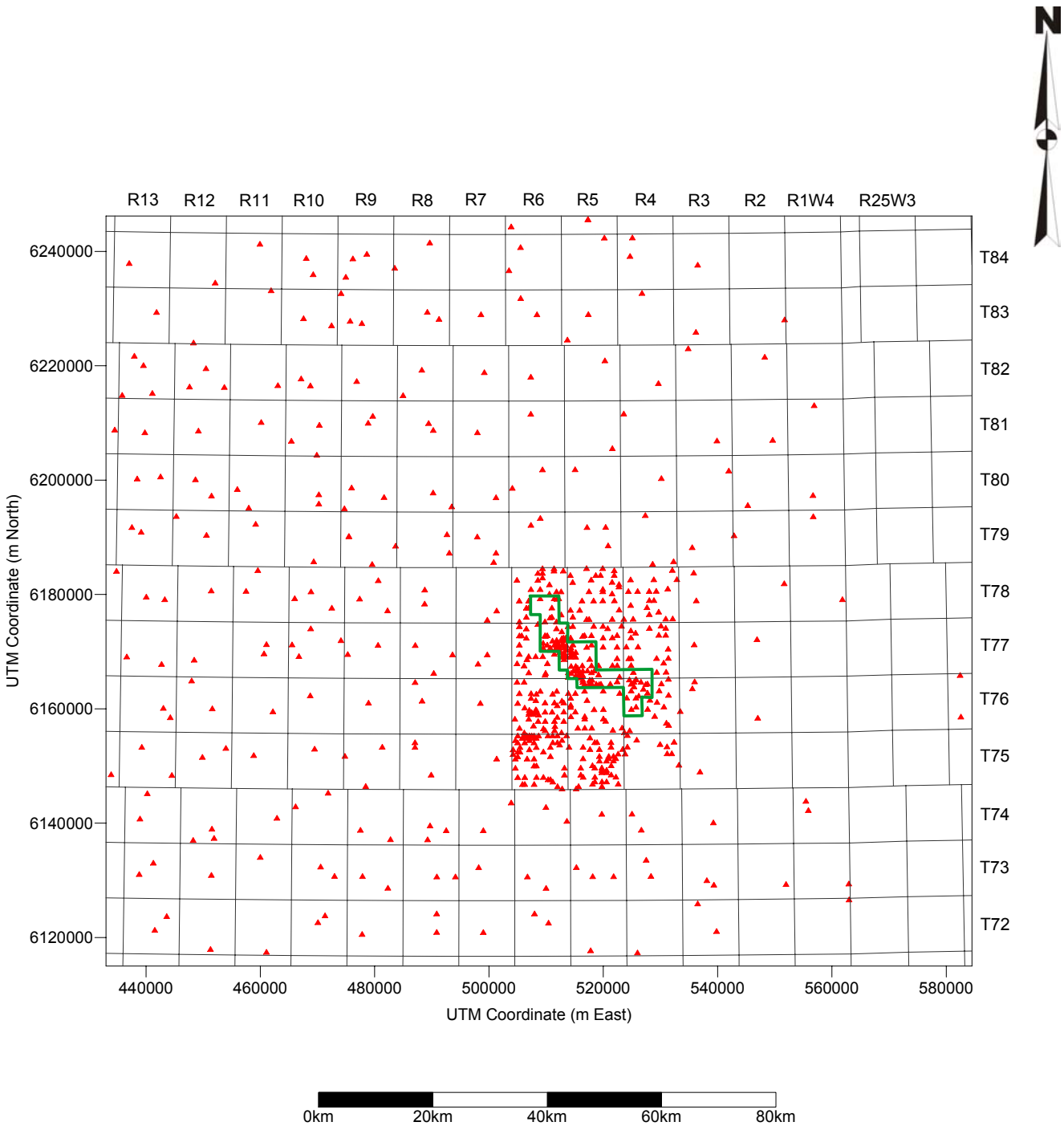
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE: 3-2



LEGEND

- WELL LOCATIONS
- MEG OIL SANDS LEASE

PROJECT

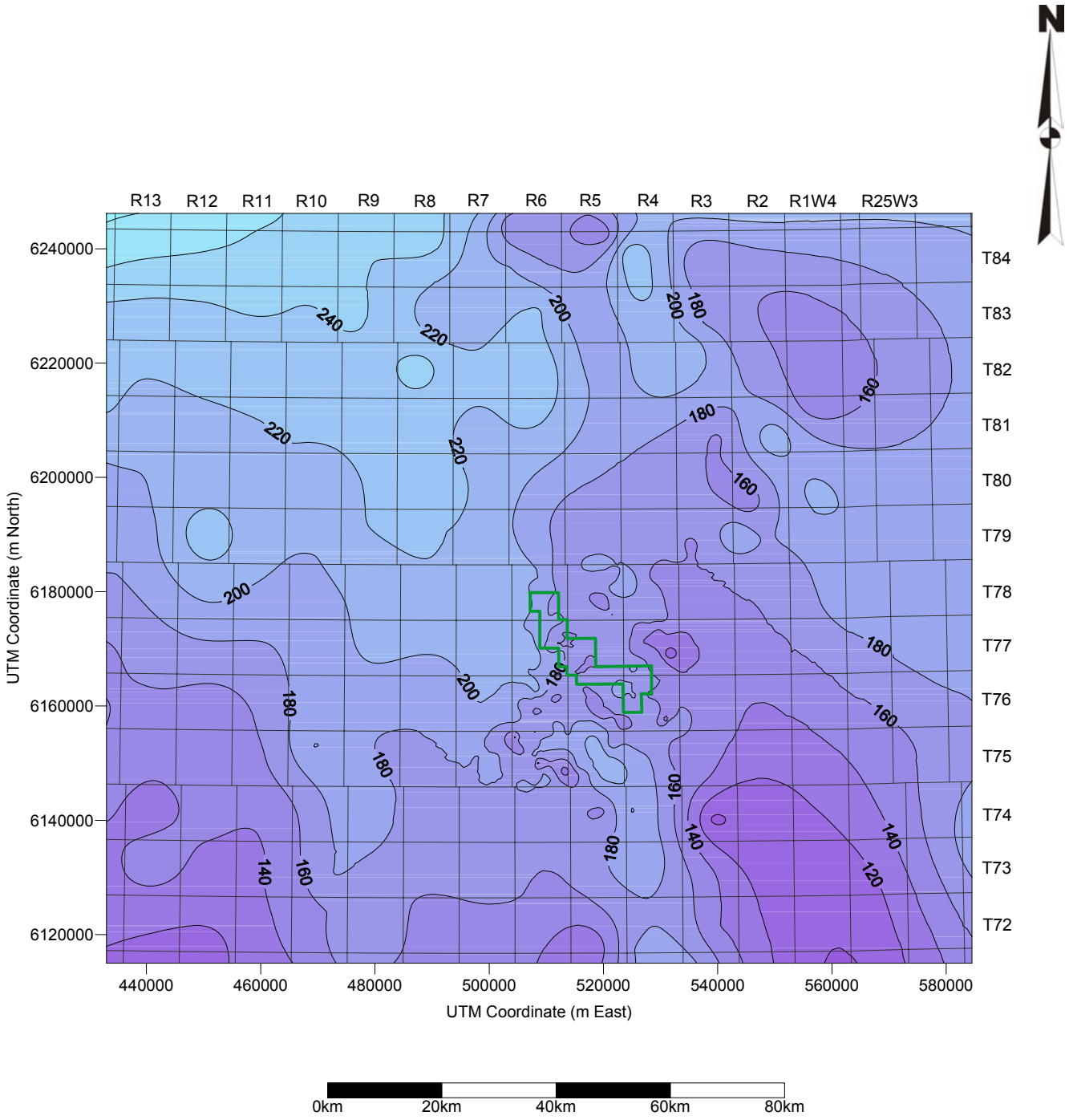
CHRISTINA LAKE REGIONAL PROJECT

TITLE

WELL LOCATIONS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-3**



LEGEND

200 PALEOZOIC SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

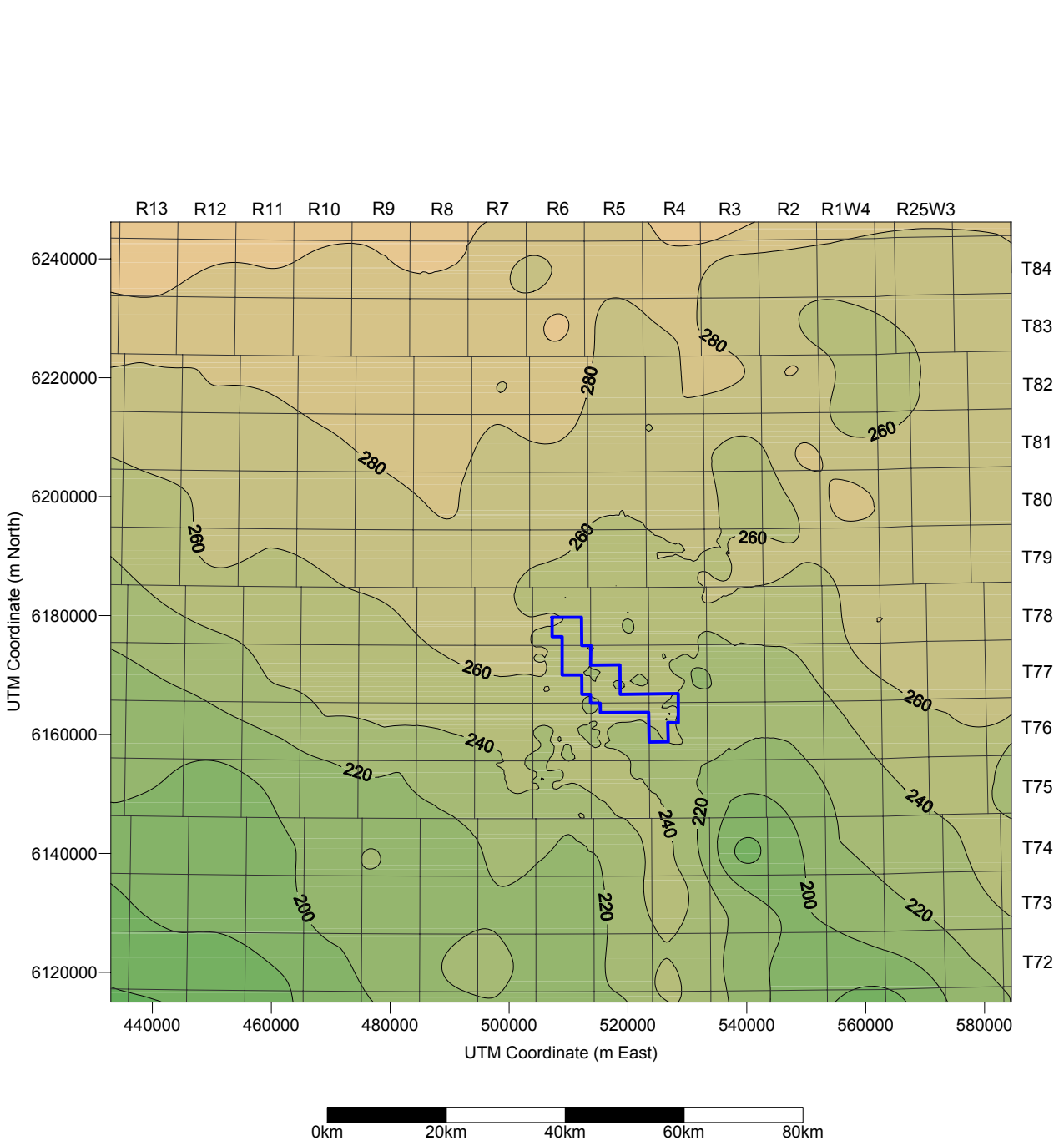
TITLE

PALEOZOIC SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 3-4



LEGEND

200 MCMURRAY FORMATION SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

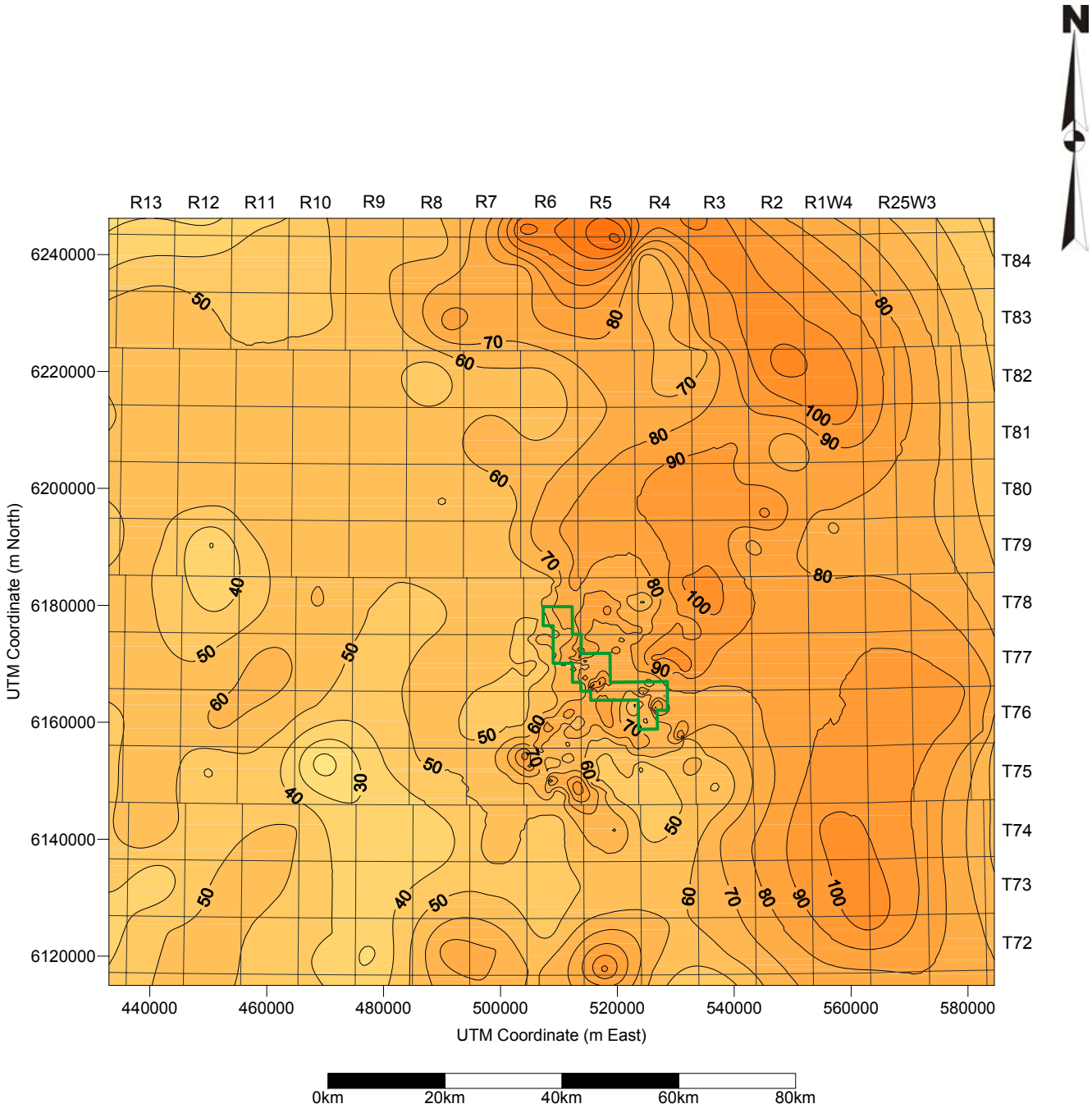
CHRISTINA LAKE REGIONAL PROJECT

TITLE

MCMURRAY FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-5



LEGEND

50 MCMURRAY FORMATION THICKNESS (m)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 10 m

PROJECT

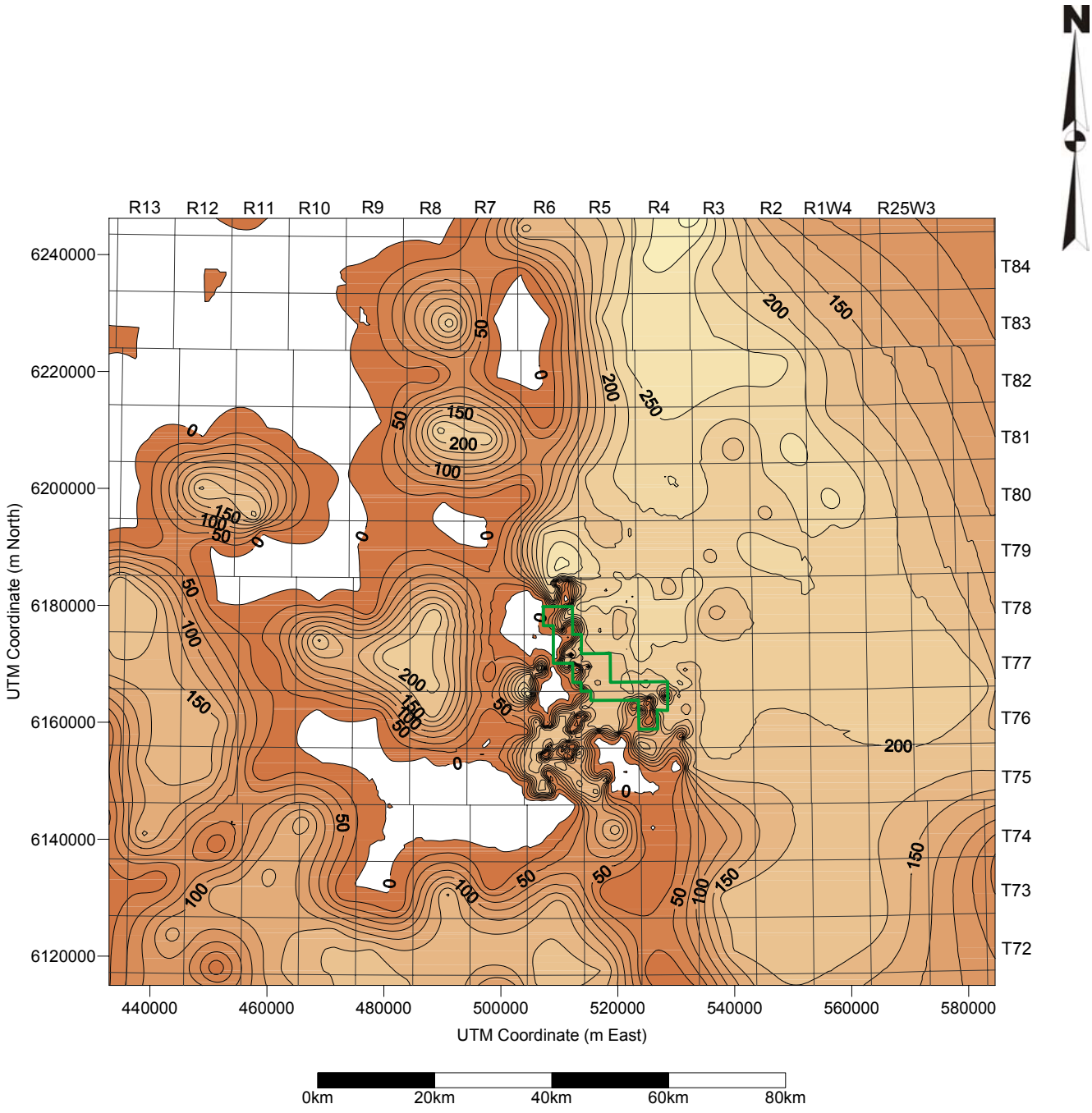
CHRISTINA LAKE REGIONAL PROJECT

TITLE

MCMURRAY FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-6**



LEGEND

200 MCMURRAY WATERSAND SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 25 m

PROJECT

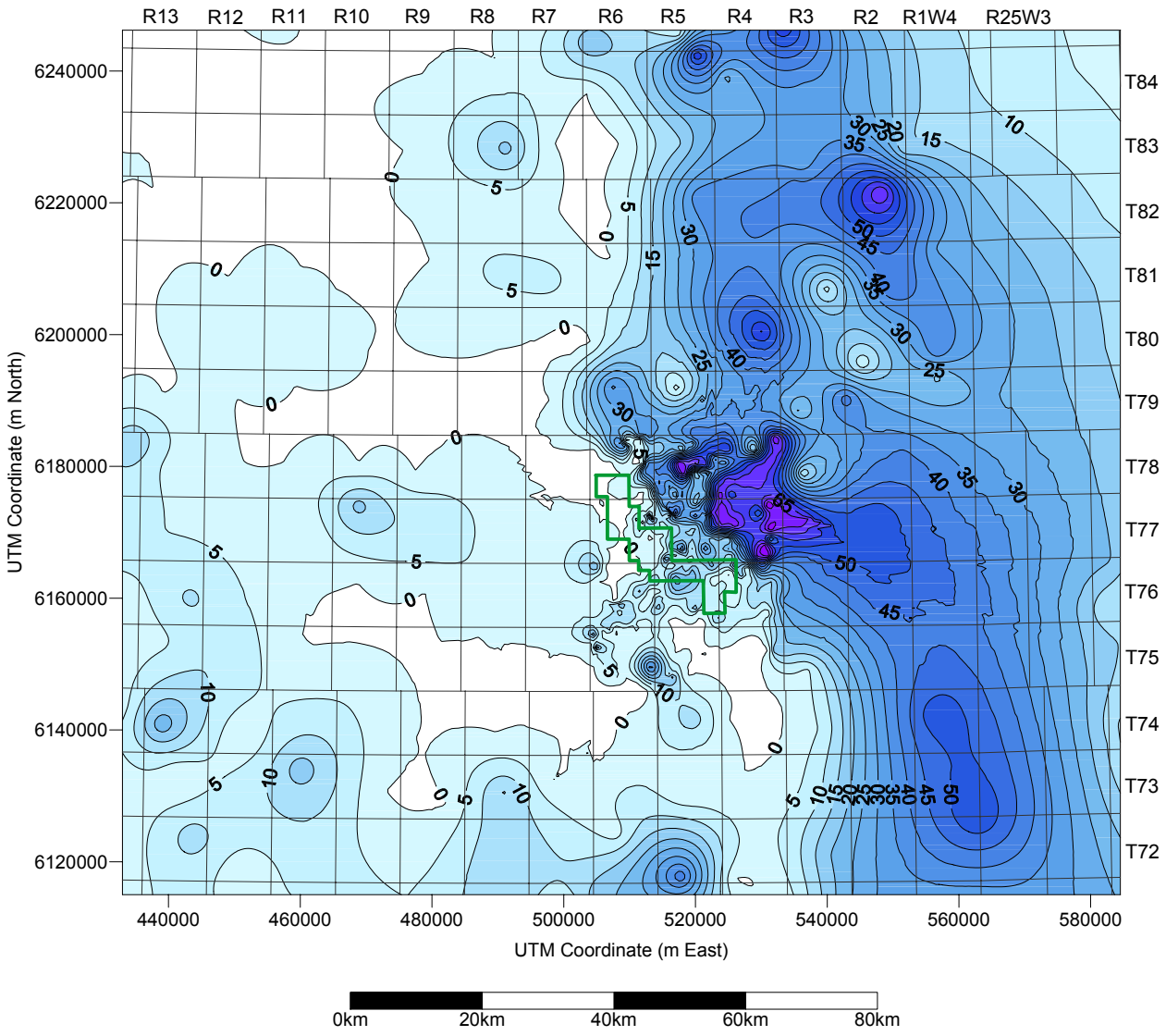
CHRISTINA LAKE REGIONAL PROJECT

TITLE

MCMURRAY WATERSAND SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-7



LEGEND

50 MCMURRAY WATERSAND THICKNESS (m)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 5 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

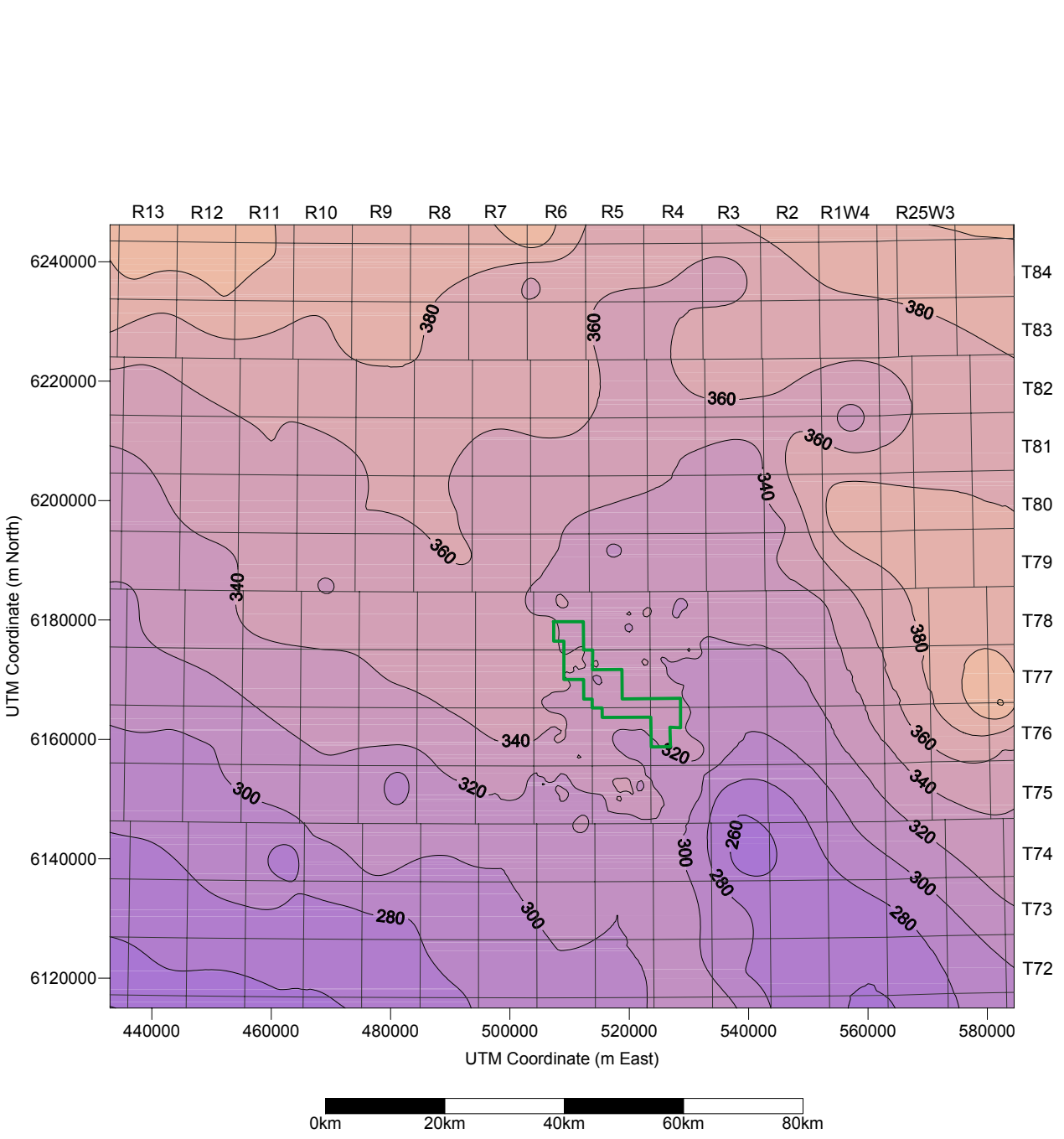
TITLE

MCMURRAY FORMATION WATERSAND ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 3-8



LEGEND

280 CLEARWATER FORMATION SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

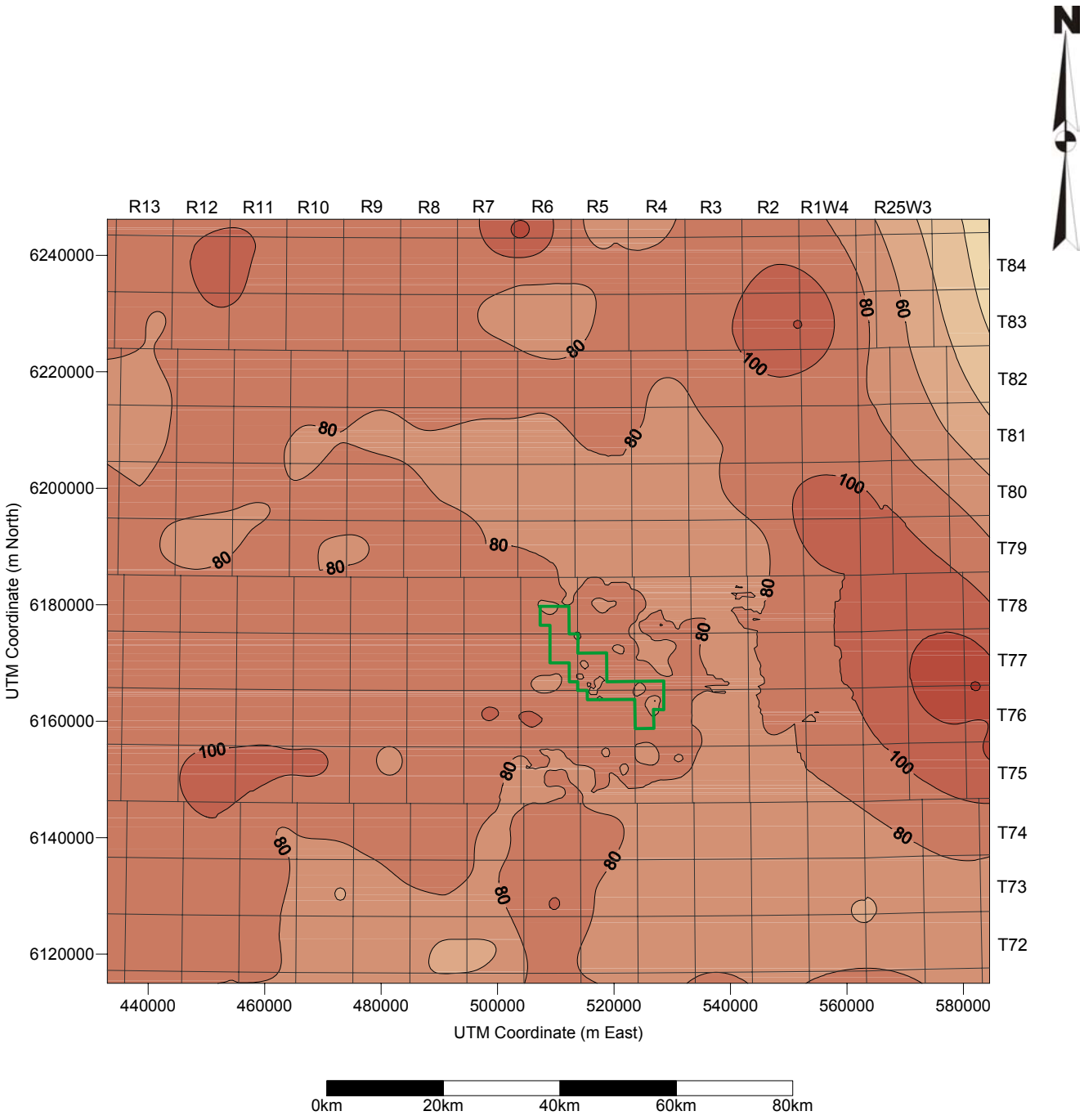
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CLEARWATER FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-9**



LEGEND

80 CLEARWATER FORMATION THICKNESS (m)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

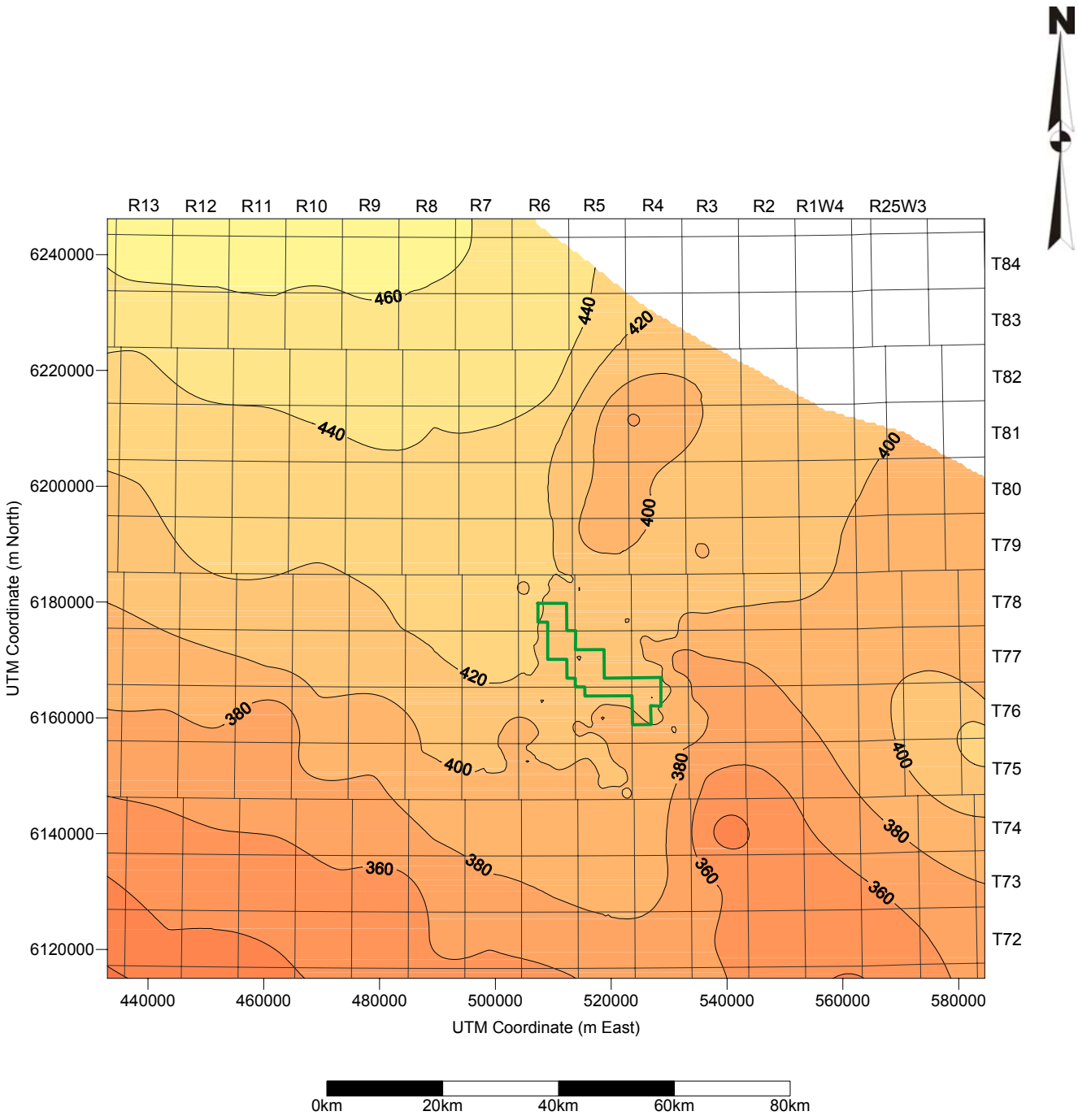
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CLEARWATER FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-10**



LEGEND

360 GRAND RAPIDS FORMATION SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

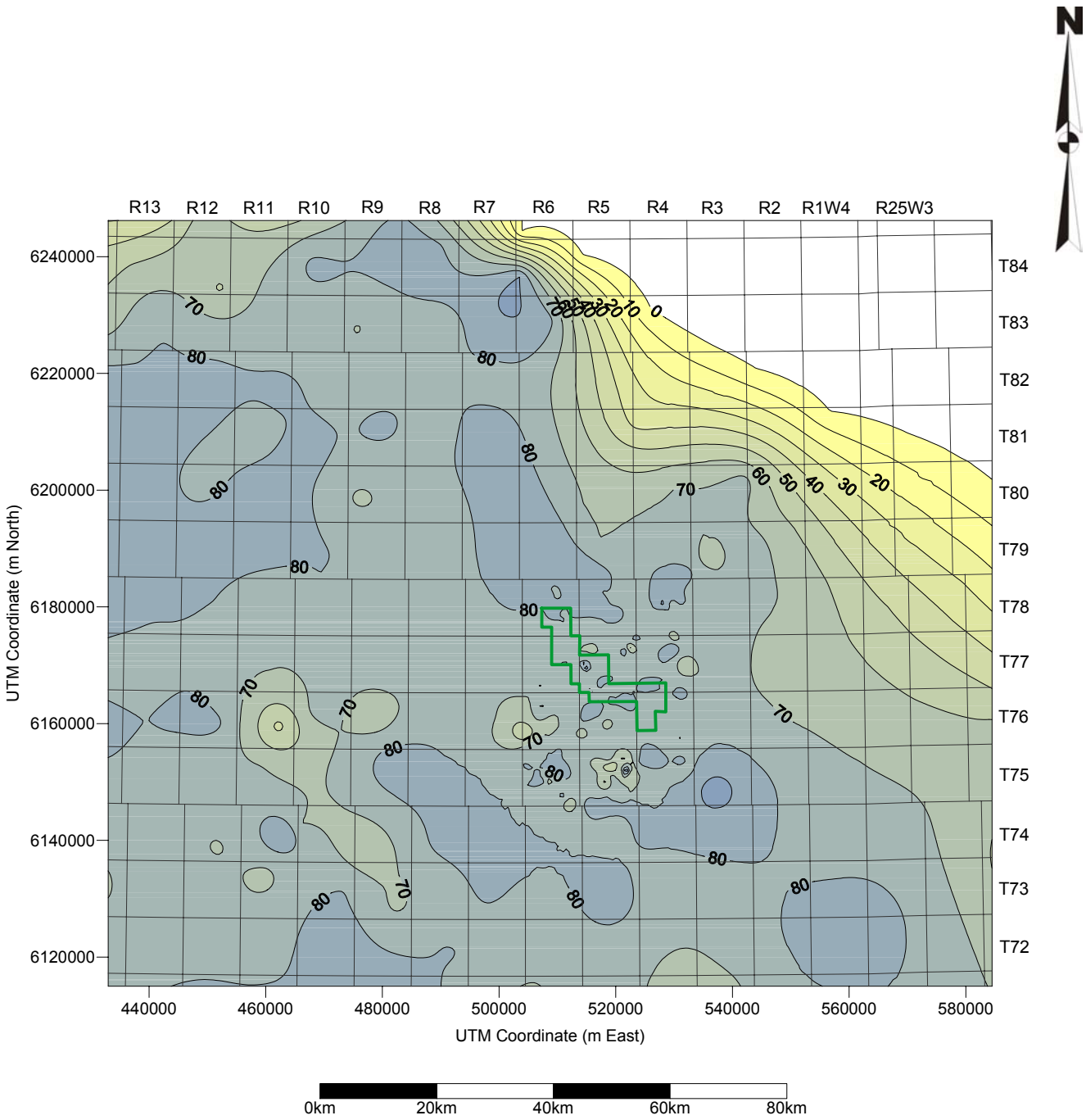
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GRAND RAPIDS FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-11**



LEGEND

80 GRAND RAPIDS FORMATION THICKNESS (m)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 10 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

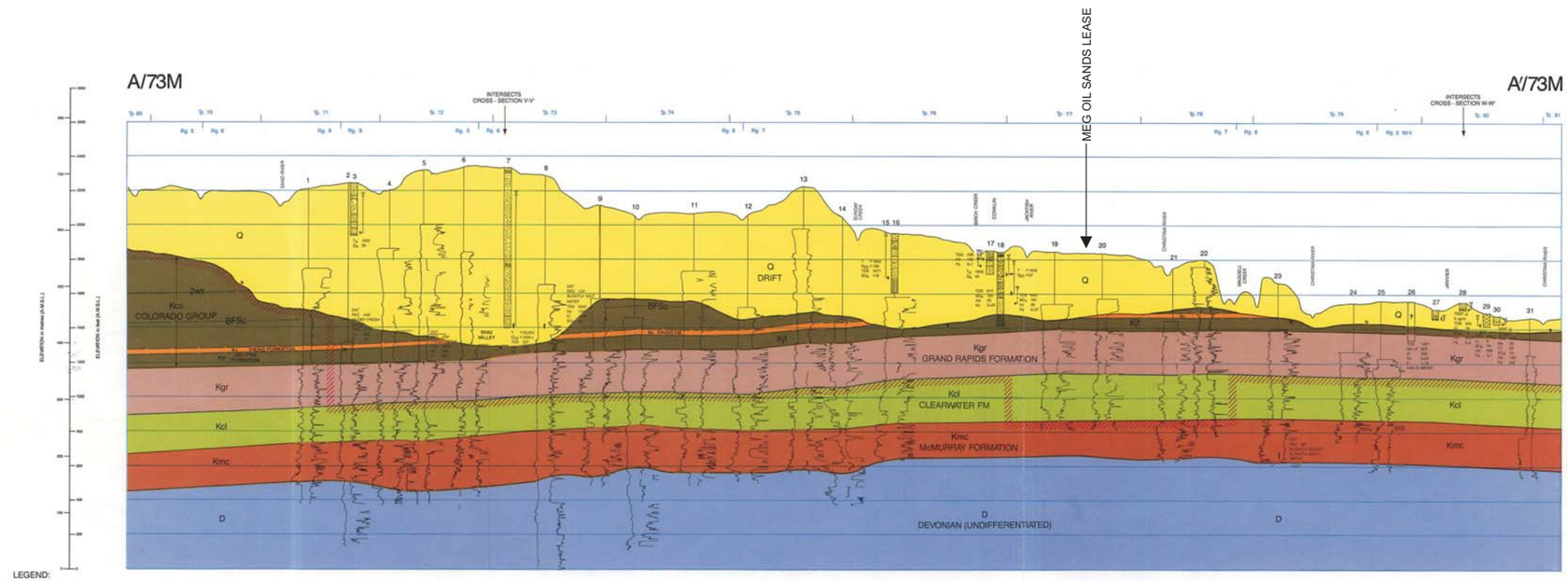
TITLE

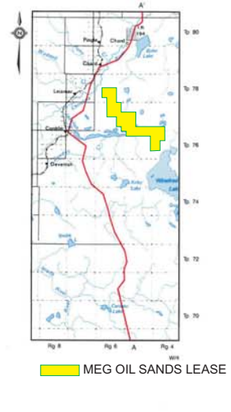
GRAND RAPIDS FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 3-12





MEG OIL SANDS LEASE

HYDROGEOLOGIC CROSS - SECTION A-A'

WINEFRED LAKE 73 M

HORIZONTAL SCALE

km 0 5 10 15 km

miles 0 5 10 miles

Alberta ENVIRONMENT

Prepared by D. Tokarsky (1986)
3 A.P. Nov

EARTH SCIENCES DIVISION for WATER RESOURCES MANAGEMENT SERVICES

LEGEND:

LITHOLOGY

- DRIFT (UNDIFFERENTIATED)
- TILL
- CLAY
- SILT
- SAND
- GRAVEL
- SHALE
- SILTSTONE
- SANDSTONE
- COAL
- VOLCANIC TUFF
- CONGLOMERATE
- LIMESTONE
- DOLOMITE
- FRACTURED ROCK
- LITHOLOGY UNKNOWN

SYMBOLS

- BEDROCK SURFACE
- GROUP, FORMATION, MEMBER, OR TONGUE BOUNDARY
- MAJOR MARKER HORIZON WITHIN A FORMATION
- CORRELATION LINE WITHIN A FORMATION
- RECOMMENDED BASE OF GROUNDWATER PROTECTION
- LATERAL CHANGE IN NOMENCLATURE
- SPRING & FLOW RATE, in igpm

ABBREVIATIONS

T	— TRANSMISSIVITY, in igpd/ft
T_A	— APPARENT TRANSMISSIVITY, in igpd/ft
igpd/ft	— IMPERIAL GALLONS PER DAY PER FOOT
Q_{20}	— PROJECTED 20 YEAR WELL YIELD, in igpm
Q_A	— APPARENT 20 YEAR WELL YIELD, in igpm
igpm	— IMPERIAL GALLONS PER MINUTE
TDS	— TOTAL DISSOLVED SOLIDS, in mg/L
mg/L	— MILLIGRAMS PER LITRE
SO_4	— SULFATE, in mg/L
DST	— DRILL STEM TEST
Na	— SODIUM, in mg/L
Cl	— CHLORIDE, in mg/L
F	— FLUORIDE, in mg/L
Fe	— IRON, in mg/L
Hd	— HARDNESS, in mg/L as $CaCO_3$
$CaCO_3$	— CALCIUM CARBONATE, in mg/L
NO_3	— NITRATE, in mg/L as N
N	— NITROGEN
REC	— RECOVERY

STRATIGRAPHY

QUATERNARY

- Q — DRIFT, UNDIFFERENTIATED; TILL, SAND, CLAY, GRAVEL

CRETACEOUS

- COLORADO GROUP; DARK GREY SHALE, SILTSTONE
  - FIRST WHITE SPECKS; MARKER HORIZON
  - SECOND WHITE SPECKS; MARKER HORIZON
  - BASE OF FISH SCALES; MARKER HORIZON
- VIKING SANDSTONE
- JOLI FOU FORMATION; DARK GREY SHALE, SILTSTONE
- Kgr — GRAND RAPIDS FORMATION; SANDSTONE, SILTSTONE, SHALE, COAL
- Kcl — CLEARWATER FORMATION; SANDSTONE, SILTSTONE, SHALE
- Kmc — McMURRAY FORMATION; SANDSTONE, SILTSTONE, SHALE

DEVONIAN

- D — DEVONIAN (UNDIFFERENTIATED); LIMESTONE, DOLOMITE, CALCAREOUS SHALE, MAY INCLUDE EVAPORITIC BEDS, GYPSUM, ANHYDRITE, SALT

WATER WELL DETAILS

SINGLE ZONE COMPLETION

NON-PUMPING WATER LEVEL

OPEN INTERVAL

REPORTED WATER ZONE

WATER ZONE

COMPOSITE OF WELLS WITHIN A SMALL AREA (e.g. a village)

OPEN INTERVAL WELL #1

OPEN INTERVAL WELL #2

FLOWING WELL

OPEN INTERVAL

ELECTRIC AND RADIOACTIVE LOG DETAIL

SPONTANEOUS POTENTIAL | RESISTANCE | Gamma Ray | RESISTANCE

NOTE: RECOMMENDED BASE OF GROUNDWATER PROTECTION IS THE APPROXIMATE DEPTH BELOW WHICH TDS CONCENTRATIONS EXCEED 4000 mg/L. SHALLOWER GROUNDWATER MAY BE MORE MINERALIZED LOCALLY.

DRILL STEM TEST

OPEN INTERVAL

GRAPHICS BY : Alberta Environment Drafting Pool

Reference: Tokarsky and Epp (1986)

PROJECT

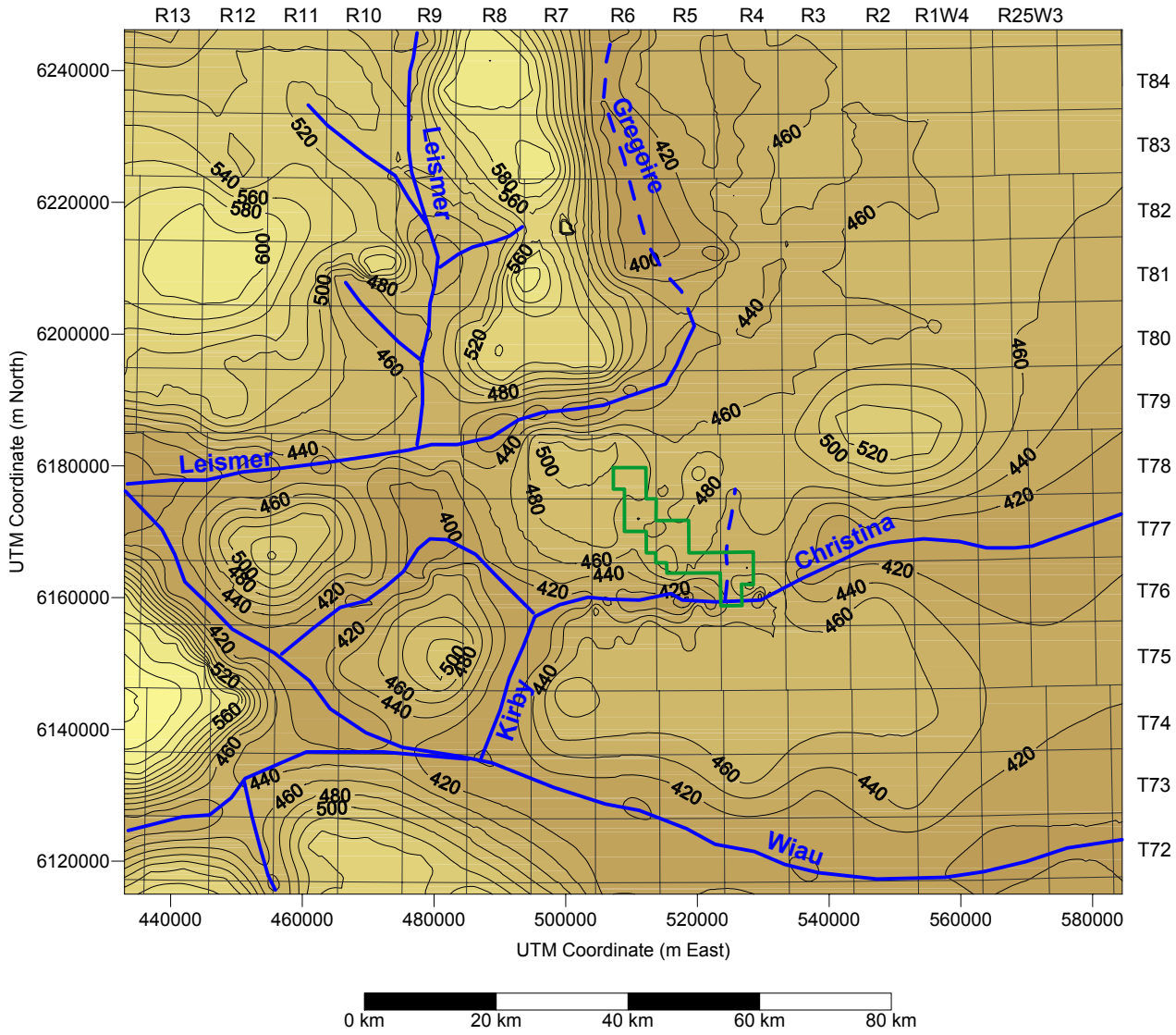
CHRISTINA LAKE REGIONAL PROJECT

TITLE

HYDROGEOLOGICAL CROSS-SECTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	FIGURE: 3-13



LEGEND

- 400 BEDROCK SURFACE ELEVATION (m asl)
- MEG OIL SANDS LEASE
- BEDROCK CHANNEL THALWEGS (AFTER ANDRIASHEK, 2003)
- INFERRED BEDROCK CHANNEL THALWEGS

CONTOUR INTERVAL = 20 m

PROJECT

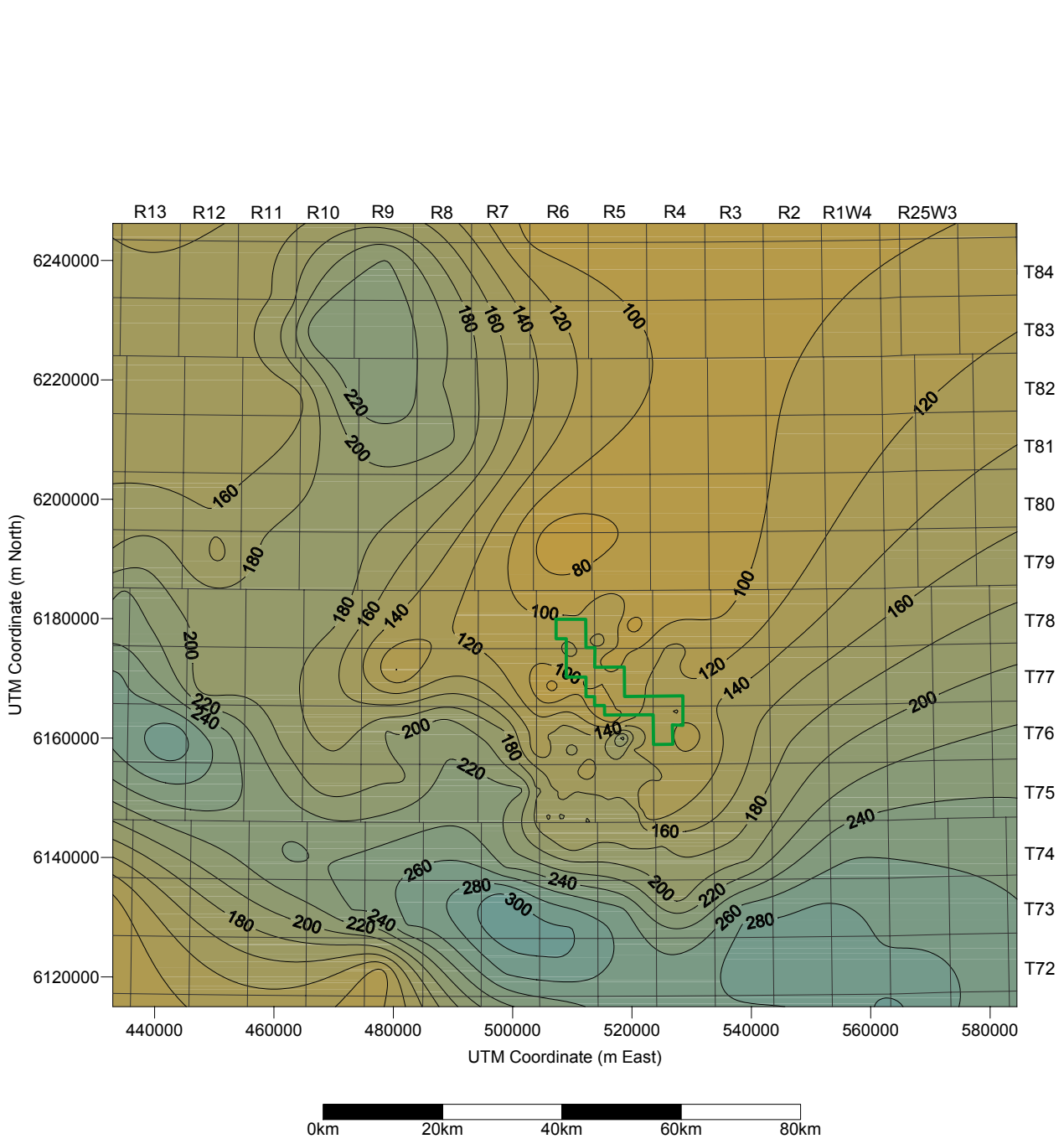
CHRISTINA LAKE REGIONAL PROJECT

TITLE

BEDROCK SURFACE STRUCTURE AND INCISED BEDROCK CHANNELS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-14



LEGEND

180 DRIFT THICKNESS (m)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

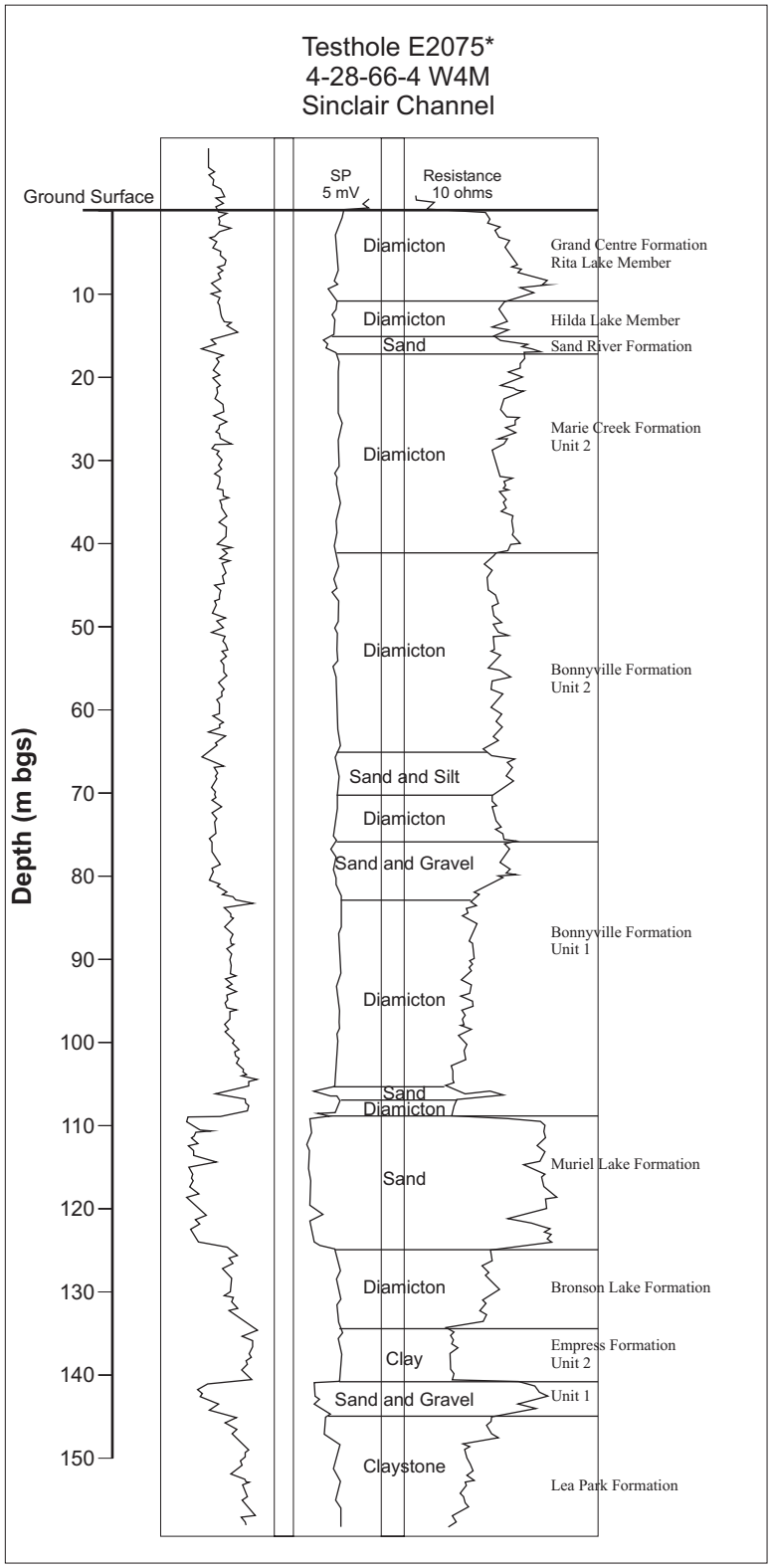
TITLE

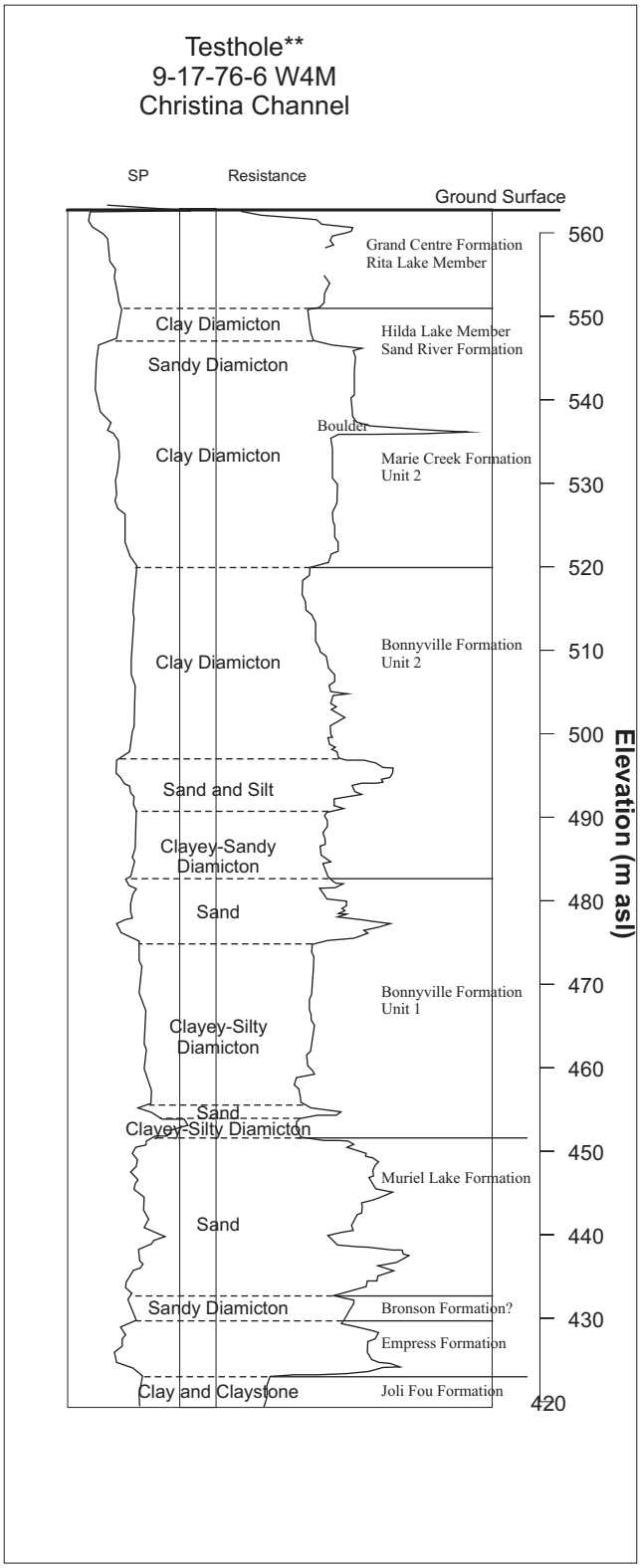
DRIFT THICKNESS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 3-15





m bgs - metres below ground surface
m asl - metres above sea level
SP - spontaneous potential

References:
* Andriashek & Fenton (1989)
**Adapted from CH2M (1998)

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

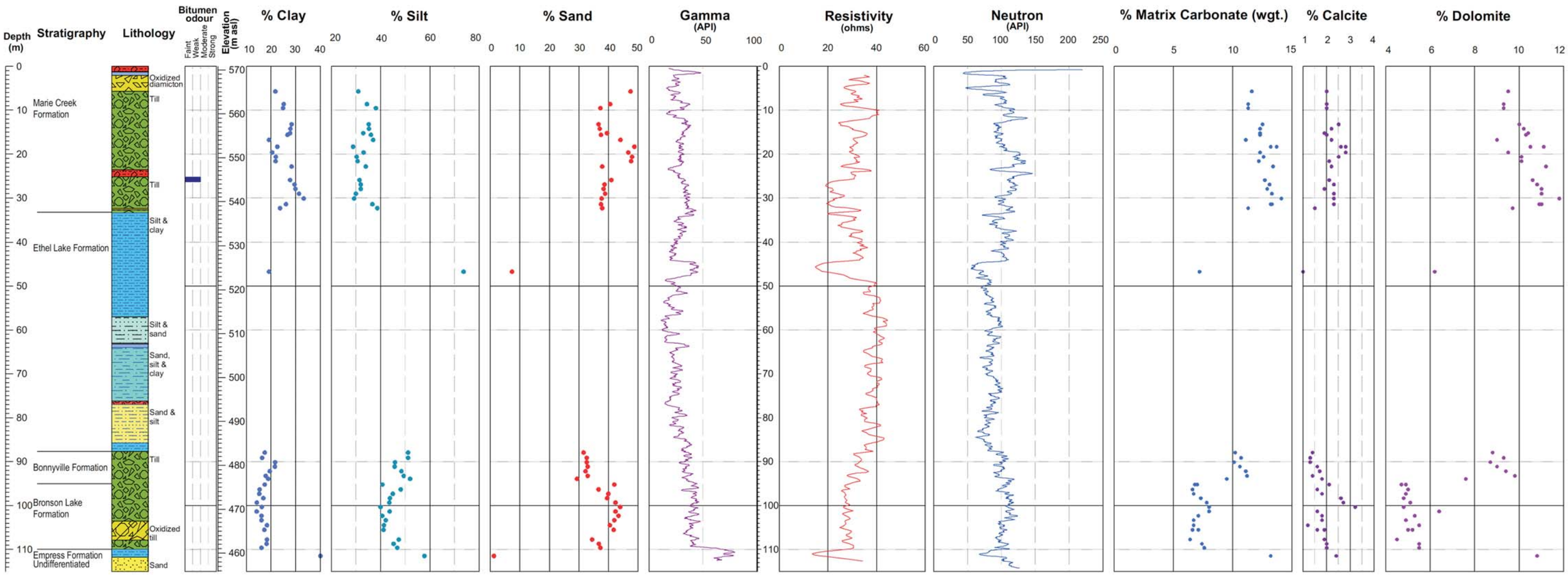
COMPARISON OF GEOPHYSICAL SIGNATURE AND LITHOLOGY SINCLAIR AND CHRISTINA CHANNELS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: EG	SCALE AS SHOWN
REVIEWED: EG	**FIGURE 3-16**

P:\09.MEG Energy\051 EIA\Task 4 Commercial HydroG Rpt\Task4 Commercial Report\Figures\Figure3-16Lithology.cdr

Hole Name: WEPA00-2
Location (DLS): 07-31-76-05-W4
Latitude: 55.6275339°
Longitude: 110.7614465°
Surveyed Ground Level: 570.83 m asl



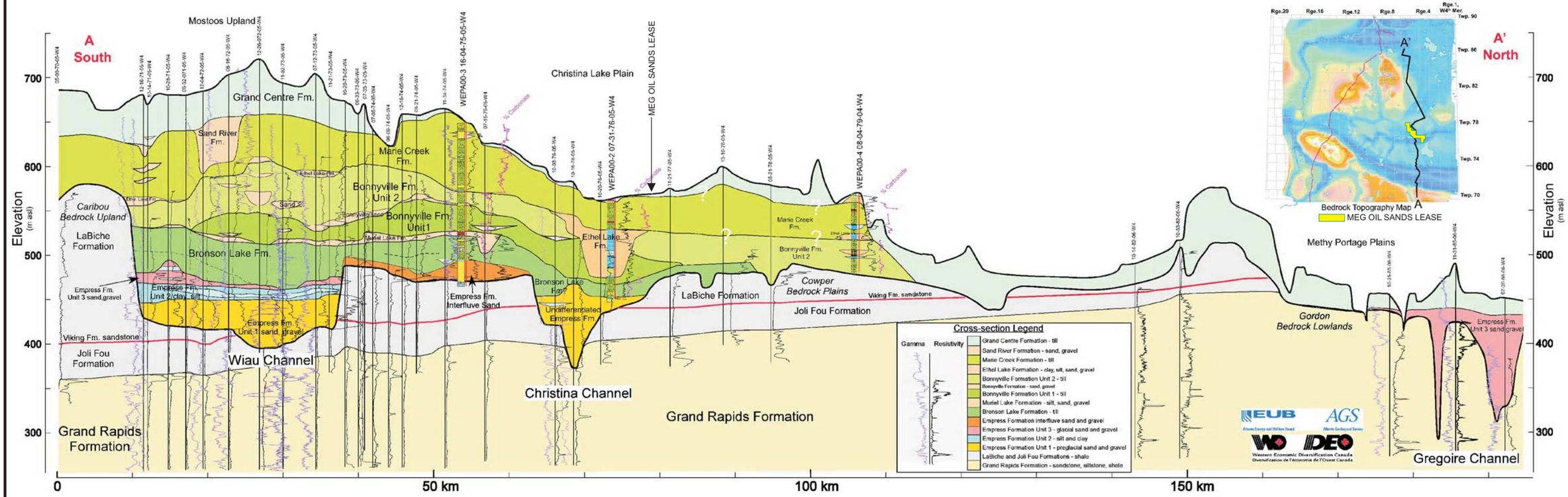
Reference: Andriashek (2003)

PROJECT
CHRISTINA LAKE REGIONAL PROJECT

TITLE
LITHOLOGICAL AND PETROPHYSICAL LOG PROPERTIES OF COREHOLE WEPA00-2

MEG ENERGY CORP.

PREPARED BY WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-17**



Reference: Andriashek (2003)

PROJECT

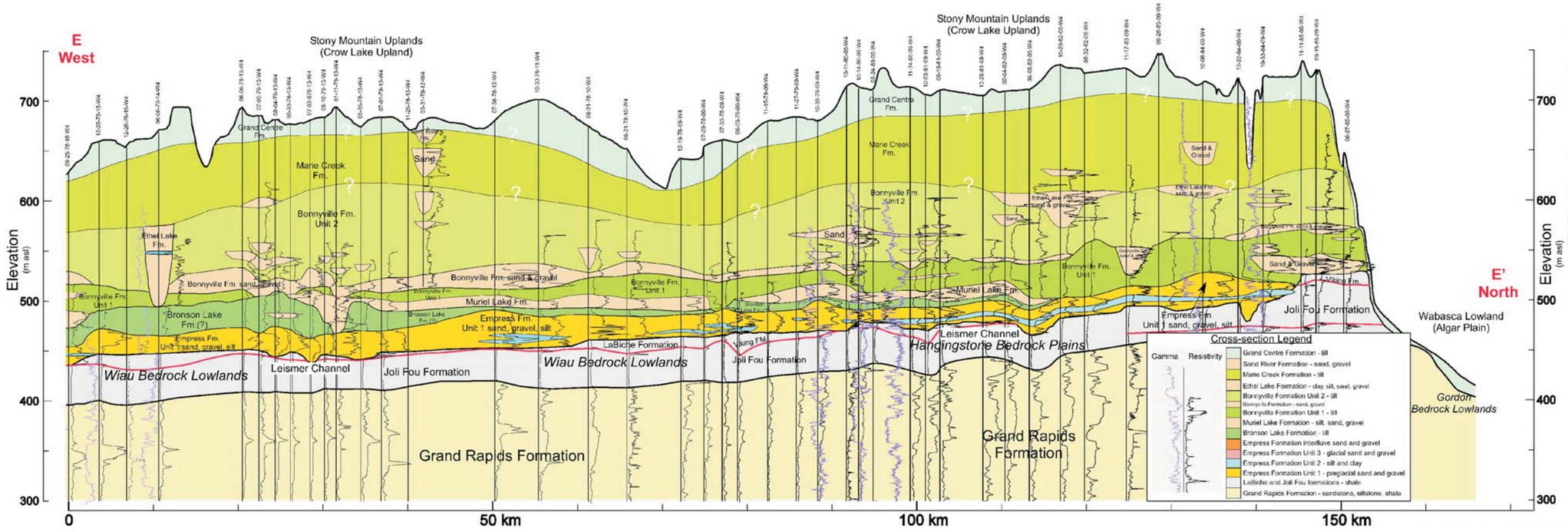
CHRISTINA LAKE REGIONAL PROJECT

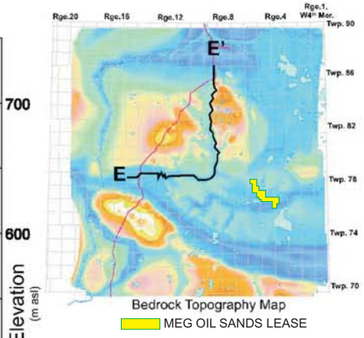
TITLE

GEOLOGICAL CROSS-SECTION THROUGH MEG LEASE AREA

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	FIGURE: 3-18





Reference: Andriashek (2003)

PROJECT

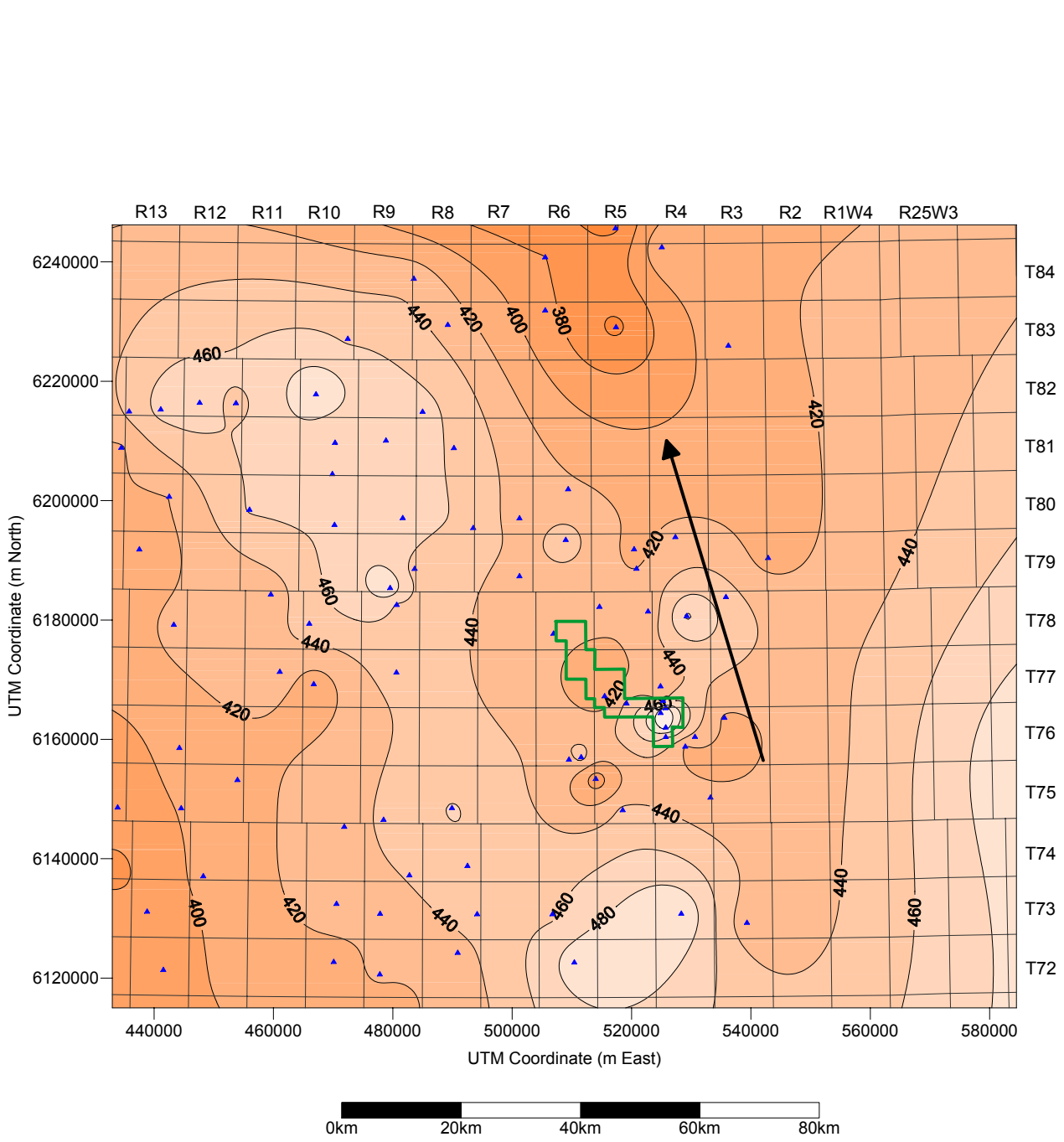
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GEOLOGICAL CROSS-SECTION THROUGH LEISMER CHANNEL

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-19**



LEGEND

- HYDRAULIC HEAD DATA POINTS
- 400 MCMURRAY HYDRAULIC HEAD ELEVATION (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE

CONTOUR INTERVAL = 20 m

PROJECT

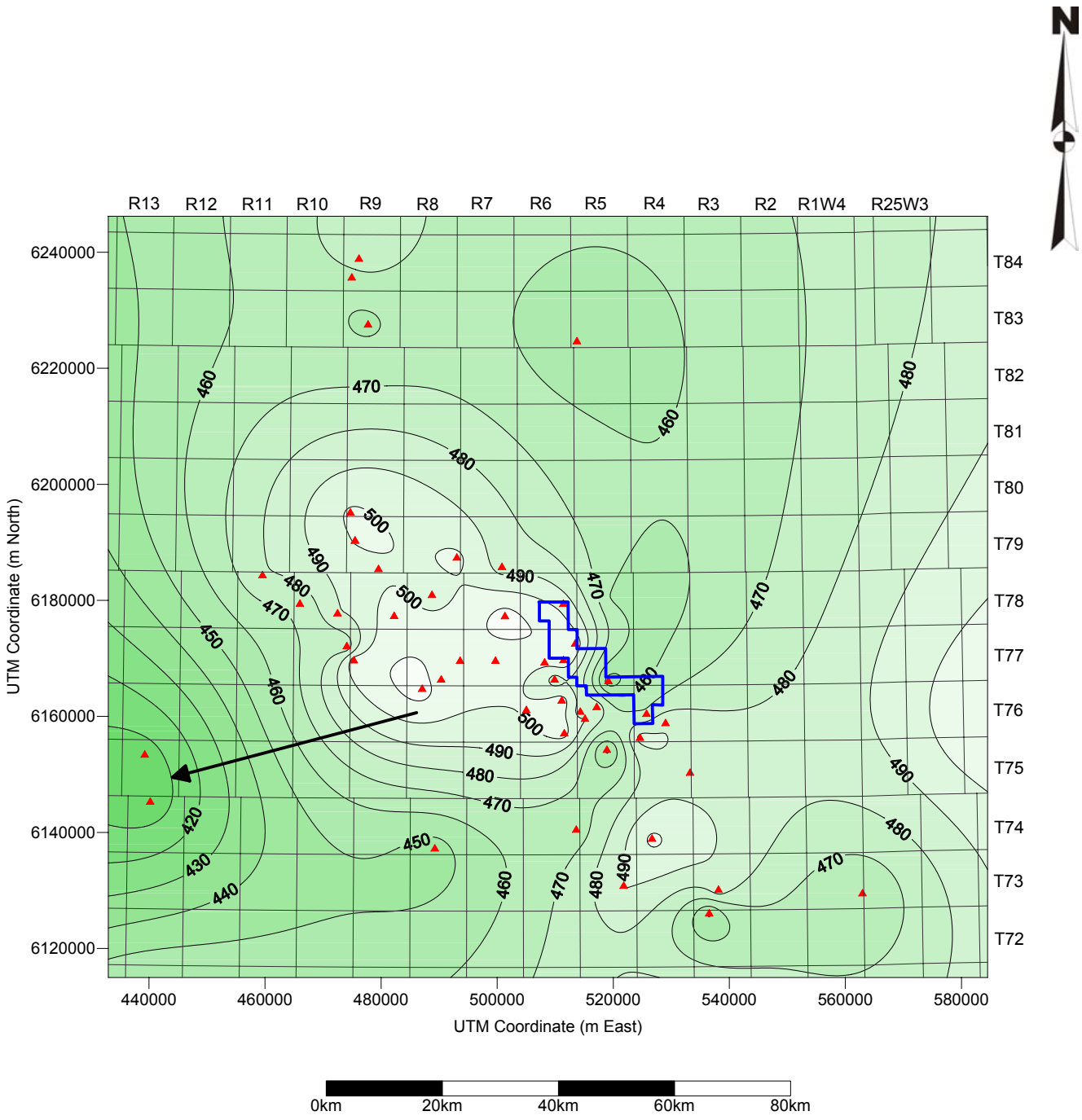
CHRISTINA LAKE REGIONAL PROJECT

TITLE

MCMURRAY FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-20



LEGEND

- HYDRAULIC HEAD DATA POINTS
- 440 CLEARWATER HYDRAULIC HEAD ELEVATION (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE

CONTOUR INTERVAL = 10 m

PROJECT

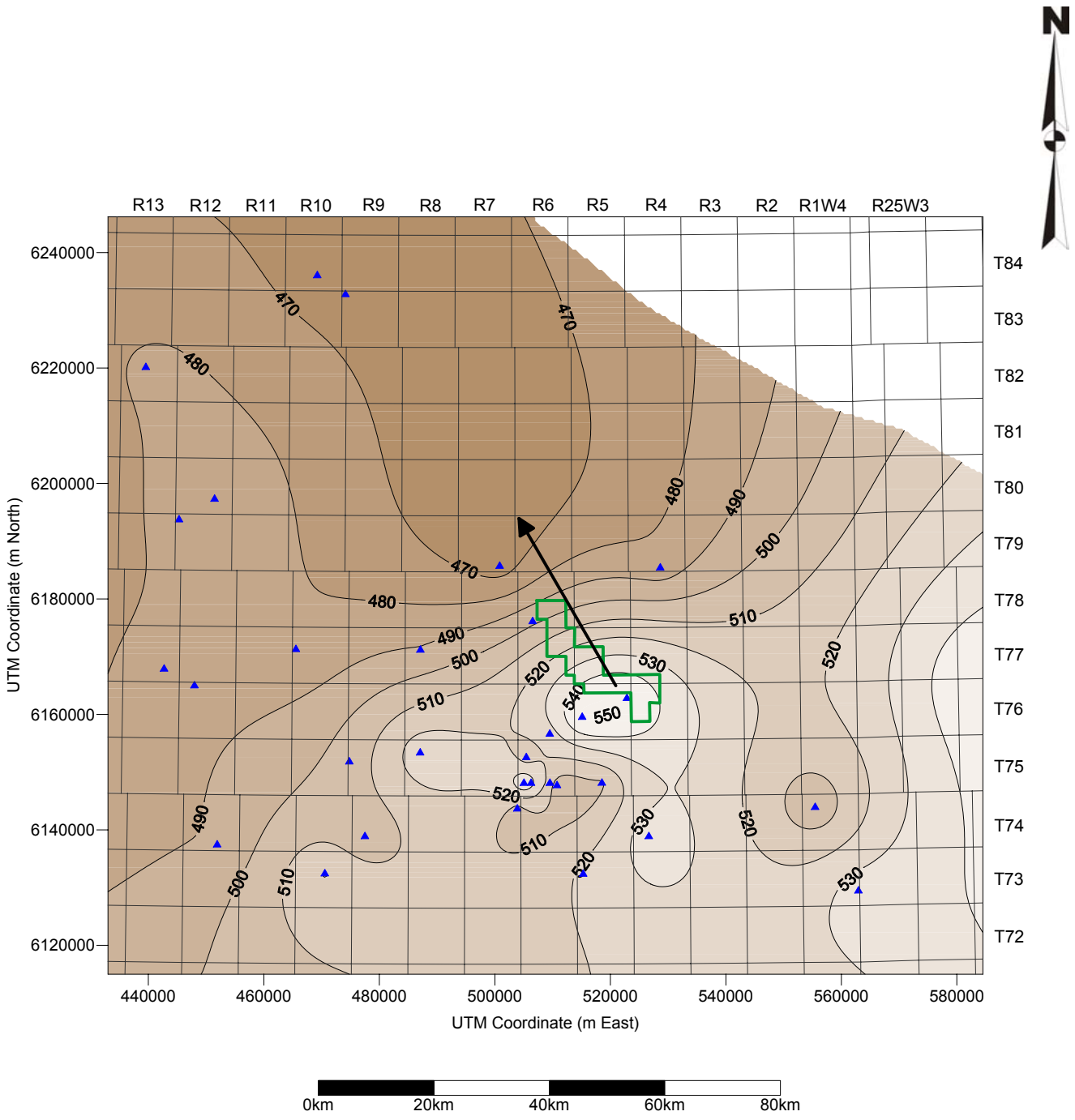
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CLEARWATER FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 3-21**



LEGEND

- HYDRAULIC HEAD DATA POINTS
- 480 GRAND RAPIDS HYDRAULIC HEAD ELEVATION (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE

CONTOUR INTERVAL = 10 m

PROJECT

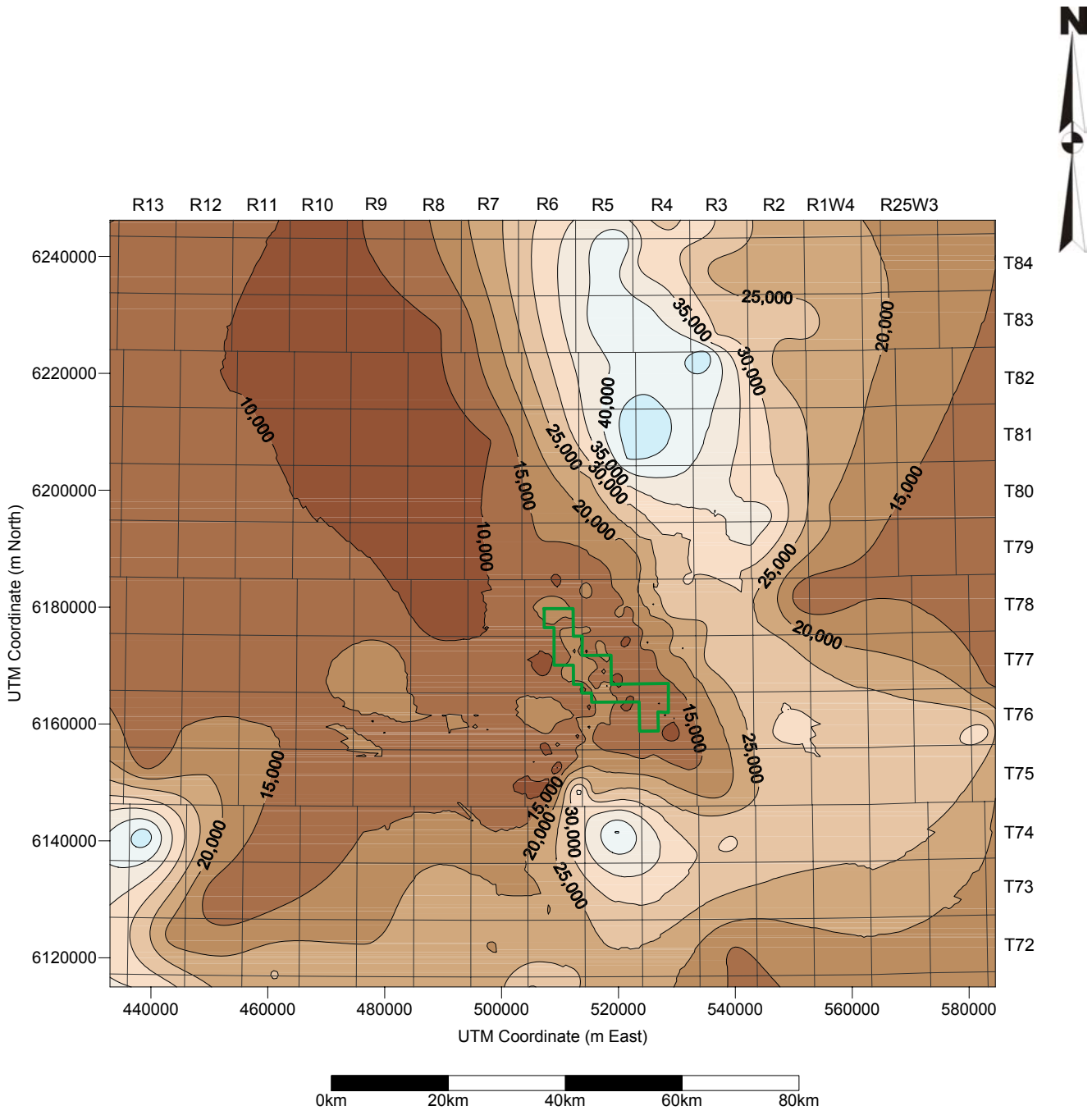
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GRAND RAPIDS FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-22



LEGEND

15,000 MCMURRAY SALINITY (mg/L)

MEG OIL SANDS LEASE

CONTOUR INTERVAL = 5,000 mg/L

PROJECT

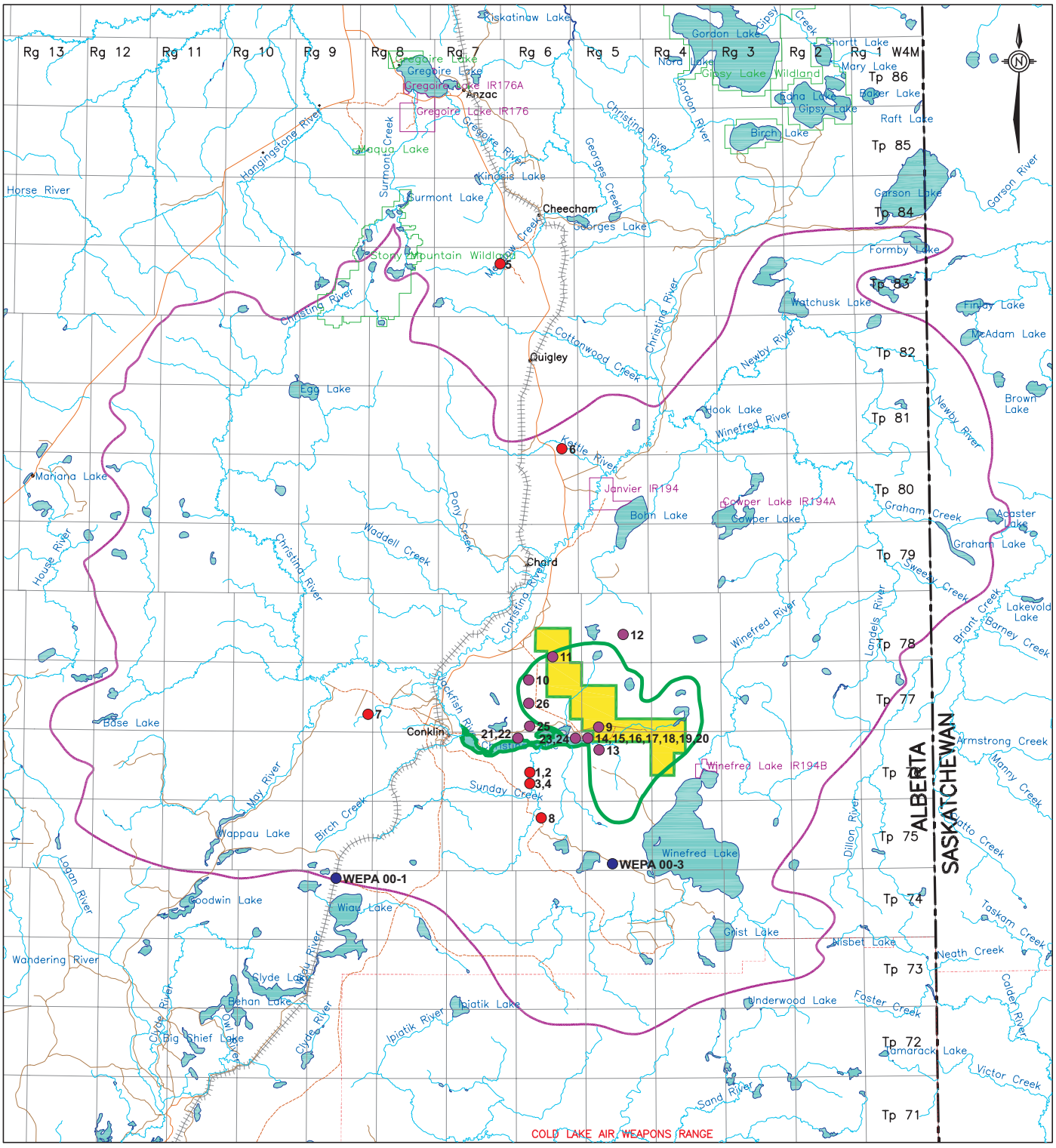
CHRISTINA LAKE REGIONAL PROJECT

TITLE

MCMURRAY FORMATION SALINITY DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 3-23



LEGEND

- MEG OIL SANDS LEASE
- REGIONAL STUDY AREA
- LOCAL STUDY AREA
- IN-SITU OIL SANDS PROJECT WATER SOURCE WELLS
- FROM AENV DATABASE
- AGS OBSERVATION WELLS

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM GEOMATICS CANADA, AUGUST 2001. DATUM: NAD 83 PROJECTION: UTM ZONE 12

PROJECT

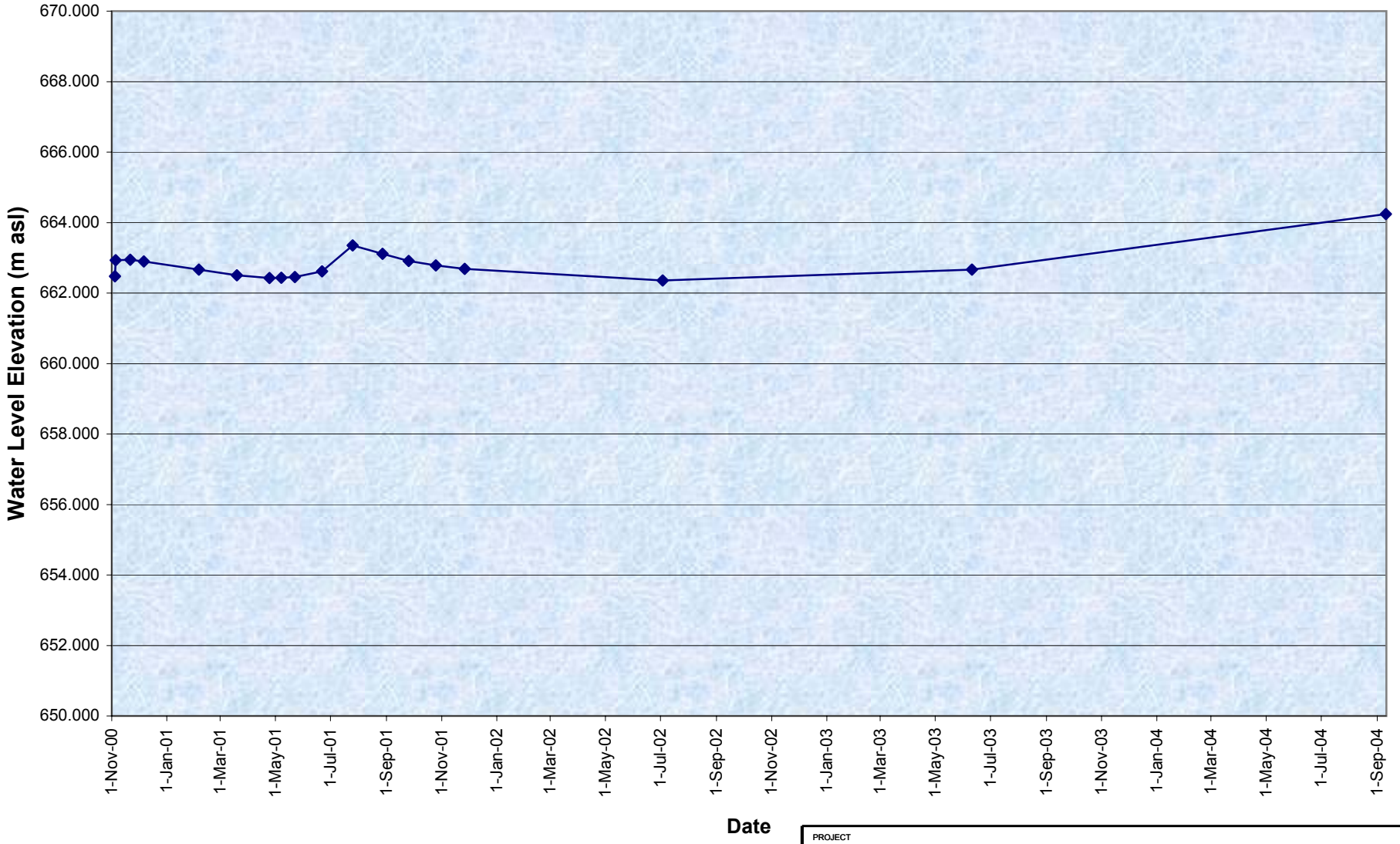
CHRISTINA LAKE REGIONAL PROJECT

TITLE

LOCATION OF DOMESTIC, OBSERVATION AND INDUSTRIAL WATER WELLS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: EG	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE 3-24



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-1-15(WT) HYDROGRAPH

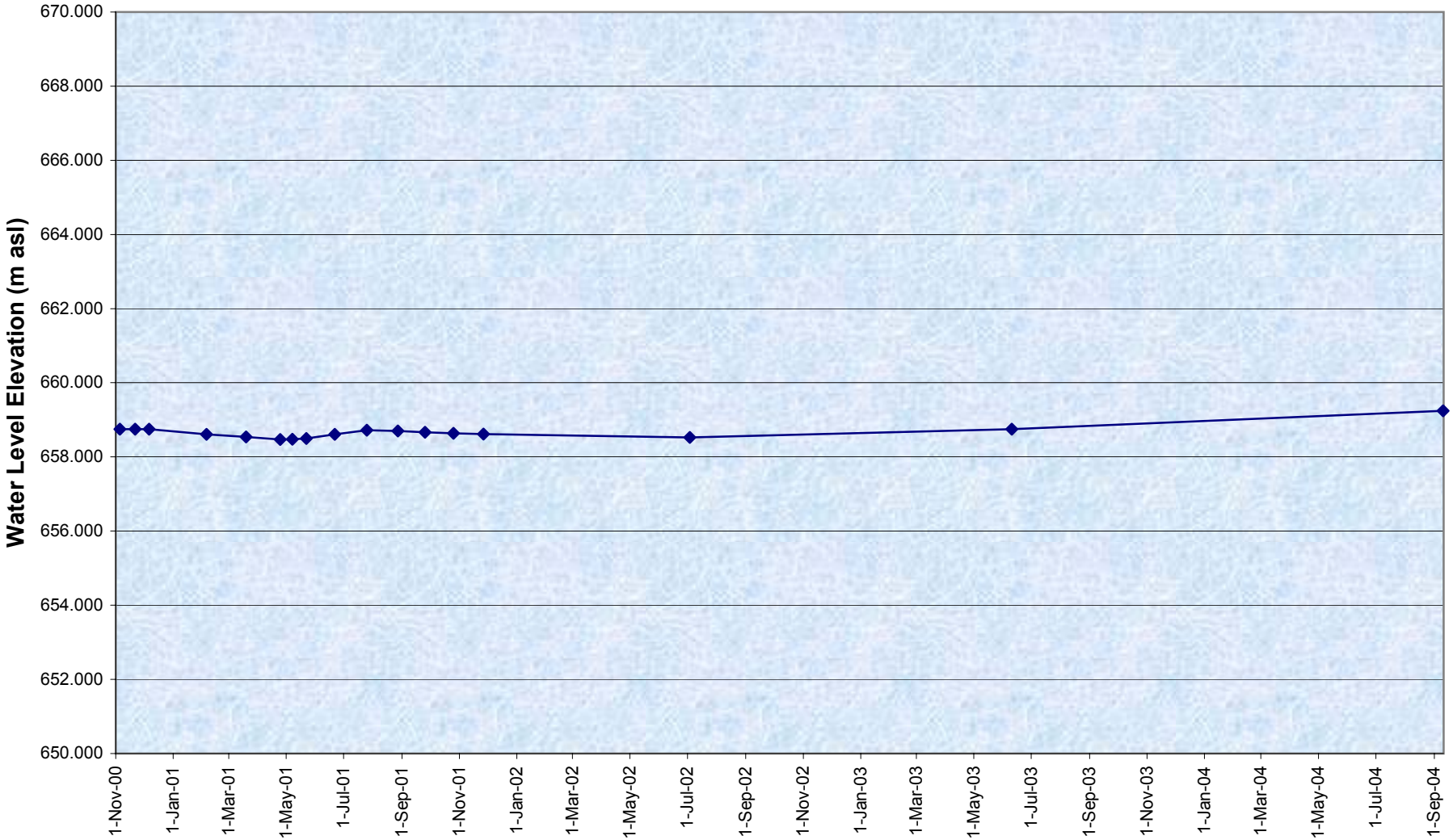
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-25



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-1-41 HYDROGRAPH

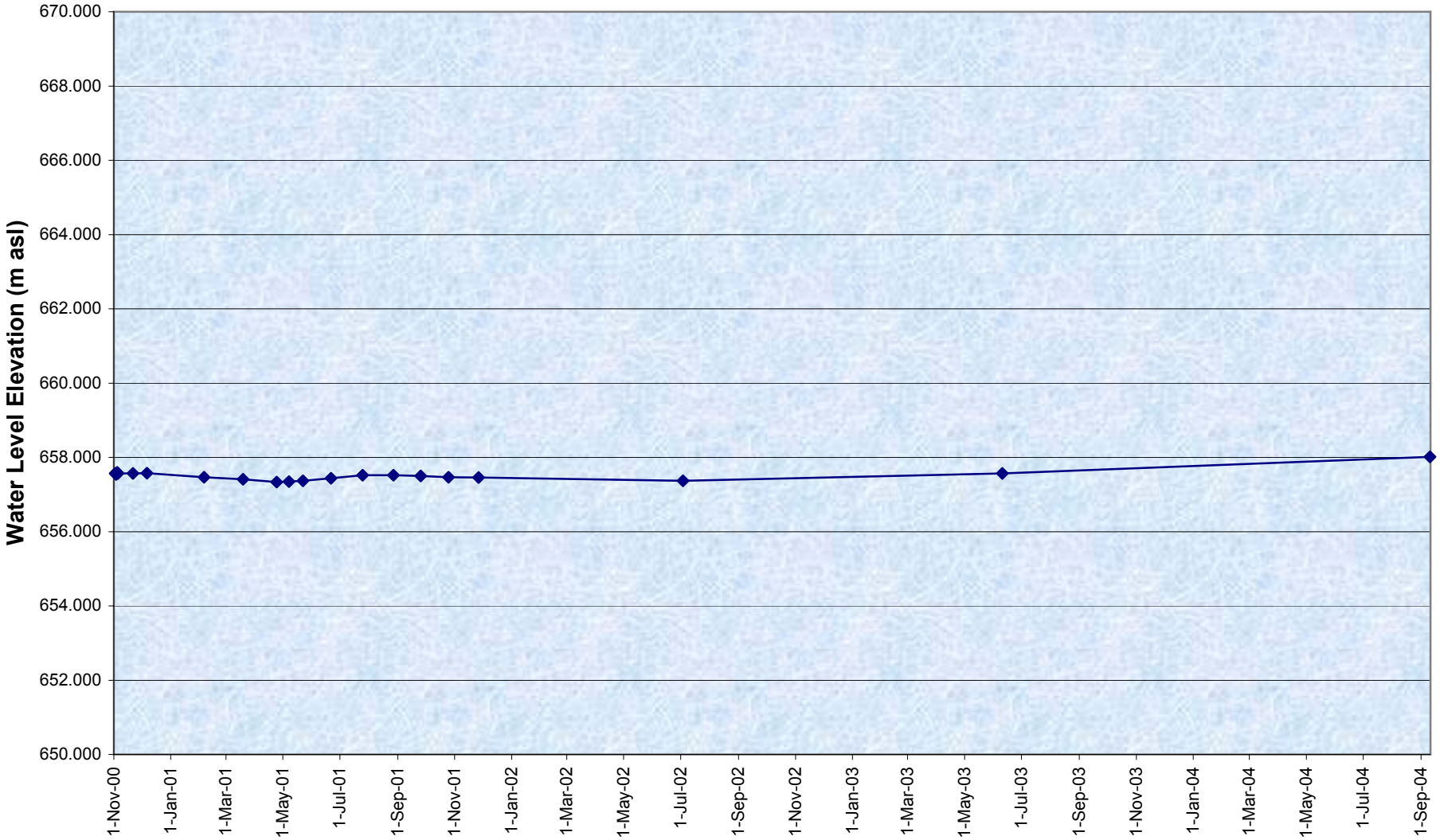
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-26



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-1-76 HYDROGRAPH

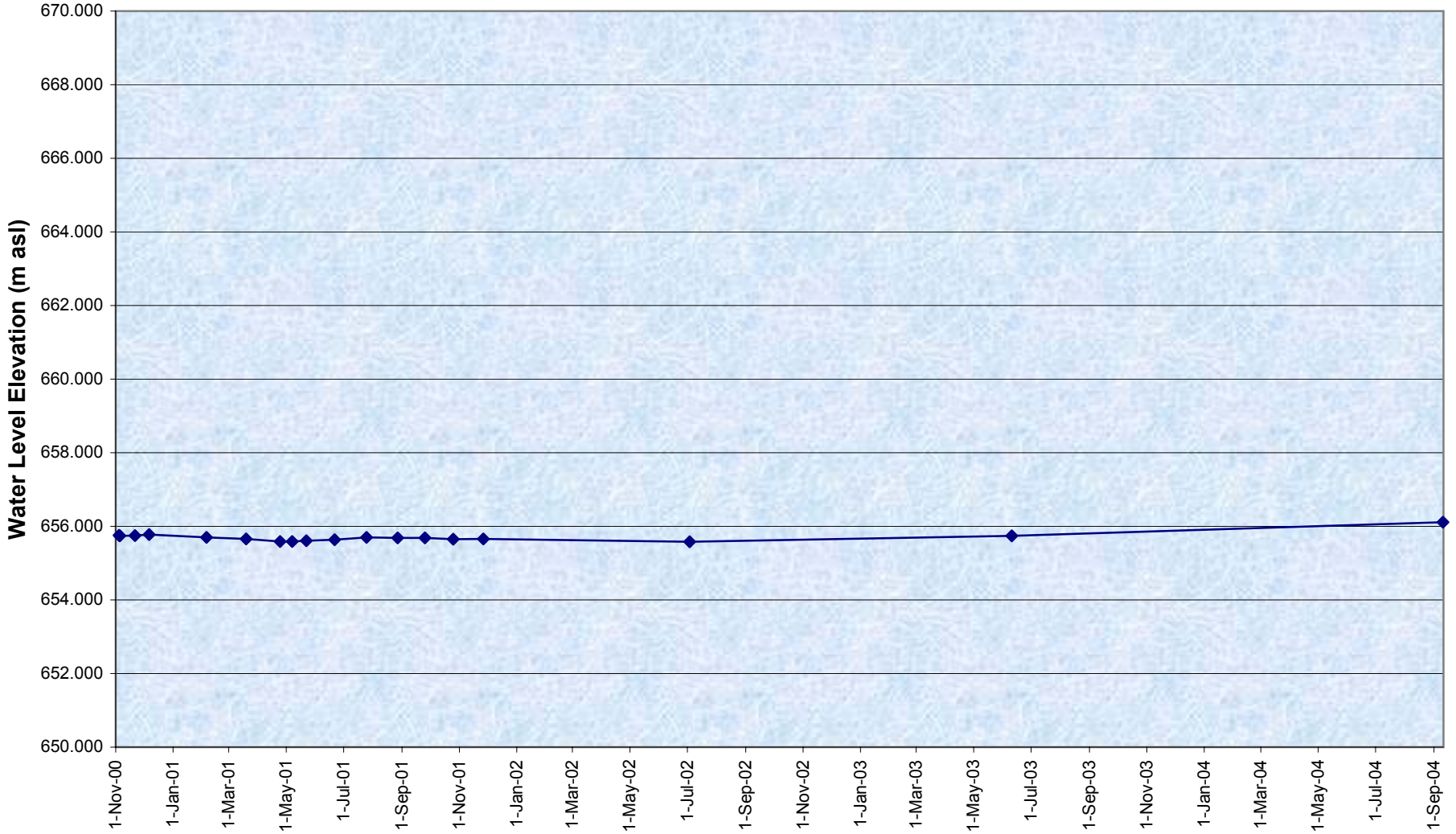
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-27



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-1-120 HYDROGRAPH

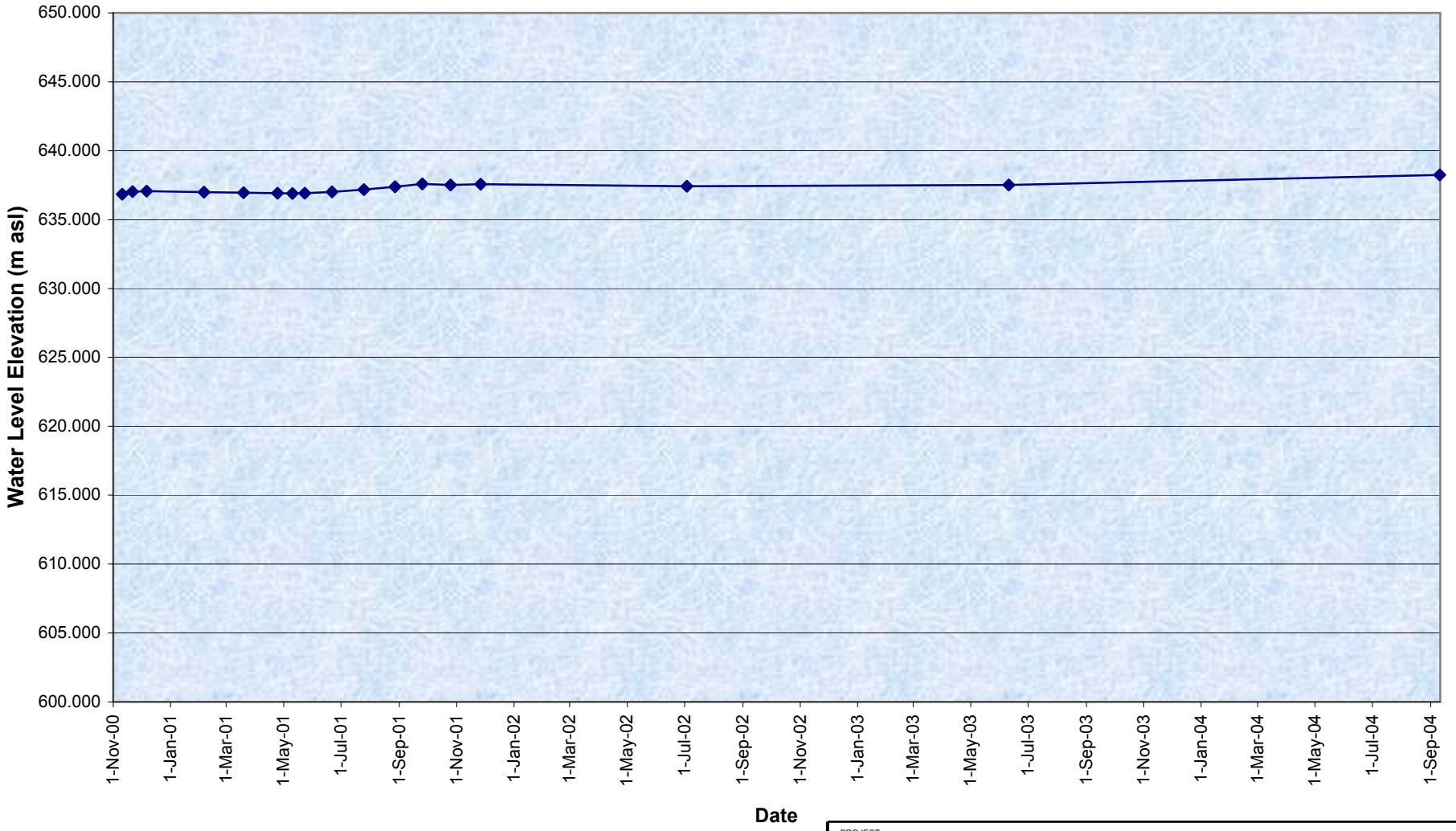
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-28



PROJECT

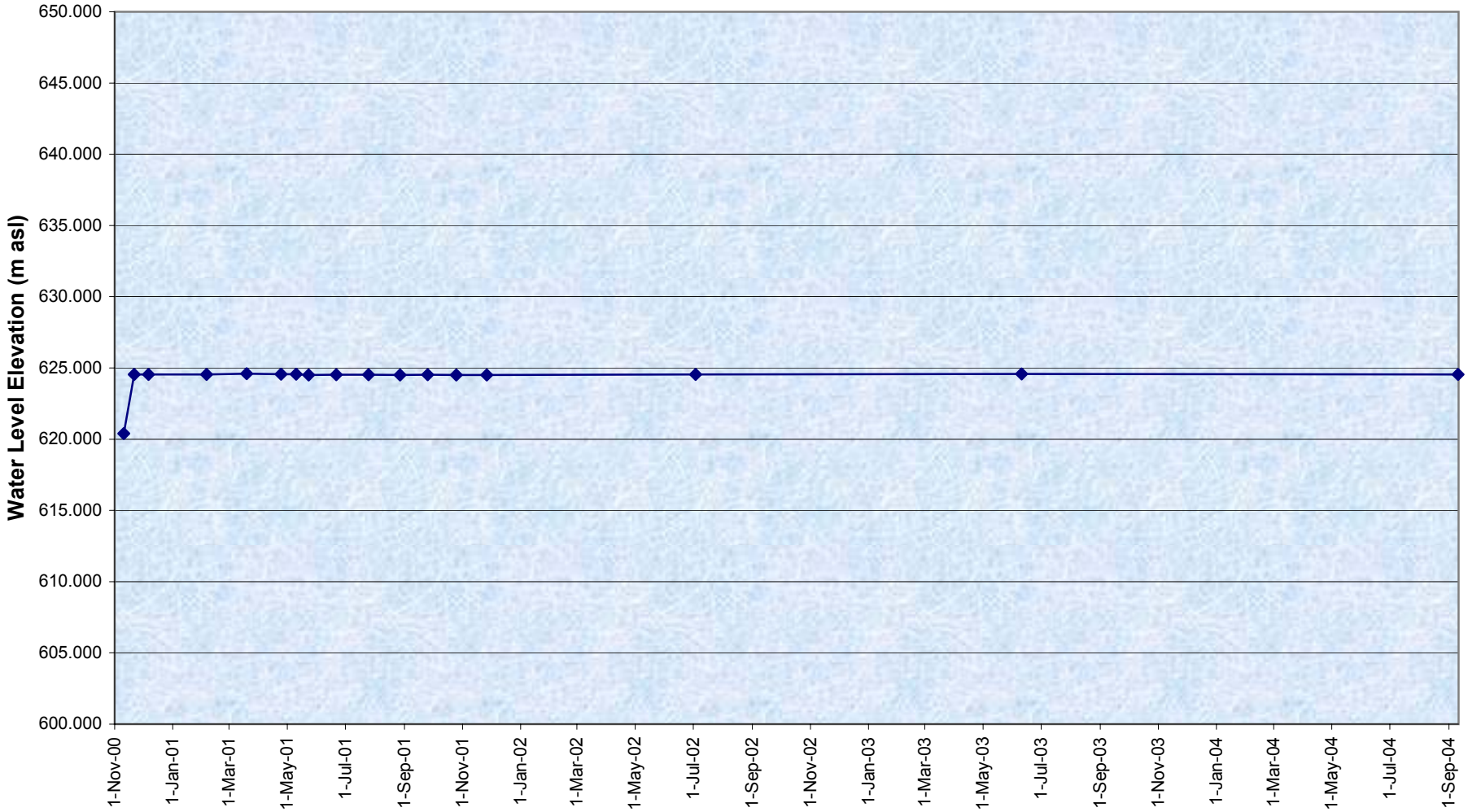
CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-3-17(WT) HYDROGRAPH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	
REVIEWED: EG	FIGURE 3-29



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-3-79 HYDROGRAPH

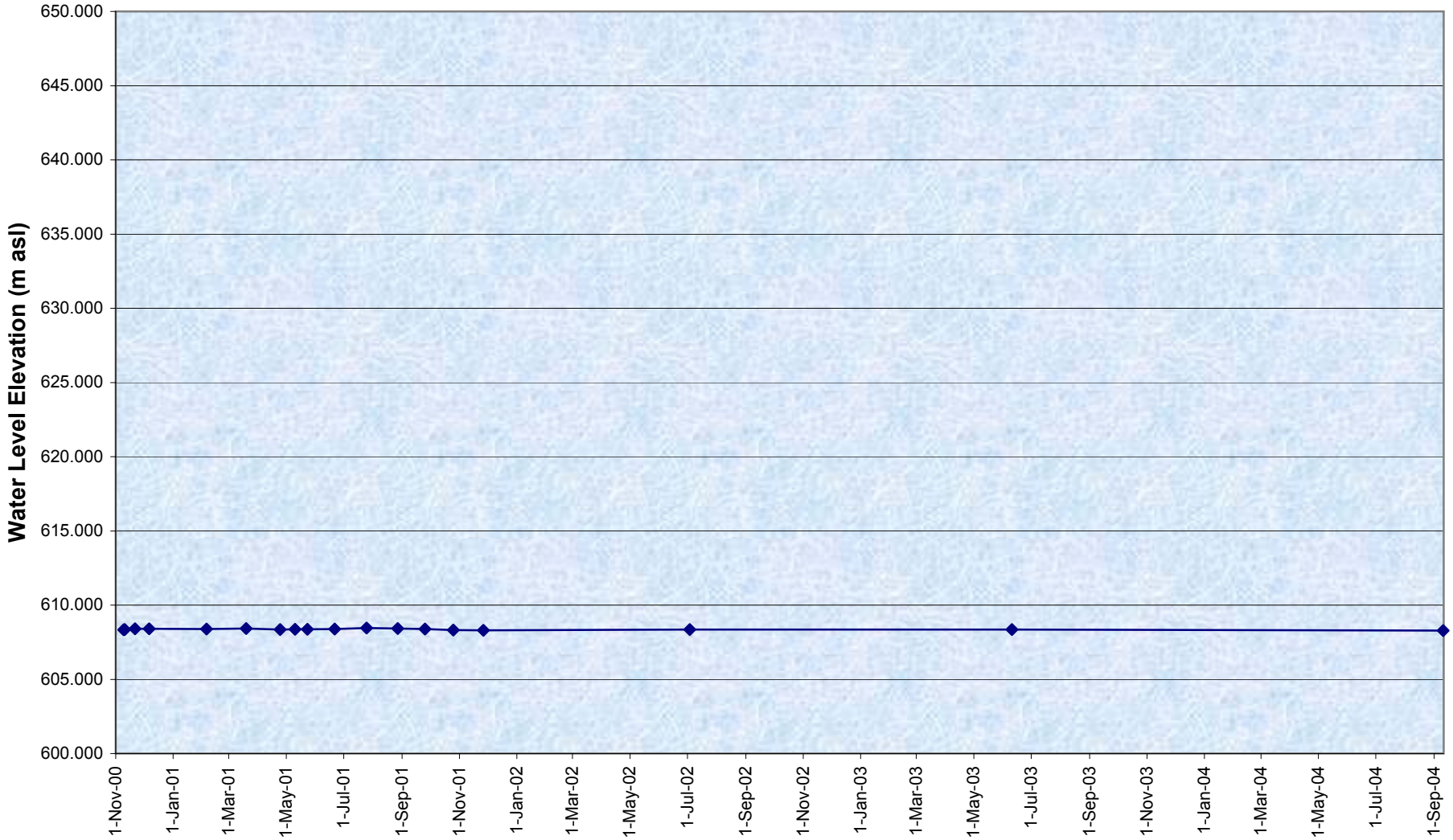
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-30



PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

WEPA 00-3-158 HYDROGRAPH

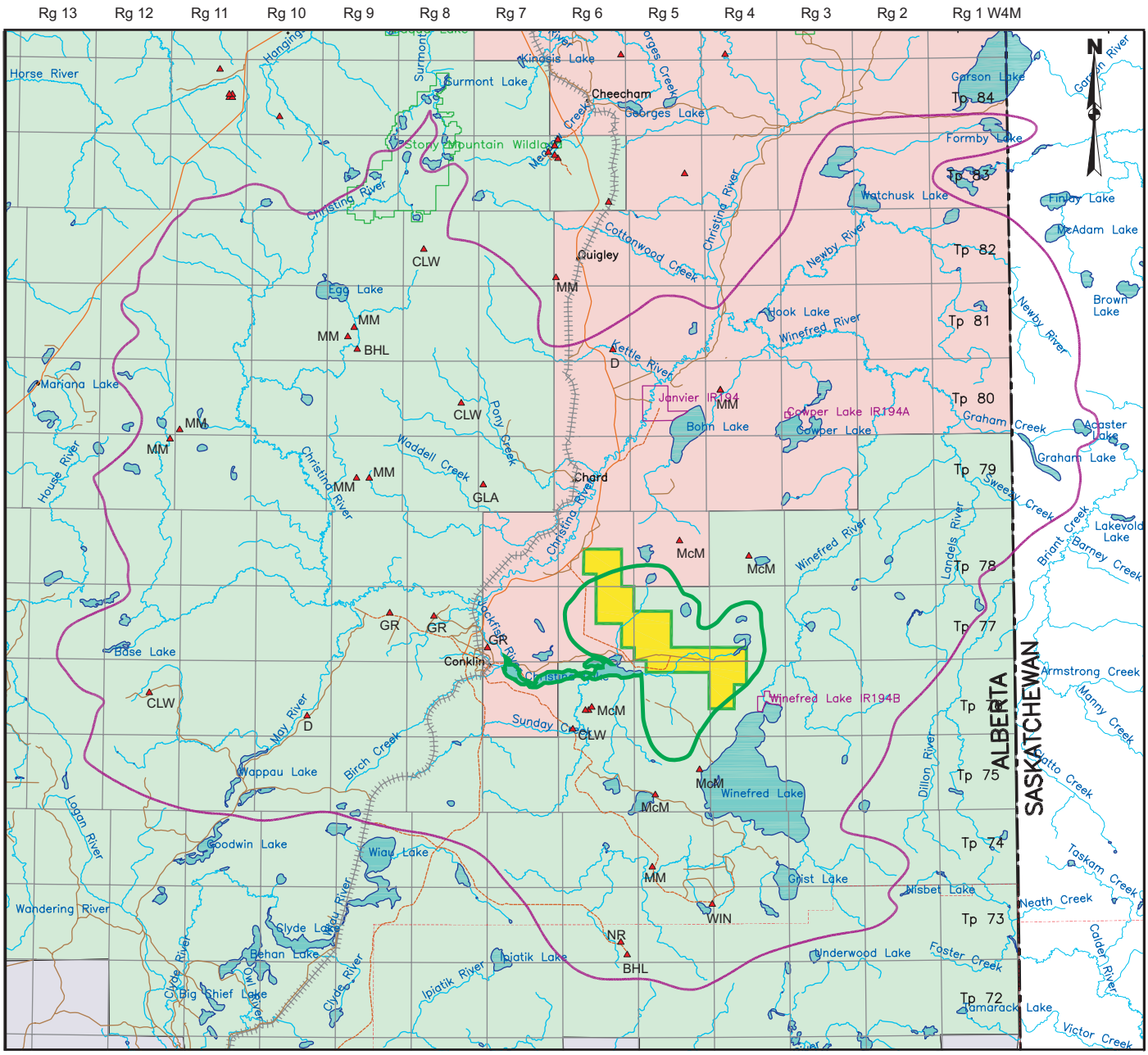
MEG ENERGY CORP.

PREPARED BY: WESTWATER

COMPILED BY: JS

REVIEWED: EG

FIGURE 3-31



DISPOSAL ZONE UTILIZED

WM	Wabasca/McMurray
GLA	Glauconitic SS
GR	Grand Rapids
MM	McMurray
CLW	Clearwater
D	Devonian
BHL	Beaverhill Lake
WIN	Winnipegosis
KR	Keg River
NR	Not Reported

LEGEND

- MEG OIL SANDS LEASE
- REGIONAL STUDY AREA
- LOCAL STUDY AREA
- DISPOSAL WELL LOCATIONS
- QUATERNARY - BASE OF GROUNDWATER PROTECTION
- GRAND RAPIDS - BASE OF GROUNDWATER PROTECTION
- CLEARWATER - BASE OF GROUNDWATER PROTECTION

REFERENCE

ALBERTA NTDB DIGITAL DATA OBTAINED FROM GEOMATICS CANADA, AUGUST 2001. DATUM: NAD 83 PROJECTION: UTM ZONE 12

PROJECT

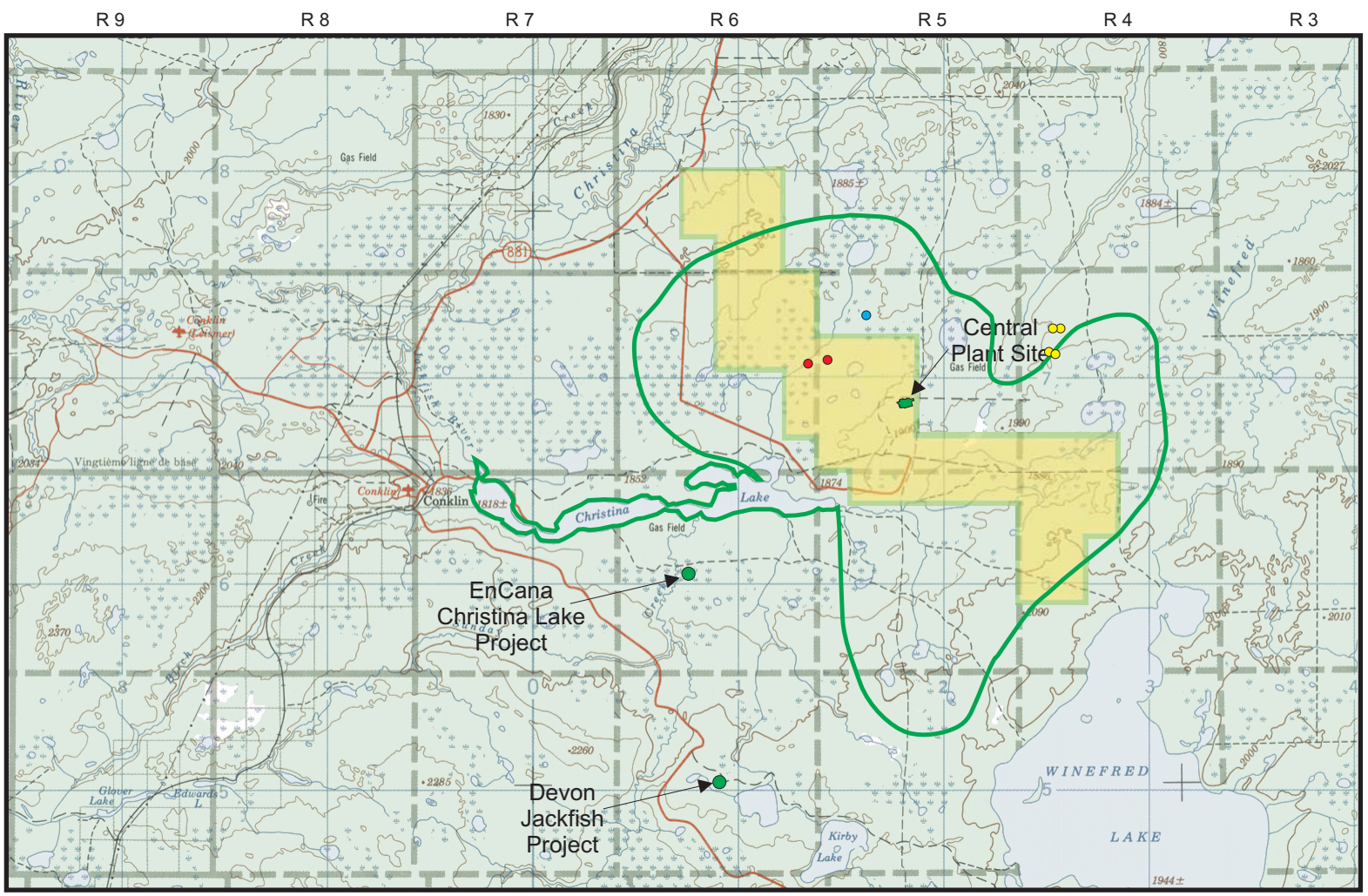
CHRISTINA LAKE REGIONAL PROJECT

TITLE

DISPOSAL WELL LOCATIONS AND THE BASE OF GROUNDWATER PROTECTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: EG	SCALE AS SHOWN
REVIEWED: EG	FIGURE 3-32



NOTE: (contour elevations shown in feet above sea level)

LEGEND

- MEG OIL SANDS LEASE
- LOCAL STUDY AREA (LSA)
- SALINE WATER WELL DRILLING TARGETS
- POTABLE WATER WELL DRILLING TARGETS
- DISPOSAL WELL

PROJECT

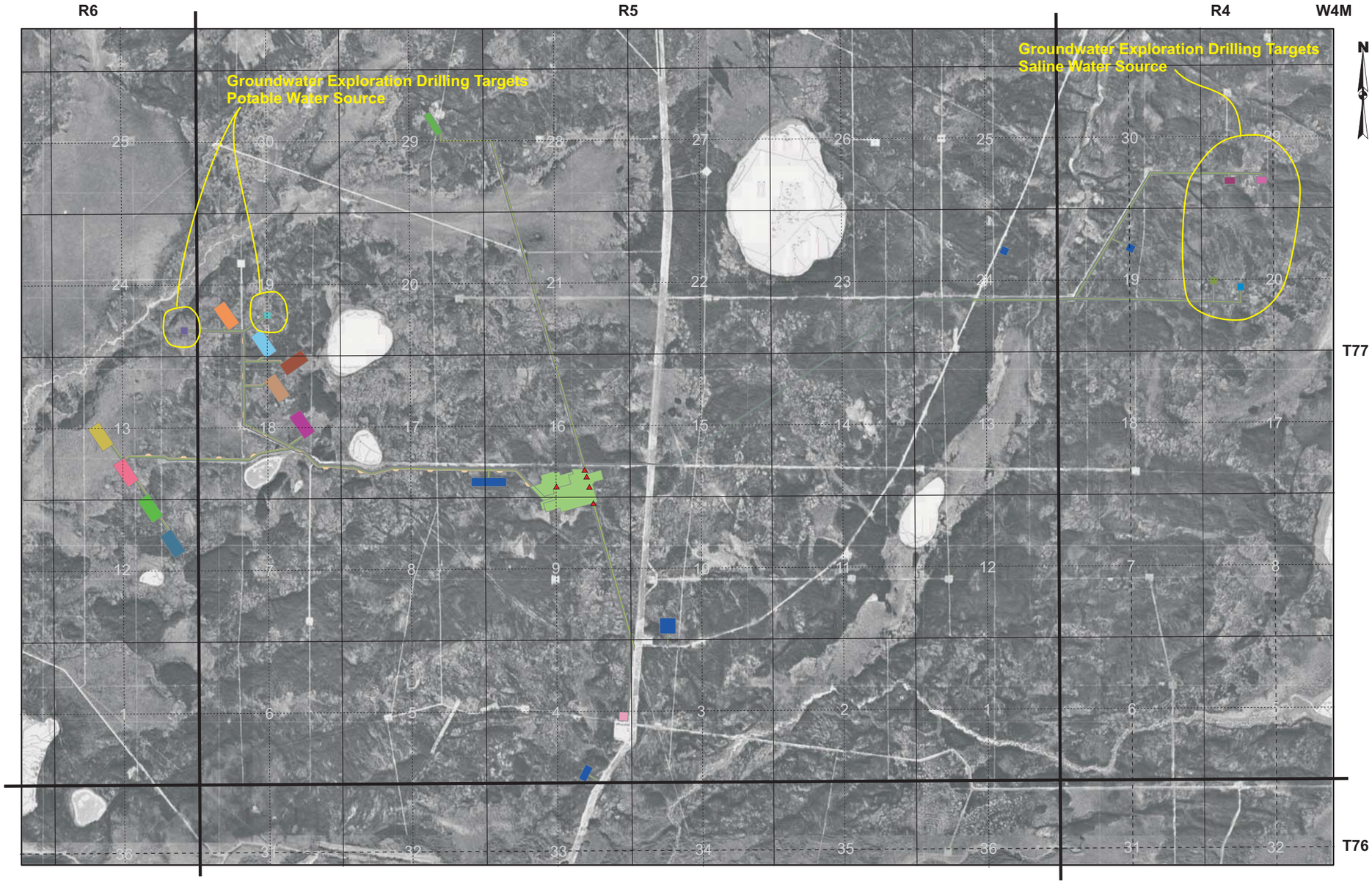
CHRISTINA LAKE REGIONAL PROJECT

TITLE

LOCAL STUDY AREA AND SITE PHYSIOGRAPHY

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED BY: EG	
	FIGURE: 4-1



LEGEND

- A/G PIPE
- BORROW PIT
- CENTRAL PLANT SITE
- DISPOSAL WELL 10-29-77-5
- POWERLINE
- PRODUCTION PAD "A"
- PRODUCTION PAD "B"
- PRODUCTION PAD "C"
- PRODUCTION PAD "D"
- PRODUCTION PAD "E"
- PRODUCTION PAD "F"
- PRODUCTION PAD "G"
- PRODUCTION PAD "H"
- PRODUCTION PAD "I"
- ROW
- ROAD
- SHALLOW GEOTECHNICAL PROGRAM BOREHOLES AND MONITORING WELLS
- CENTRAL PLANT SITE

Reference:
Digital data provided by Pearson Timberline Ltd., March 2004, used under license.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 12

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

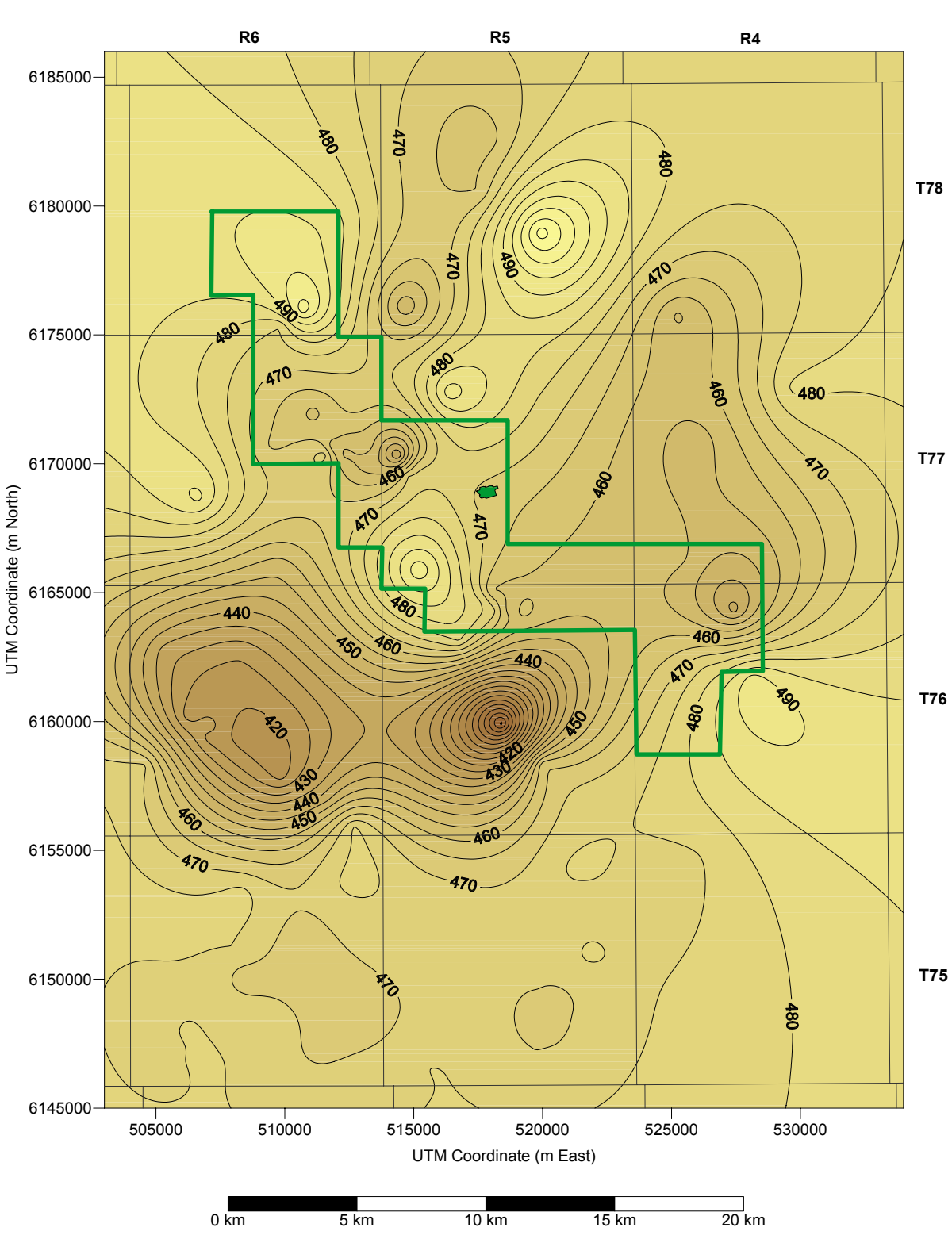
TITLE

LOCATION OF CENTRAL PLANT MONITORING WELLS AND GROUNDWATER EXPLORATION TARGETS

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-2



LEGEND

- 470 BEDROCK SURFACE ELEVATION (m asl)
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

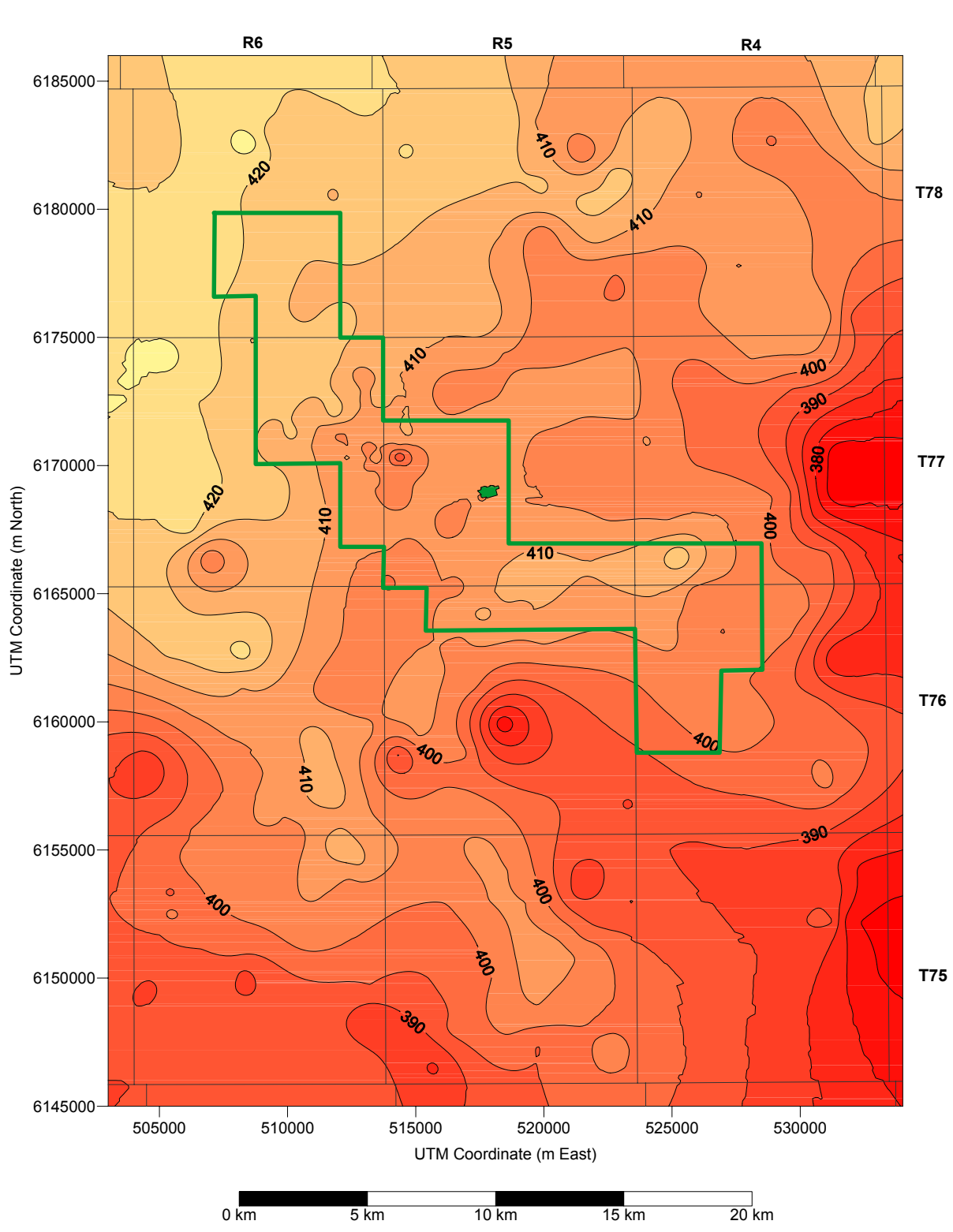
CHRISTINA LAKE REGIONAL PROJECT

TITLE

BEDROCK SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 4-3**



LEGEND

- 400 GRAND RAPIDS SURFACE ELEVATION (m asl)
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

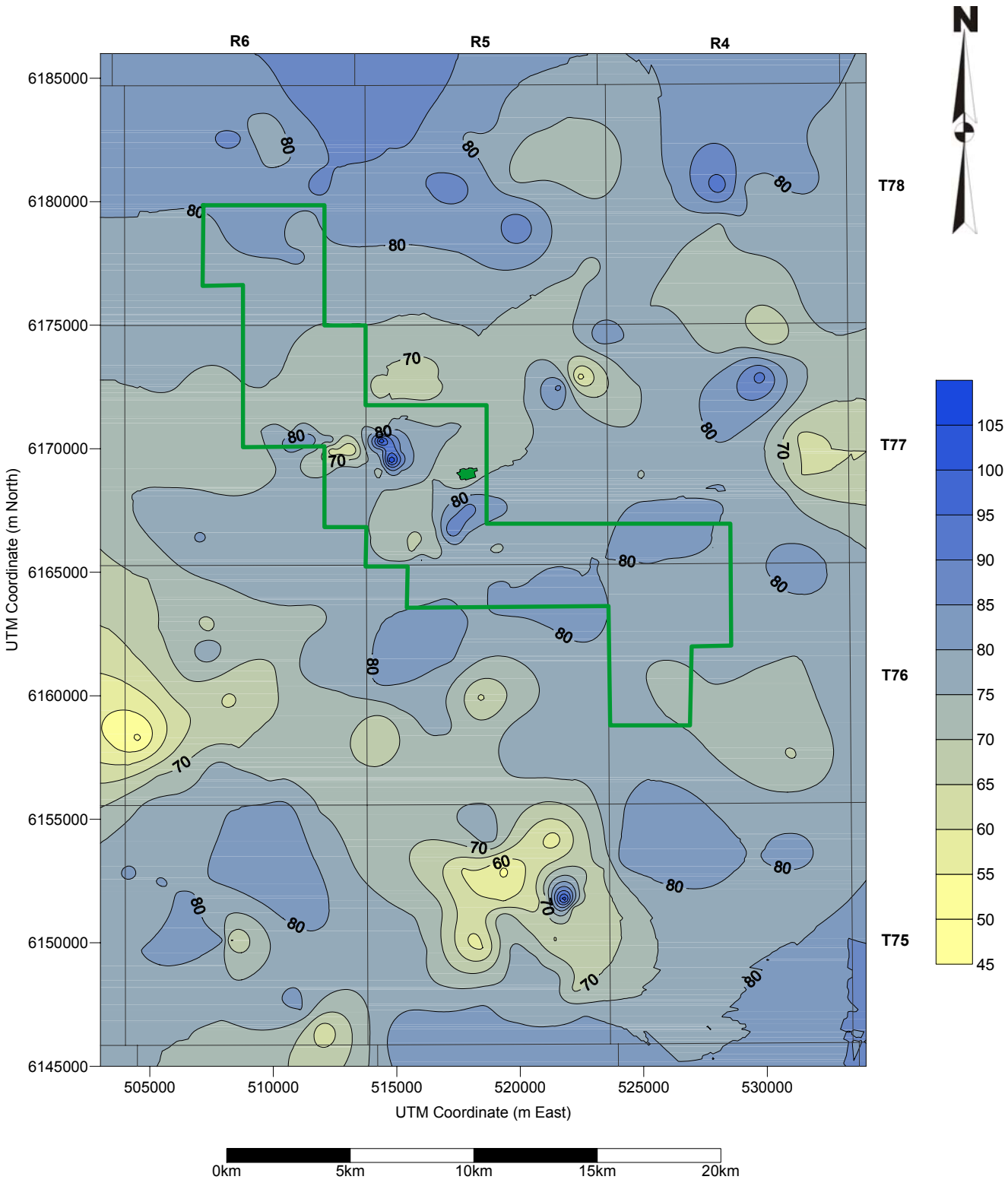
TITLE

GRAND RAPIDS FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-4



LEGEND

80 GRAND RAPIDS THICKNESS (m)

MEG OIL SANDS LEASE

CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

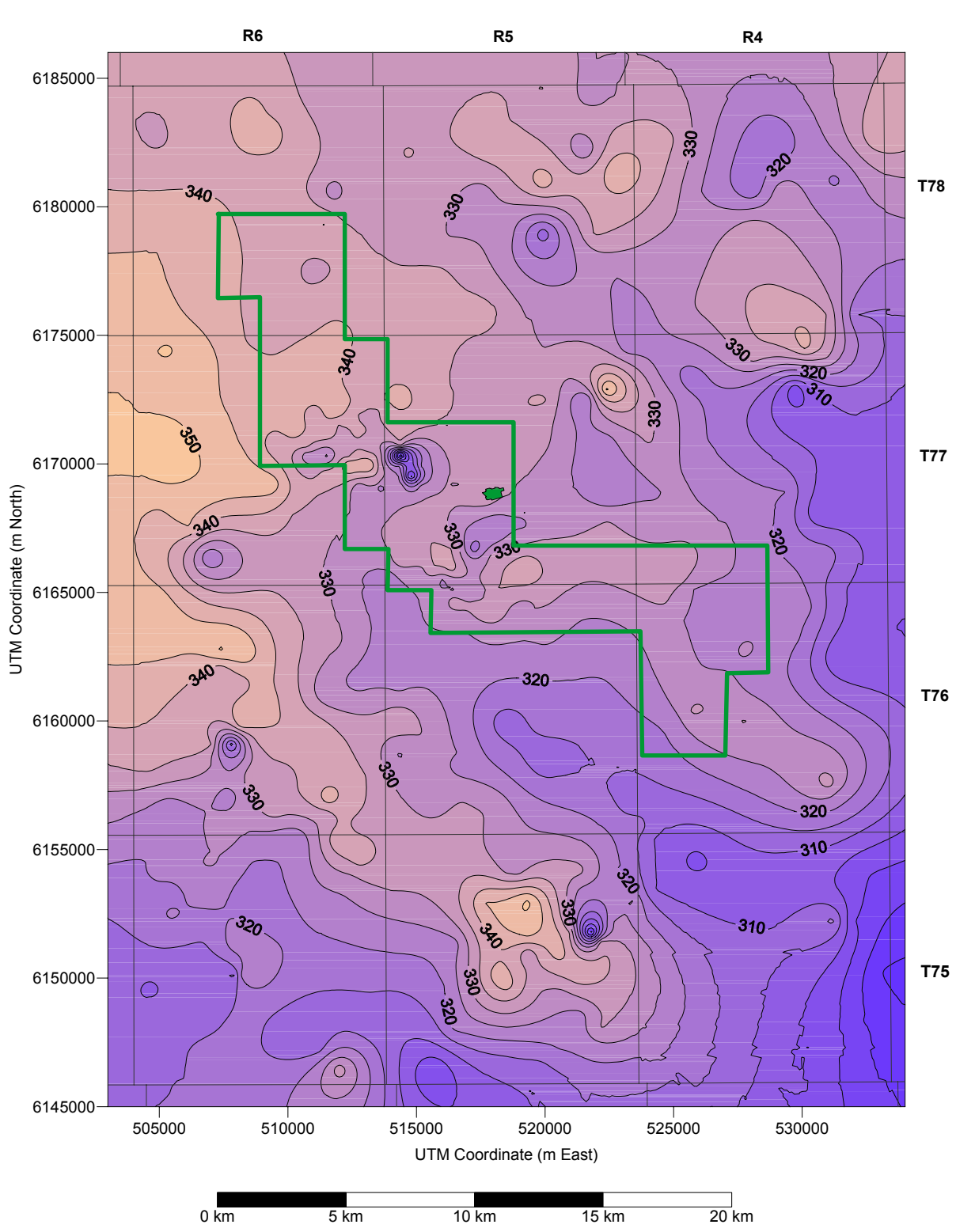
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GRAND RAPIDS FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 4-5



LEGEND

330 CLEARWATER SURFACE ELEVATION (m asl)

MEG OIL SANDS LEASE

CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

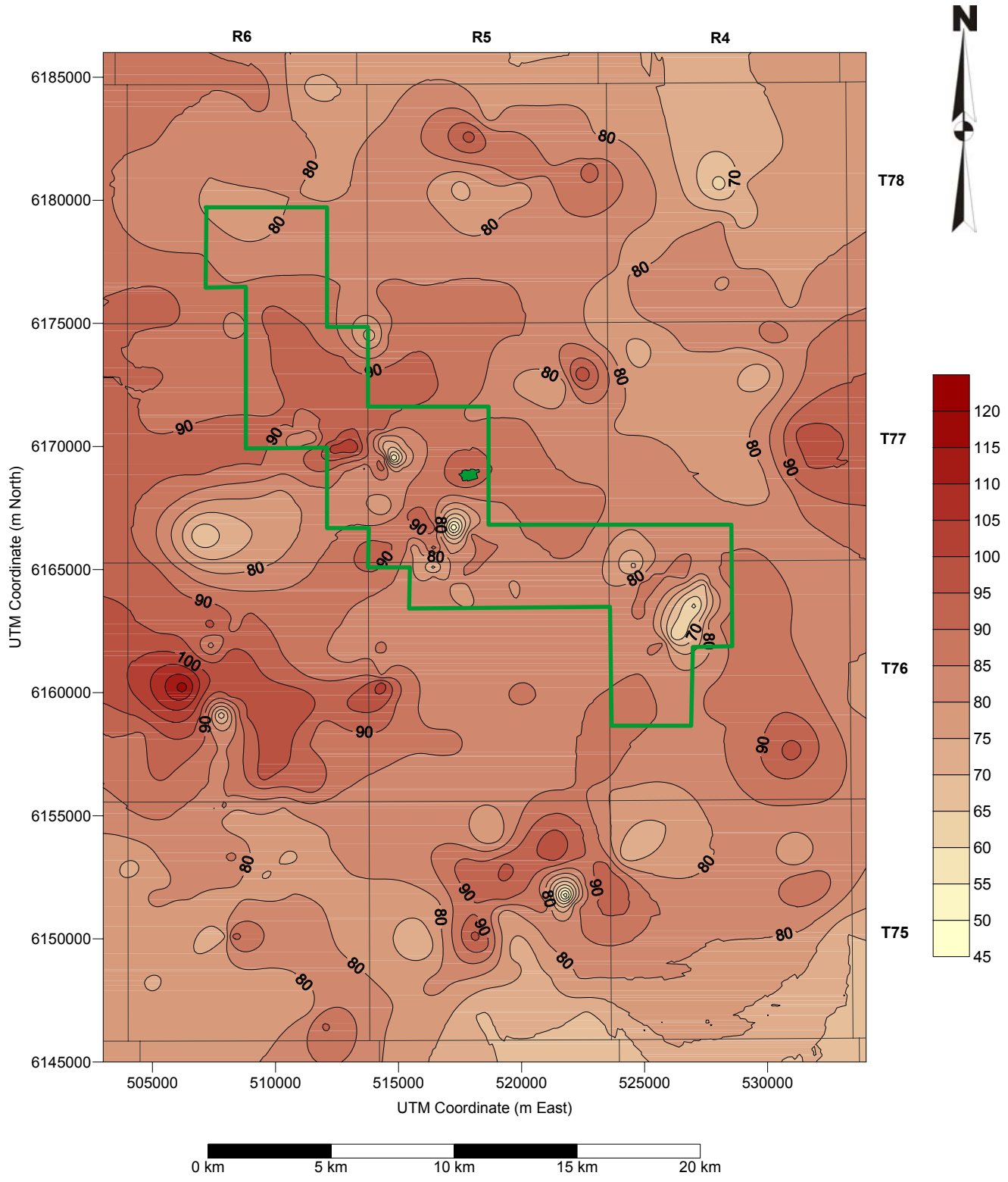
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CLEARWATER FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 4-6



LEGEND

- 80 — CLEARWATER THICKNESS (m)
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

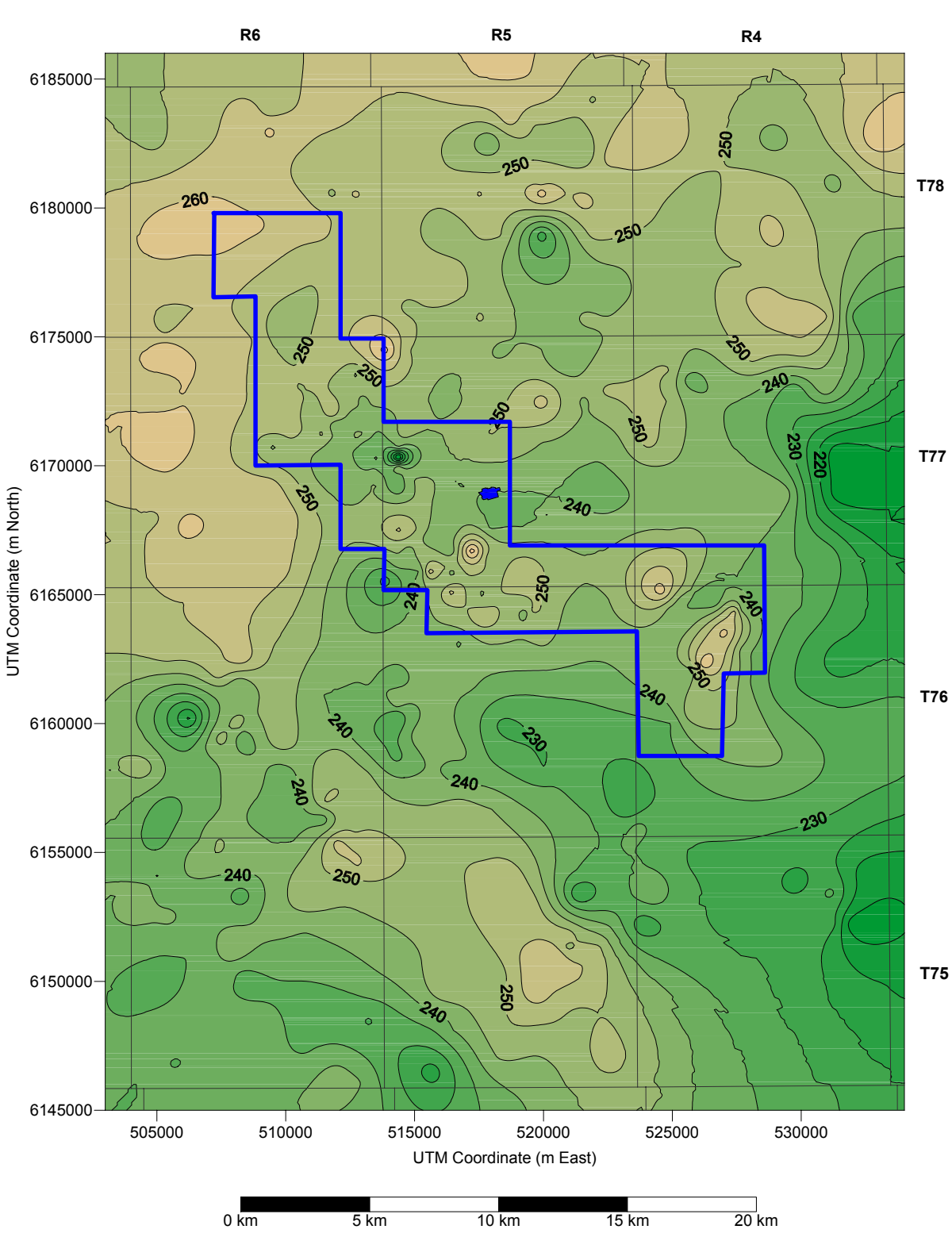
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CLEARWATER FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	**FIGURE: 4-7**



LEGEND

- 250 — MCMURRAY SURFACE ELEVATION (m asl)
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

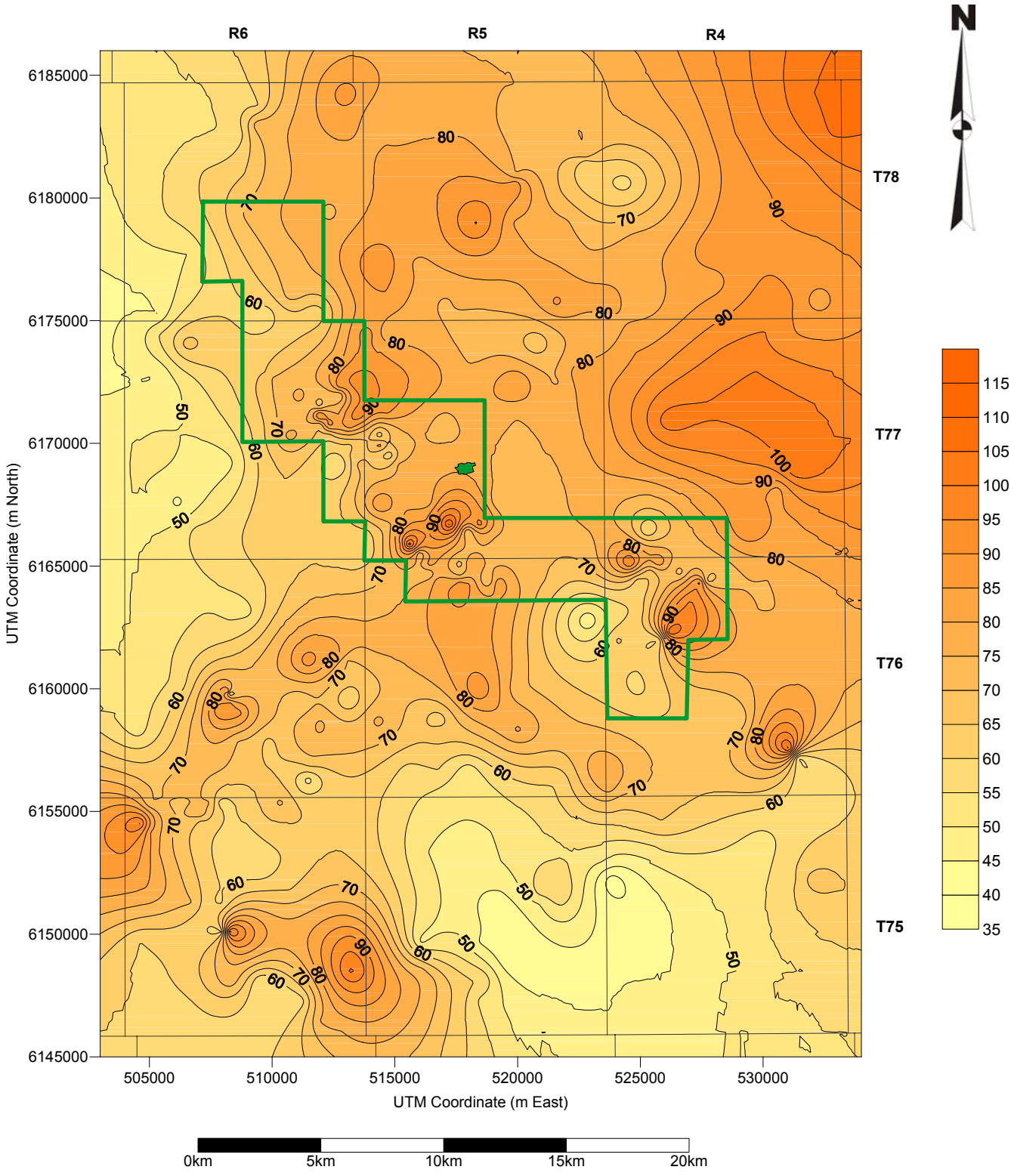
TITLE

MCMURRAY FORMATION SURFACE STRUCTURE

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-8



LEGEND

- 80 MCMURRAY THICKNESS (m)
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 5 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

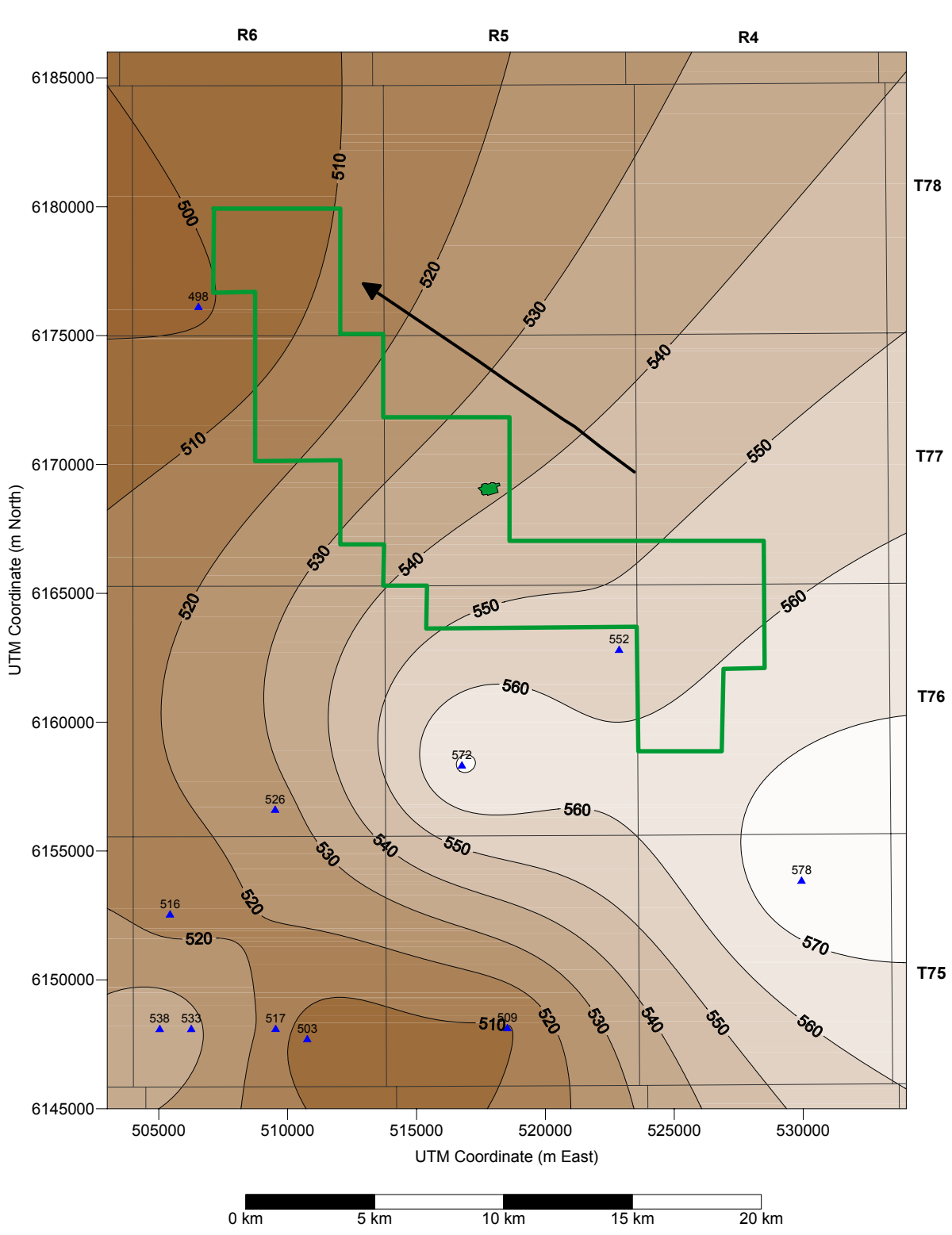
TITLE

MCMURRAY FORMATION ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-9



LEGEND

- 520 — GRAND RAPIDS HYDRAULIC HEAD ELEVATION (m asl)
- ▲ 516 — HYDRAULIC HEAD (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 10 m

PROJECT

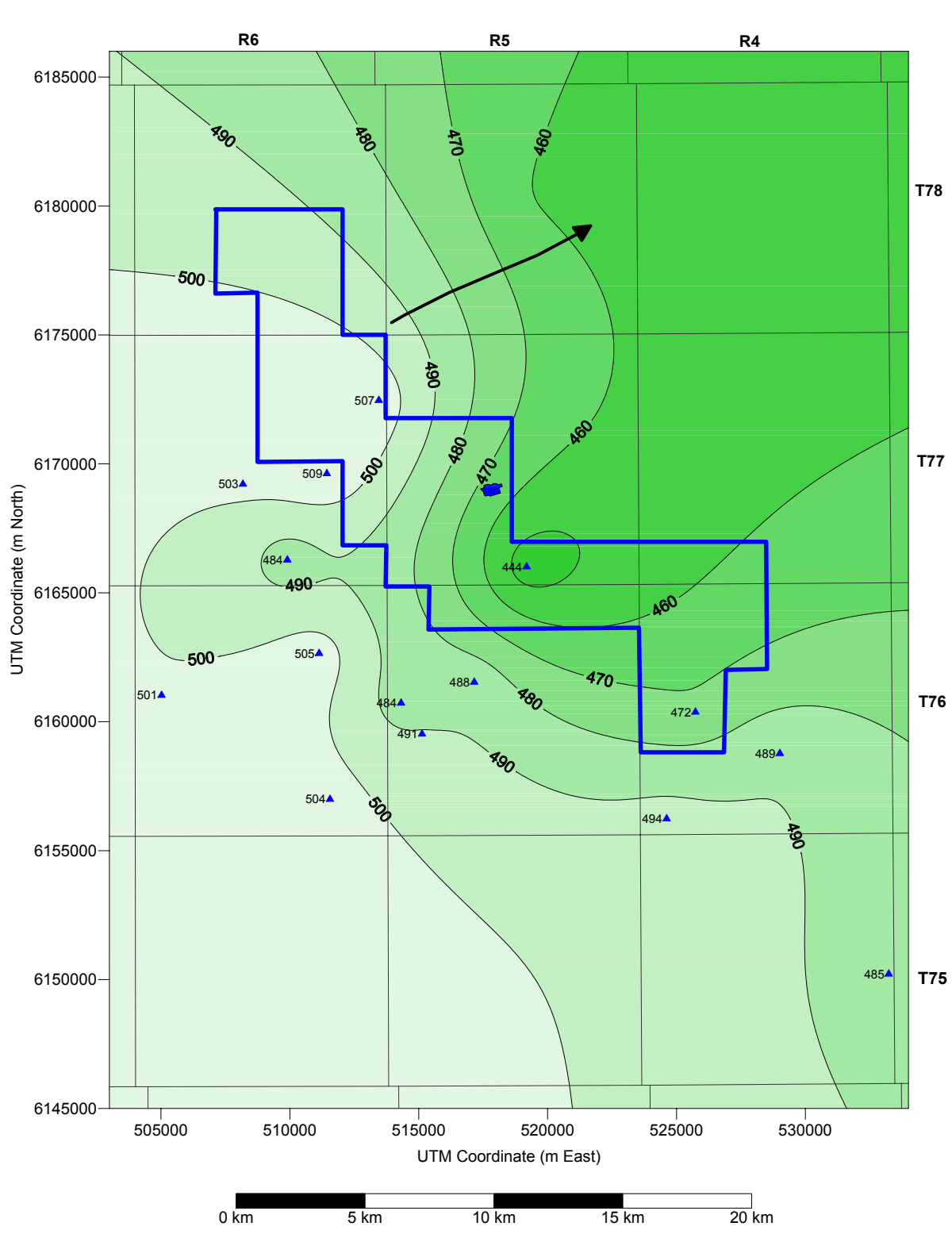
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GRAND RAPIDS FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	
	FIGURE: 4-10



LEGEND

- 490 — CLEARWATER HYDRAULIC HEAD ELEVATION (m asl)
- ▲504 — HYDRAULIC HEAD (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 10 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

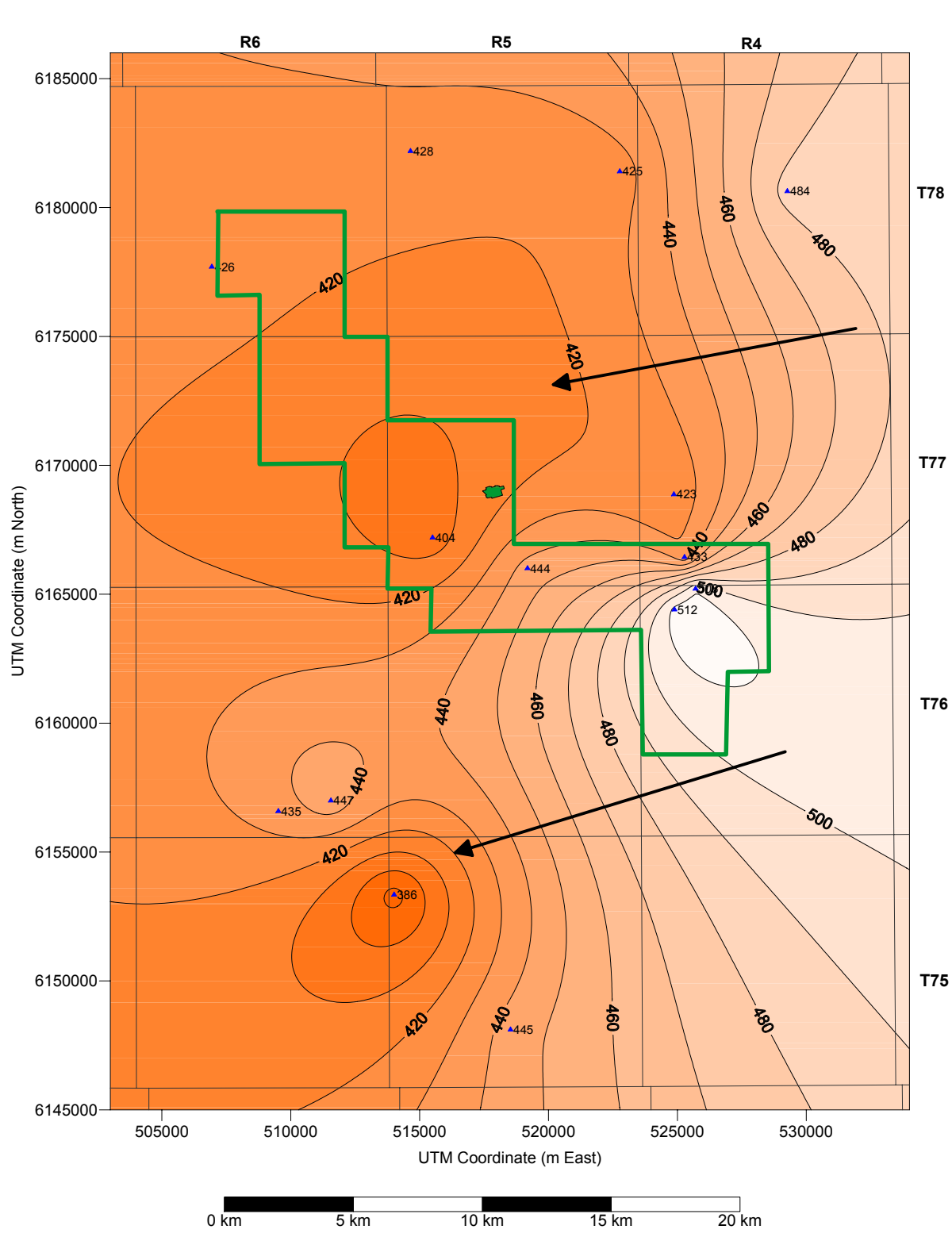
TITLE

CLEARWATER FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-11



LEGEND

- 420 — MCMURRAY HYDRAULIC HEAD ELEVATION (m asl)
- ▲435 HYDRAULIC HEAD (m asl)
- GROUNDWATER FLOW DIRECTION
- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE

CONTOUR INTERVAL = 10 m

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

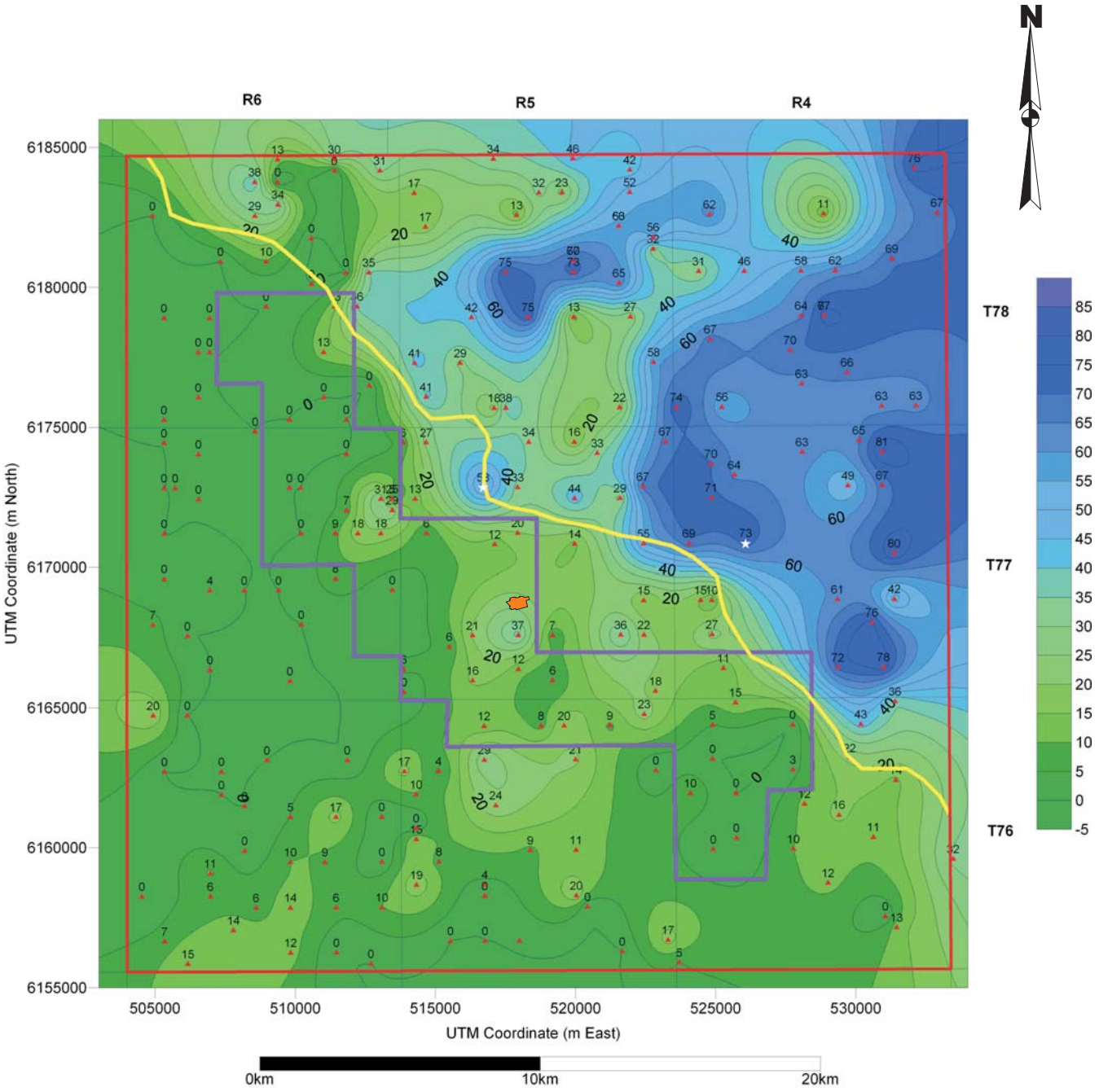
TITLE

MCMURRAY FORMATION HYDRAULIC HEAD DISTRIBUTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: JS	SCALE AS SHOWN
REVIEWED: EG	

FIGURE: 4-12



LEGEND

- MEG OIL SANDS LEASE
- CENTRAL PLANT SITE
- GEOLOGIC CONTROL POINTS
- APPROXIMATE OIL/WATER CONTACT LINE

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

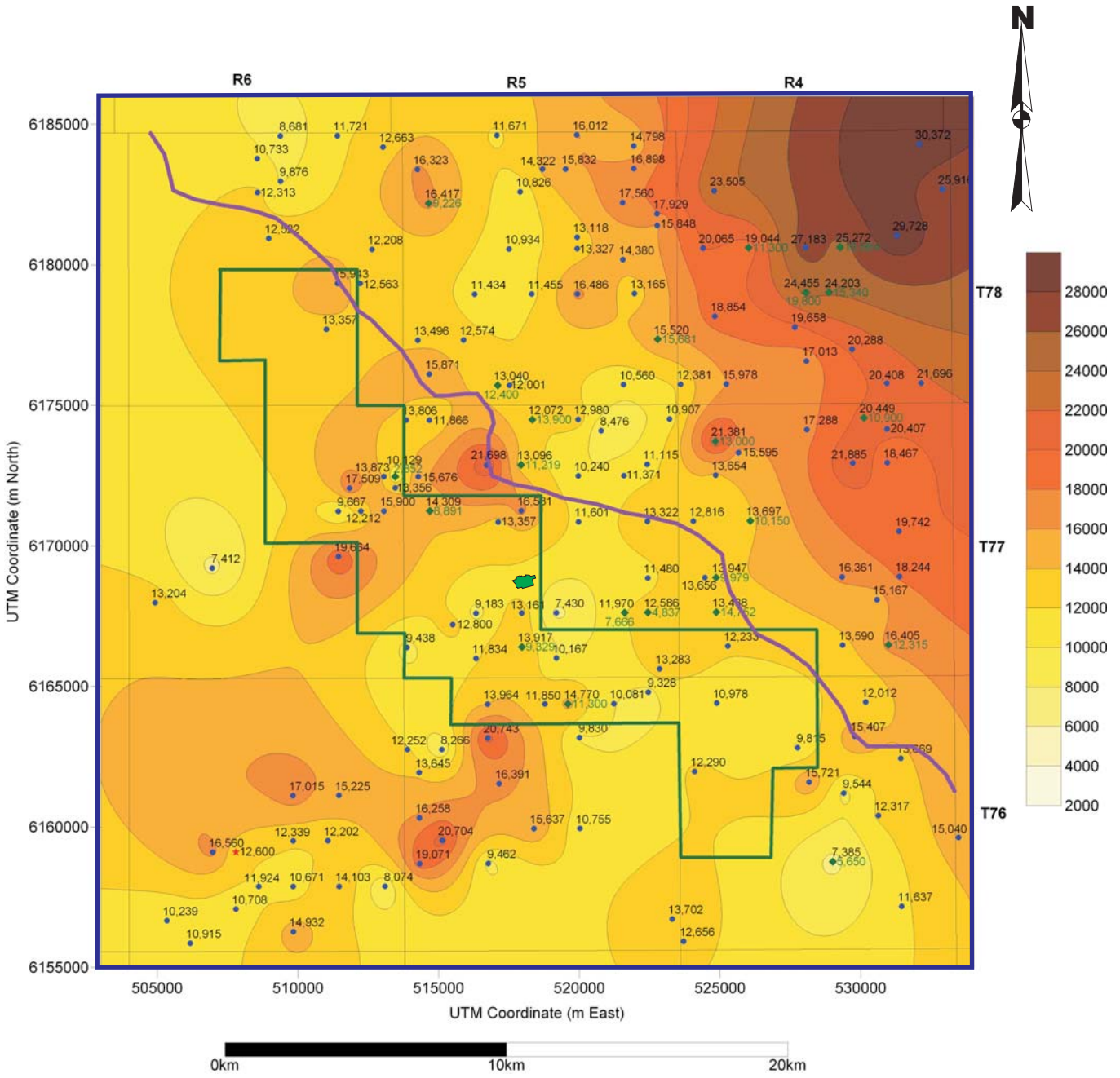
MCMURRAY FORMATION WATERSAND ISOPACH

MEG ENERGY CORP.

PREPARED BY: WESTWATER
COMPILED BY: JS
REVIEWED: EG

SCALE AS SHOWN

FIGURE 4-13



LEGEND

- MEG LEASE AREA
- CENTRAL PLANT SITE
- APPROXIMATE OIL/WATER CONTACT LINE
- 9,017 CALCULATED BASAL MCMURRAY TDS (MG/L)
- 13,000 ACTUAL UPPER MCMURRAY TDS (MG/L)
- MEASURED TDS IN BASAL MCMURRAY

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

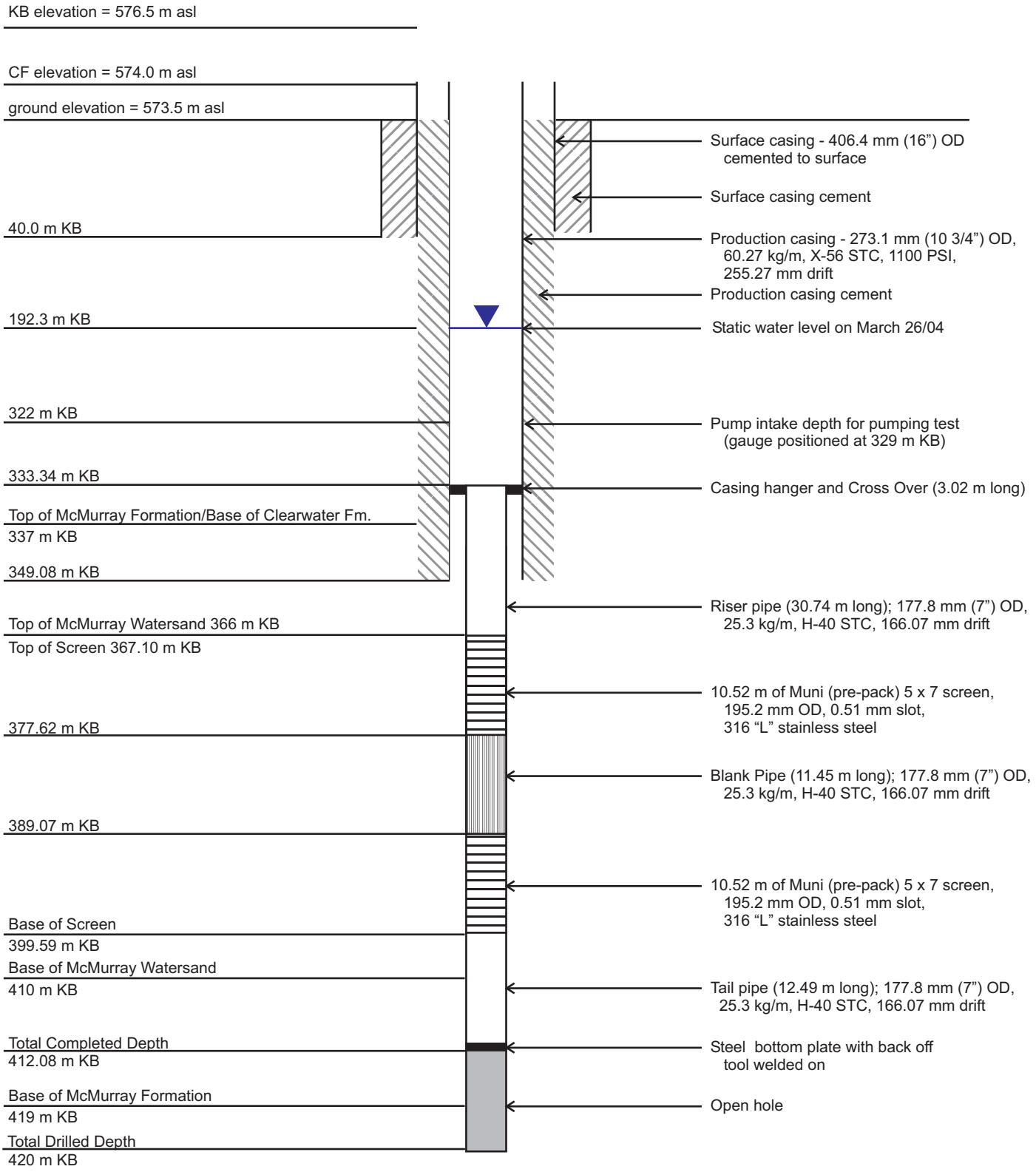
MCMURRAY FORMATION TOTAL DISSOLVED SOLIDS CONCENTRATION

MEG ENERGY CORP.

PREPARED BY: WESTWATER
COMPILED BY: JS
REVIEWED: EG

SCALE AS SHOWN

FIGURE 4-14



Schematic Only, Not To Scale

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

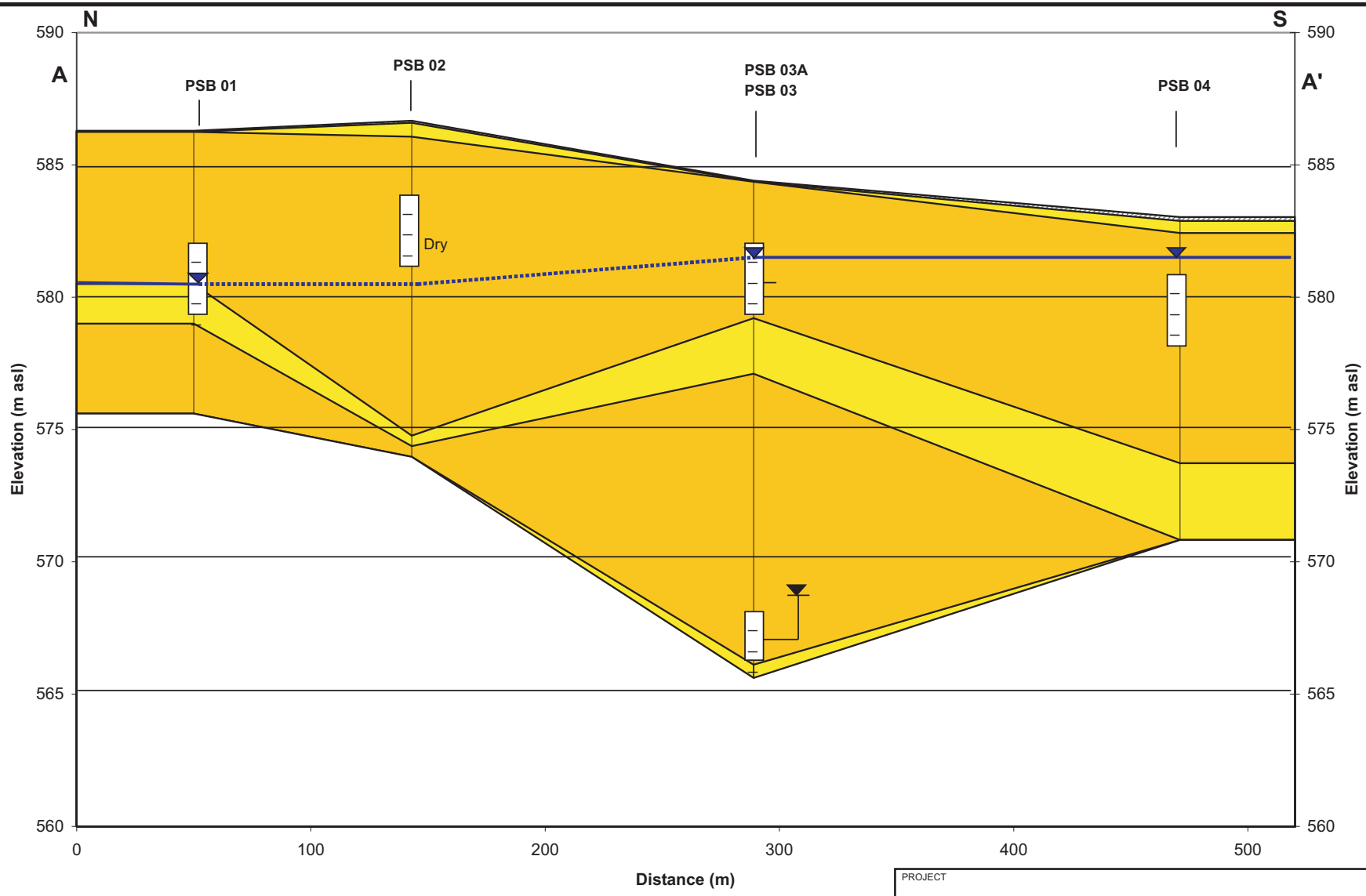
WATER DISPOSAL WELL COMPLETION
MEG HARDY 10-29-77-5

MEG ENERGY CORP.

PREPARED BY: WESTWATER
COMPILED BY: GM
REVIEWED BY: EG

SCALE AS SHOWN

FIGURE: 4-15



LEGEND

- Muskeg
- Sandy Clay (Till)
- Poorly Graded Sand

Water Level

PVC Screen Interval

Water levels taken on March 17 and 18, 2004

PROJECT

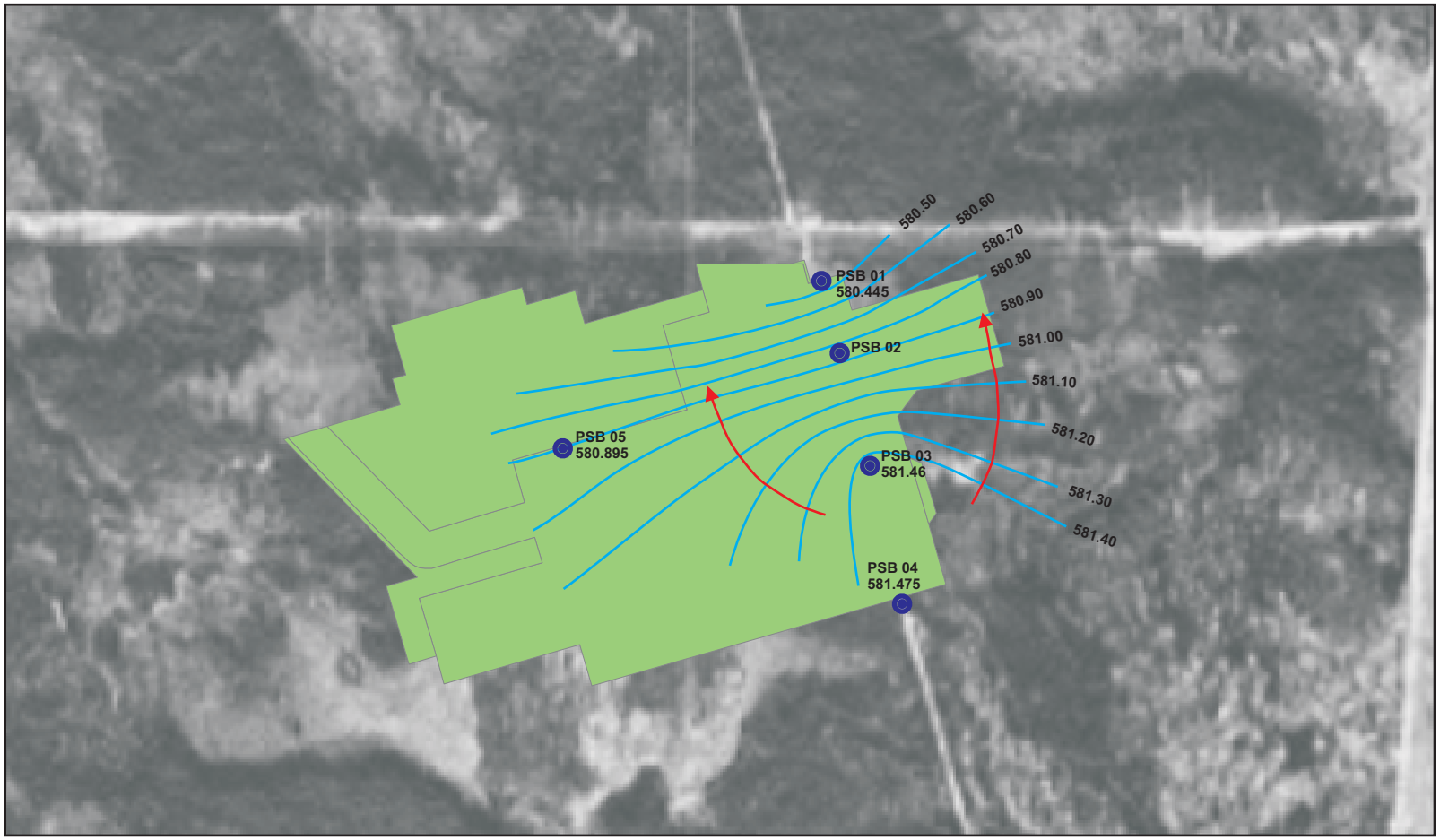
CHRISTINA LAKE REGIONAL PROJECT

TITLE

CENTRAL PLANT SITE HYDROGEOLOGICAL CROSS-SECTION

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED BY: EG	
	FIGURE: 4-16



LEGEND

- 581.475 — Existing Monitoring Well and Water Level Elevation (masl) on March 17 - 18, 2004
- 581.4 — Groundwater Elevation Contour (masl)
- Groundwater Flow Direction

REFERENCE:
Basemap by MEG Worley

PROJECT

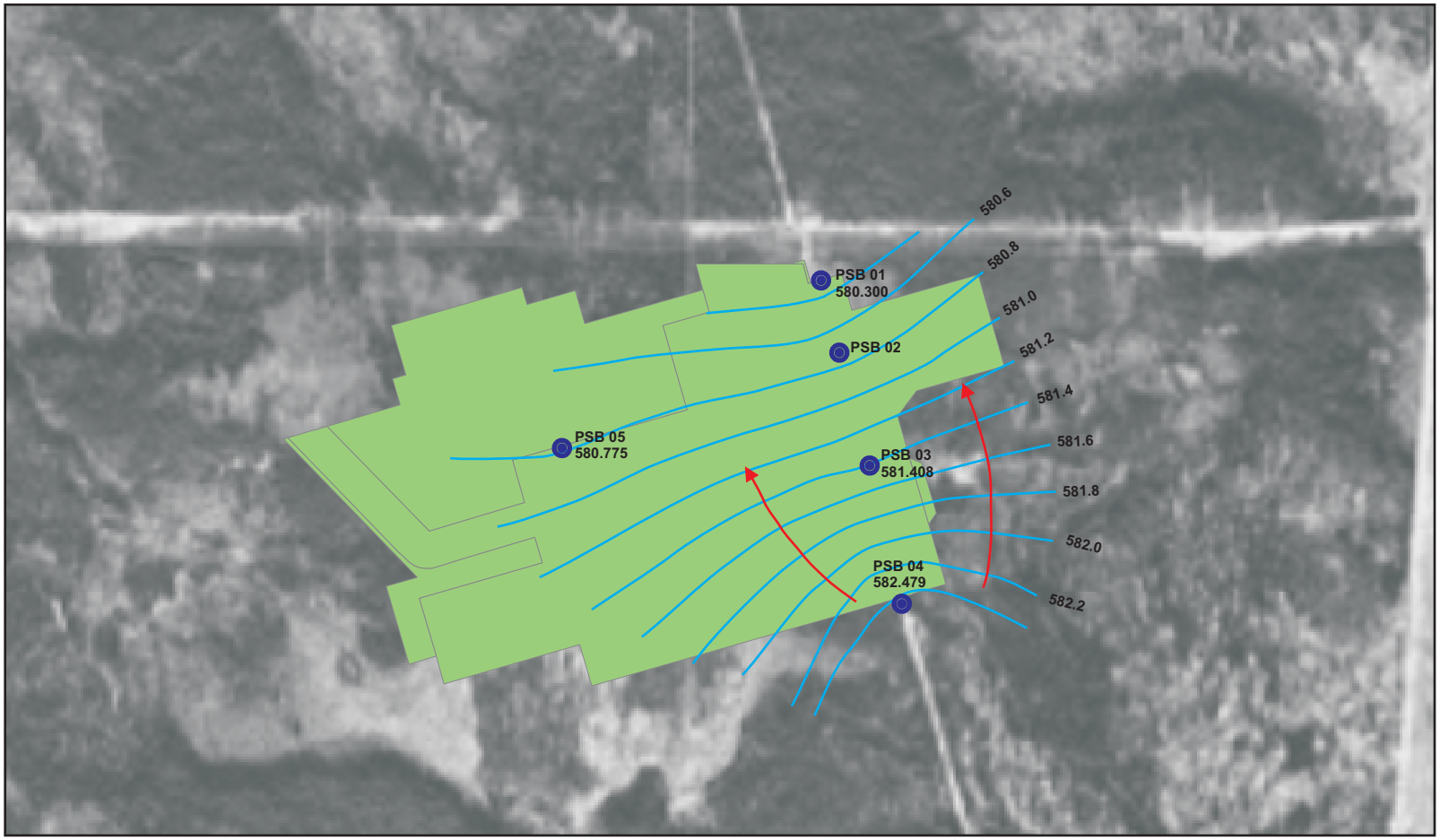
CHRISTINA LAKE REGIONAL PROJECT

TITLE

GROUNDWATER FLOW IN THE WATER TABLE AQUIFER (MARCH 17 AND 18, 2004)

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED BY: EG	
	FIGURE: 4-17



LEGEND

- 581.479 — Existing Monitoring Well and Water Level Elevation (masl) on May 26, 2004
- 581.4 — Groundwater Elevation Contour (masl)
- Groundwater Flow Direction

REFERENCE:
Basemap by MEG Worley

PROJECT

CHRISTINA LAKE REGIONAL PROJECT

TITLE

GROUNDWATER FLOW IN THE WATER TABLE AQUIFER (MAY 26, 2004)

MEG ENERGY CORP.

PREPARED BY: WESTWATER	
COMPILED BY: DC	SCALE AS SHOWN
REVIEWED BY: EG	
	FIGURE: 4-18

Appendix A

Water Well Drilling Reports

Alberta Environment Groundwater Database
as of January 20-21, 2005

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0279184
Map Verified:	Not Verified
Date Report Received:	1986/10/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: LAKELAND DRILLING LTD.		Drilling Company Approval No.: 38404
Mailing Address: BOX 1388	City or Town: ST PAUL AB CA	Postal Code: T0A 3A0
WellOwner's Name: CAN WORLDWIDE	Well Location Identifier:	
P.O. Box Number:	Mailing Address: BONNYVILLE	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
08	04	077	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
36	Clay
40	Sand
200	Till & Sand Stringers
218	Coarse Grained Gravel

5. Well Completion

Date Started(yyyy/mm/dd): 1986/10/10	Date Completed(yyyy/mm/dd): 1986/10/11
Well Depth: 218 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type:
Size OD: 4.5 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 213 FT	Top: 0 FT Bottom: 0 FT

Perforations
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT

Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches

Perforated by:

Seal: Puddled Clay
from: 0 FT to: 150 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT

Screen Type: Stainless Steel
from: 205 FT to: 210 FT
Screen ID: 5 Inches
Slot Size: 0.015 Inches

Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Threaded
Bottom: Plug

Pack: Frac Sand
Grain Size:
Amount: 4 Bags

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: 100 FT
Diameter: 1 Inches

Comments:

6. Well Yield

Test Date(yyyy/mm/dd): 1986/10/11
Start Time: 11:00 AM
Test Method: Pump

Non pumping static level: 26 FT

Rate of water removal: 9 Gallons/Min

Depth of pump intake: 32 FT

Water level at end of pumping: 32 FT

Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 6 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 9 Gallons/Min

Recommended pump intake: 100 FT

Type Pump Installed
Pump Type: SUB
Pump Model:
H.P.: 1/2
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0092138
Map Verified:	Field
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: BAILEY SELBURN OIL	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
10	29	077	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1890 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Oil Exploratory
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1975/02/07 Materials Used: Unknown
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): 1975/02/04	Date Completed(yyyy/mm/dd): 1975/02/07
Well Depth: 1400 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0092200
Map Verified: Field
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: HOME OIL CO	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
03	03	078	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1980 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Drill Stem Test Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1967/02/14 Materials Used: Unknown
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): 1967/02/05	Date Completed(yyyy/mm/dd): 1967/02/14
Well Depth: 1400 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: ELECTRIC Retained on Files: ELECTRIC yes	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 2
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0092199
Map Verified:	Field
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: BAILEY SELBURN OIL	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
07	15	078	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1895 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Drill Stem Test Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1974/03/12 Materials Used: Unknown
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet) | **Lithology Description**

5. Well Completion

Date Started(yyyy/mm/dd): 1974/03/08	Date Completed(yyyy/mm/dd): 1974/03/12
Well Depth: 1450 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations
from: 0 FT to: 0 FT — Perforations Size: 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
Perforated by:

Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches
Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches
Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0092092
Map Verified:	Field
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: BAILEY SELBURN OIL	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
10	29	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1828 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Oil Exploratory
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1974/02/04 Materials Used: Unknown
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date(yyyy/mm/dd):Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): 1974/02/01	Date Completed(yyyy/mm/dd): 1974/02/04
Well Depth: 1348 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0278934
Map Verified:	Not Verified
Date Report Received:	1986/10/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: LAKELAND DRILLING LTD.		Drilling Company Approval No.: 38404
Mailing Address: BOX 1388	City or Town: ST PAUL AB CA	Postal Code: T0A 3A0
WellOwner's Name: CAN WORLDWIDE	Well Location Identifier:	
P.O. Box Number: 1770	Mailing Address: BONNYVILLE	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
05	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
16	Clay
38	Till
60	Red Fine Grained Sand
165	Till
186	Coarse Grained Sand

5. Well Completion

Date Started(yyyy/mm/dd): 1986/10/08	Date Completed(yyyy/mm/dd): 1986/10/09
Well Depth: 186 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type:
Size OD: 4.5 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 186 FT	Top: 0 FT Bottom: 0 FT

Perforations
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches

Perforated by:

Seal: Puddled Clay
from: 0 FT to: 100 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT

Screen Type: Stainless Steel
from: 180 FT to: 185 FT
Screen ID: 5 Inches
Slot Size: 0.015 Inches

Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Threaded
Bottom: Plug

Pack: Frac Sand
Grain Size:
Amount: 4 Bags

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: 100 FT
Diameter: 1 Inches

Comments:

6. Well Yield

Test Date(yyyy/mm/dd): 1986/10/09
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 21 FT
Rate of water removal: 9 Gallons/Min
Depth of pump intake: 27 FT
Water level at end of pumping: 27 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 6 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 9 Gallons/Min
Recommended pump intake: 100 FT

Type Pump Installed
Pump Type: SUB
Pump Model:
H.P.: 1/2
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162379
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP391	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
09	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1819 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/21 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet) — Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/21
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations — Perforations Size:
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches

Perforated by:

Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount: 0

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:
FLOWED AT .5-1 GPM.@ 32'.

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162380
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP401	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
09	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1818 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date(yyyy/mm/dd):Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	 to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	 Bottom:
Pack: Grain Size:	 Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	 Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	 Diameter:
Comments: FLOWED AT .5-1 GPM.@ 32'.	

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162382
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP407	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
09	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1819 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet) — **Lithology Description**

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations — Perforations Size:
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches

Perforated by:

Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount: 0

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:
FLOWED AT .5-1 GPM.@ 32'.

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162383
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP411	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
09	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1819 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations	Perforations Size:
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments: FLOWED AT .5-1 GPM.@ 32'.	

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0157579
Map Verified:	Not Verified
Date Report Received:	1990/04/12
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: LAPOINTE, JOSE	Well Location Identifier:	
P.O. Box Number:	Mailing Address: GENERAL DELIVERY, CONKLIN	Postal Code: T0P 1H0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SW	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Not Applicable
Flowing Well: No
Rate: Gallons
Gas Present:
Oil Present:
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet) — Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd):
Well Depth: 100 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	 to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	 Bottom:
Pack: Grain Size:	 Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	 Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	 Diameter:
Comments:	

6. Well Yield

Test Date(yyyy/mm/dd):Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162381
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP406	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
09	31	076	05	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1819 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day: 0 Gallons

4. Formation Log

Depth from ground level (feet) | Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations / Perforations Size:
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches

Perforated by:

Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches
Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount: 0

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:
FLOWED AT .5-1 GPM.@ 32'.

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0278940
Map Verified:	Not Verified
Date Report Received:	1984/09/05
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: LAKELAND DRILLING LTD.		Drilling Company Approval No.: 38404
Mailing Address: BOX 1388	City or Town: ST PAUL AB CA	Postal Code: T0A 3A0
WellOwner's Name: ALTA HOUSING	Well Location Identifier:	
P.O. Box Number:	Mailing Address: ST PAUL	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
00	31	076	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
56	Rocks
65	Clay
75	Sand
145	Clay

5. Well Completion

Date Started(yyyy/mm/dd): 1984/01/01	Date Completed(yyyy/mm/dd): 1984/01/17
Well Depth: 145 FT	Borehole Diameter: 0 Inches
Casing Type: Galvanized Steel	Liner Type:
Size OD: 4.5 Inches	Size OD: 0 Inches
Wall Thickness: 0.156 Inches	Wall Thickness: 0 Inches
Bottom at: 80 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: Formation Packer from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	 to: 60 FT to: 0 FT to: 0 FT
Screen Type: Stainless Steel from: 65 FT to: 70 FT	Screen ID: 5 Inches Slot Size: 0.012 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top: Threaded	 Bottom: Plug
Pack: Frac Sand Grain Size:	 Amount: 20 Bags
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	 Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	 Diameter: Inches
Comments:	

6. Well Yield

Test Date(yyyy/mm/dd): 1984/01/17	Start Time: 11:00 AM
Test Method: Air	
Non pumping static level:	60 FT
Rate of water removal:	10 Gallons/Min
Depth of pump intake:	68 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 10 Gallons/Min

Recommended pump intake: 70 FT

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0278941
Map Verified:	Not Verified
Date Report Received:	1984/09/05
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: LAKELAND DRILLING LTD.		Drilling Company Approval No.: 38404
Mailing Address: BOX 1388	City or Town: ST PAUL AB CA	Postal Code: T0A 3A0
WellOwner's Name: ALTA HOUSING	Well Location Identifier:	
P.O. Box Number:	Mailing Address: ST PAUL	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
00	31	076	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
44	Rocks
60	Clay
90	Sand
145	Clay
146	Rocks
180	Clay

5. Well Completion

Date Started(yyyy/mm/dd): 1981/01/01	Date Completed(yyyy/mm/dd): 1981/01/17
Well Depth: 180 FT	Borehole Diameter: 0 Inches
Casing Type: Galvanized Steel	Liner Type:
Size OD: 4.5 Inches	Size OD: 0 Inches
Wall Thickness: 0.156 Inches	Wall Thickness: 0 Inches
Bottom at: 90 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: Formation Packer from: 0 FT	to: 50 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: Stainless Steel from: 75 FT to: 80 FT	Screen ID: 5 Inches Slot Size: 0.015 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top: Threaded	Bottom: Plug
Pack: Frac Sand Grain Size:	Amount: 20 Bags
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments:	

6. Well Yield

Test Date(yyyy/mm/dd): 1984/01/17	Start Time: 11:00 AM
Test Method: Air	
Non pumping static level:	42 FT
Rate of water removal:	30 Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 10 Gallons/Min

Recommended pump intake: 70 FT

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162384
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD#SP416	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
12	36	076	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1821 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments: FLOWED AT .5-1 GPM.@ 32'.	

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0162385
Map Verified:	Not Verified
Date Report Received:	1991/04/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: VENTURE SEISMIC LTD	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
12	36	076	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 1821 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Flowing Shot Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1990/12/17 Materials Used: Bassani Plug
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed(yyyy/mm/dd): 1990/12/17
Well Depth: 32 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments: FLOWED AT .5-1 GPM.@ 32'.	

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0279187
Map Verified: Field
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: SEDCO DRILLING/BOW VALLEY RESOURCE SERVICES LTD.
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
WellOwner's Name: HOME OIL CO LTD
Well Location Identifier:
P.O. Box Number:
Mailing Address:
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
10	05	077	06	4

Location in Quarter
1909 FT from N Boundary
1923 FT from E Boundary
Lot Block Plan
Well Elev: 1875 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Drill Stem Test Hole
Reclaimed Well
Date Reclaimed(yyyy/mm/dd):
Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No
Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet) — Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): 1967/01/25
Date Completed(yyyy/mm/dd): 1967/02/04
Well Depth: 1360 FT
Borehole Diameter: 0 Inches
Casing Type: Steel
Liner Type: Steel
Size OD: 8 Inches
Size OD: 5.56 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 580 FT
Top: 0 FT Bottom: 1355 FT
Perforations
Perforations Size:
from: 1202 FT to: 1208 FT 0 Inches x 0 Inches
from: 1220 FT to: 1226 FT 0 Inches x 0 Inches
from: 0 FT to: 0 FT 0 Inches x 0 Inches
Perforated by:
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type:
Screen ID: 0 Inches
from: 0 FT to: 0 FT
Slot Size: 0 Inches
Screen Type:
Screen ID: 0 Inches
from: 0 FT to: 0 FT
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken: ELECTRIC
Retained on Files: ELECTRIC yes
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 1
Documents Held: 3
Pitless Adapter Type:
Drop Pipe Type:
Length:
Diameter:
Comments:

6. Well Yield

Test Date(yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0230554
Map Verified:	Not Verified
Date Report Received:	1993/12/14
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: LAKELAND DRILLING LTD.		Drilling Company Approval No.: 38404
Mailing Address: BOX 1388	City or Town: ST PAUL AB CA	Postal Code: T0A 3A0
WellOwner's Name: BENSON CONST	Well Location Identifier:	
P.O. Box Number: 2100	Mailing Address: LAC LA BICHE	Postal Code: T0A 2C0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
02	17	077	06	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well-Abandoned
Reclaimed Well
Date Reclaimed(yyyy/mm/dd): 1993/12/08
Materials Used: Bentonite Product
Method of Drilling: Rotary
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
20	Clay
40	Soft Clay & Sand
236	Clay
280	Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1993/12/08	Date Completed(yyyy/mm/dd): 1993/12/08
Well Depth: 280 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date(yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Appendix B

Supporting Documents

EnCana Christina Lake Thermal Project

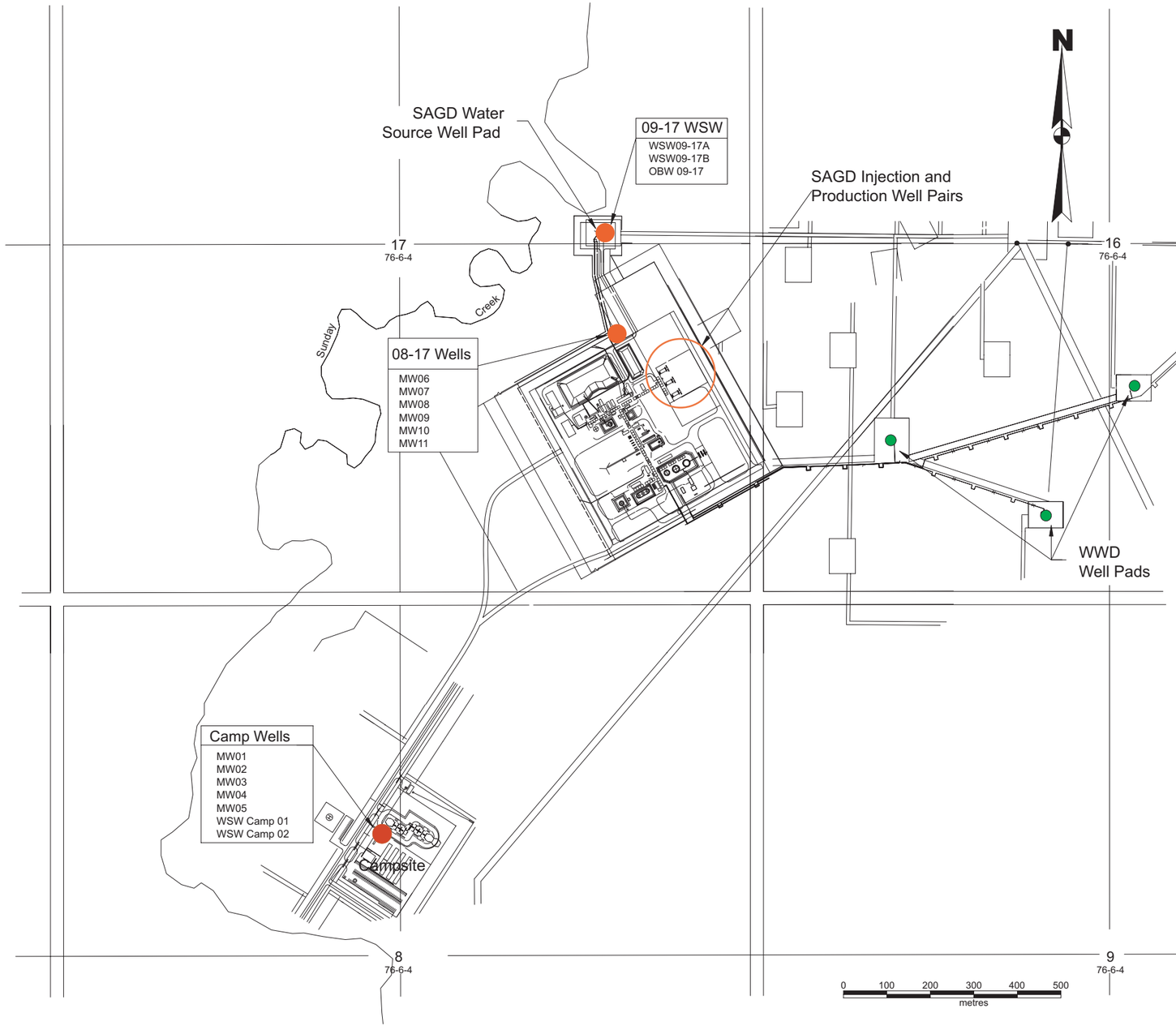
Appendix C Supporting Documents taken from:

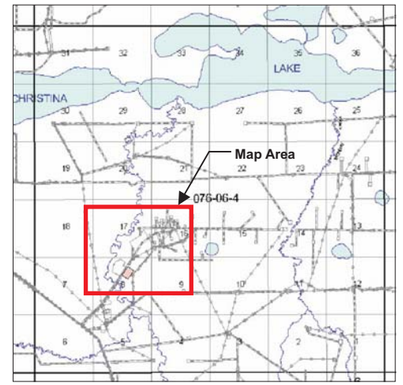
Westwater Environmental Ltd.
2003 Groundwater Monitoring Report
Christina Lake Thermal Project
March 2004

Figure 4-4 Site Plan
Figure 4-5 Regional Hydrogeologic Cross-Section A-A'
Table 4-2 EnCana Christina Lake Project – Summary of Testhole and Well Completion Details

Regional Control Chart WSW 09-17A
Regional Control Chart OBW09-17
Regional Control Chart MW-01
Regional Control Chart MW-02
Regional Control Chart MW-03
Regional Control Chart MW-04
Regional Control Chart MW-05
Regional Control Chart MW-06
Regional Control Chart MW-07
Regional Control Chart MW-08
Regional Control Chart MW-09
Regional Control Chart MW-10
Regional Control Chart MW-11
Regional Control Chart MW-12
Regional Control Chart MW-13
Regional Control Chart MW-14
Regional Control Chart MW-15

Table B-6 Regional Monitoring Well Analytical Results, Christina Lake Thermal Project
Table C-1 Arsenic Data, EnCana Christina Lake Thermal Project





Key Plan
N.T.S.

Completion Details of Regional Monitoring Wells

Well ID	Hydrogeologic Unit	Date Drilled	Area	LSD	Total Depth	Depth to Top of Sand Pack	Depth to Base of Sand Pack	Depth to Top of Well Screen	Depth to Base of Well Screen
MW01	1A	26-Jan-01	CAMP	11-08-076-06-W4	152.40	126.80	152.40	132.90	139.00
MW02	2B	27-Jan-01	CAMP	11-08-076-06-W4	86.90	71.30	86.90	77.40	83.50
MW03	3	27-Jan-01	CAMP	11-08-076-06-W4	54.90	41.50	54.90	47.50	53.60
MW04	4	28-Jan-01	CAMP	11-08-076-06-W4	27.40	12.20	27.40	18.30	24.40
MW05	5	28-Jan-01	CAMP	11-08-076-06-W4	7.60	1.50	7.60	3.70	6.70
MW06	1A	31-Jan-01	WSW[1]	08-17-076-06-W4	148.40	131.10	148.40	137.20	143.30
MW07	1B	19-Feb-01	WSW	08-17-076-06-W4	121.90	104.20	121.90	110.30	116.40
MW08	2A	19-Feb-01	WSW	08-17-076-06-W4	79.20	64.00	79.20	70.10	76.20
MW09	2B	19-Feb-01	WSW	08-17-076-06-W4	64.00	50.30	64.00	56.40	62.50
MW10	3	20-Feb-01	WSW	08-17-076-06-W4	48.80	30.50	48.80	36.60	45.70
MW11	4	20-Feb-01	WSW	08-17-076-06-W4	24.40	11.00	24.40	17.10	23.20
OBW09-17	1A	1998	WSW	09-17-076-06-W4	140.20	121.90	140.20	121.90	139.00
MW12	1A	21-Mar-01	WDW[2]	07-16-076-06-W4	158.50	137.80	158.50	143.90	154.50
MW13	1B	06-Mar-01	WDW	07-16-076-06-W4	128.00	106.70	128.00	112.80	118.90
MW14	4	07-Mar-01	WDW	07-16-076-06-W4	24.40	15.20	24.40	18.30	24.40
MW15	5	19-Mar-01	WDW	07-16-076-06-W4	13.70	3.00	13.70	6.10	12.20

Note 1: WSW: Water Source Well Pad
Note 2: WDW: Wastewater Disposal Well Pad

Completion Details of Water Source Wells

Well ID	WSW-CAMP-01	WSW-CAMP-02	WSW-09-17B	WSW-09-17A
Hydrogeologic Unit	2B	3	1A	1A
Date drilled	29-Jan-01	19-Mar-01	23-Feb-01	1998
Area	CAMP WSW[1]	CAMP WSW	SAGD WSW[2]	SAGD WSW
LSD	10-08-076-06-W4	10-08-076-06-W4	09-17-076-06-W4	09-17-076-06-W4
Estimated Ground Elevation (m amsl)	576.70	576.70	562.60	562.60
Total Depth (m)	86.90	42.60	138.40	139.60
Depth to Base of Casing (m)	79.20	29.90	109.70	110.30
Depth to Top of Screen (m)	79.20	30.00	123.70	127.40
Depth to Base of Screen (m)	84.10	36.00	135.90	139.60

Note 1: Camp WSW: Water source well for camp domestic supply.
Note 2: SAGD WSW: Water source well for supply to SAGD steam production.

LEGEND

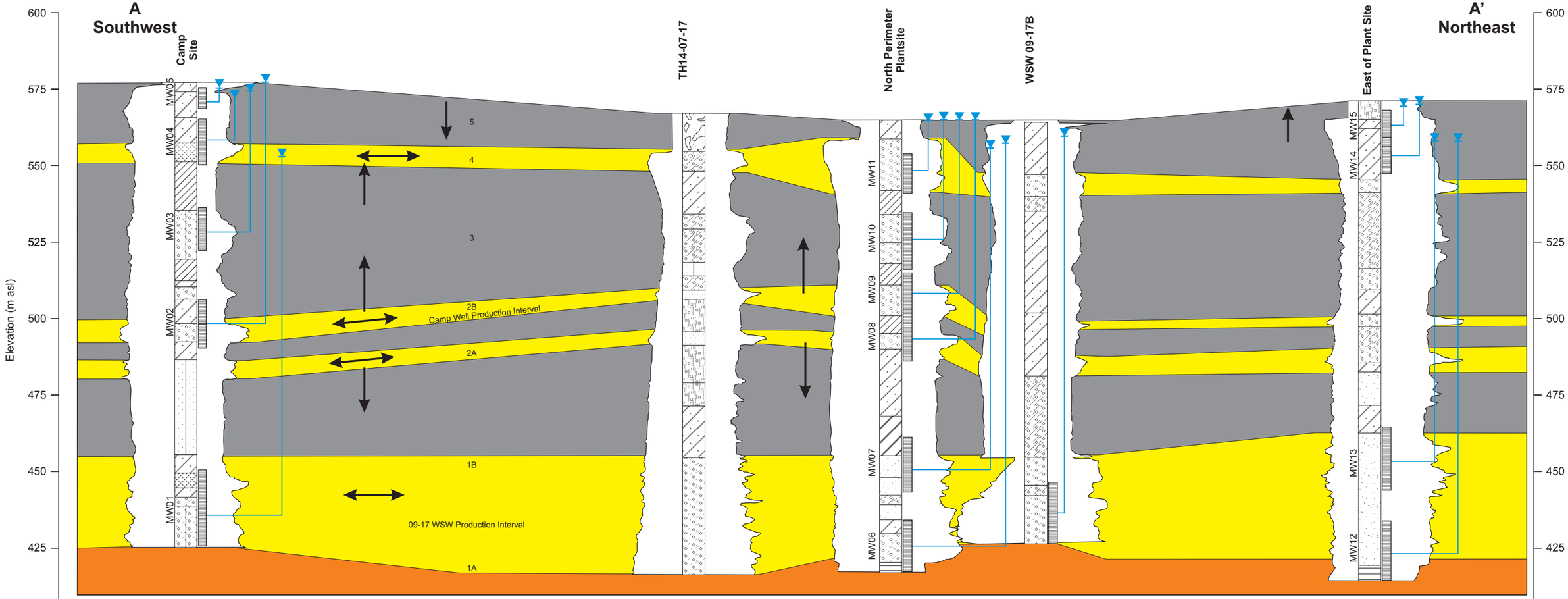
- Groundwater Monitoring Wells
- Wastewater Disposal (WWD) Well Pad (McMurray Fm.)

Reference: Revised after Westwater, 2004

Figure 4-4
Site Plan

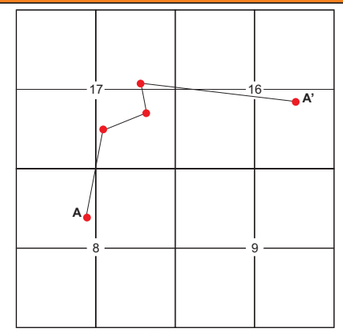
Westwater ENVIRONMENTAL LTD.

P://09.MEG Energy/051 EIA/Task 4 Commercial HydroG Rpt/Task 4 Commercial Report/Figures/Figure4-4 SitePlan.cdr



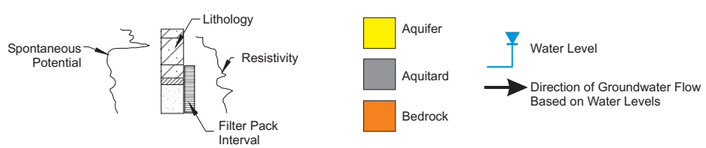
Well	Unit	Geology	Aquifer Type	Analysis	Hydraulic Conductivity (cm/sec)
MW01	1A	Sand / Till / Gravel	Confined	Not Tested	Not Tested
MW02	2B	Sand and Gravel	Confined	See Pumping Test	6.86E-04
MW03	3	Silty Sand and Gravel	Confined	Hvorslev	1.14E-05
MW04	4	Sand with Silt Layers	Confined	Frozen	Frozen
MW05	5	Sandy Clay	Unconfined	Hvorslev	4.38E-06
MW06	1A	Sand and Fine Gravel	Confined	Bower and Rice	4.03E-04
MW07	1B	Sand	Confined	Hvorslev	2.79E-04
MW08	2A	Gravel	Confined	Hvorslev	6.73E-03
MW09	2B	Fine Sand and Clay	Confined	Hvorslev	1.43E-03
MW10	3	Sandy Clay Till / Sand	Confined	Hvorslev	7.18E-04
MW11	4	Clay Till and Gravel	Confined	Hvorslev	7.96E-05
MW12	1A	Sand	Confined	Hvorslev	1.38E-04
MW13	1B	Sand	Confined	Hvorslev	3.93E-04
MW14	4	Sandy Clay Till	Unconfined	Frozen	Frozen
MW15	5	Sandy Clay Till	Unconfined	Hvorslev	4.13E-04
OBW09-17	1A	Sand and Gravel	Confined	See Pumping Test	9.48E-02

Well	Unit	Date	Water Level (m asl)
MW01	1A	13/11/2001	553.11
MW02	2B	13/11/2001	577.04
MW03	3	13/11/2001	574.07
MW04	4	13/11/2001	571.82
MW05	5	13/11/2001	575.22
MW06	1A	13/11/2001	557.12
MW07	1B	13/11/2001	555.59
MW08	2A	13/11/2001	564.80
MW09	2B	13/11/2001	564.80
MW10	3	13/11/2001	564.95
MW11	4	13/11/2001	564.49
MW12	1A	13/11/2001	557.77
MW13	1B	13/11/2001	557.76
MW14	4	13/11/2001	569.89
MW15	5	13/11/2001	569.25



76-6 W4M

LEGEND



NOTES:

1. Geophysics is specified to each testhole

Figure 4-5
Regional Hydrogeologic Cross-Section A-A'

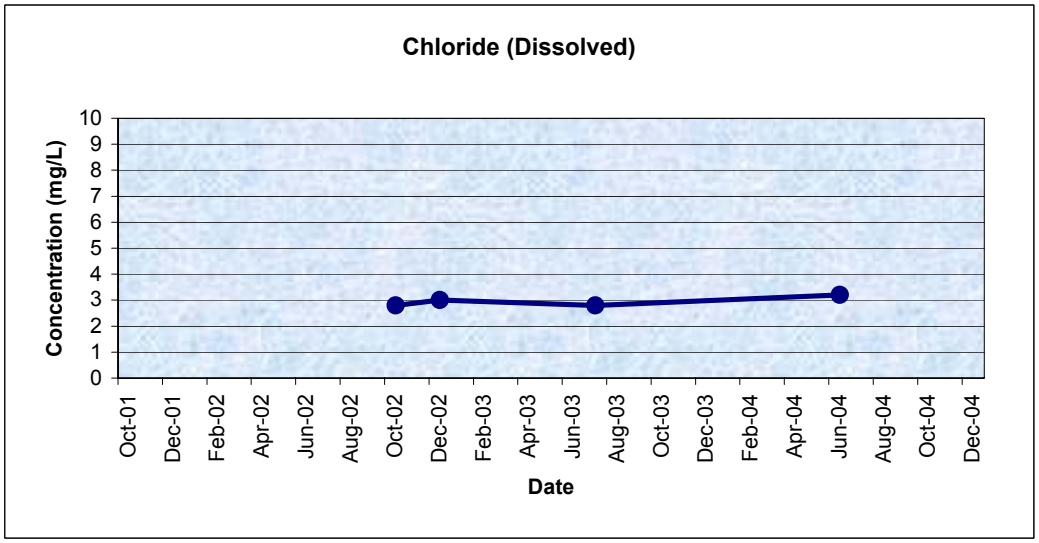
Westwater ENVIRONMENTAL LTD.

P://09.MEG Energy/051 EIA/Task4 Commerical HydroG rpt/Task 4 Commercial Report/Figures/Figure 4-5 Cross-Section.cdr

Table 4-2
EnCana Christina Lake Project
Summary of Testhole and Well Completion Details

Installation ID	Date Drilled	Area Description	LSD	Type of Installation	Est. Ground Elevation (m amsl)	Riser Pipe Stick Up (m)	Top of Pipe Elevation (m amsl)	Total Depth (m)	Depth to Casing Bottom (m)	Depth to WSW Rizer (m)	Depth to Sand Pack Top (m)	Depth to Sand Pack Bottom (m)	Depth to Screen Top (m)	Depth to Screen Bottom (m)
MW01	26-Jan-01	CAMP	10-08-076-06-W4	Monitoring Well	575.08	0.58	575.66	152.4	NA	NA	126.8	152.4	132.9	139.0
MW02	27-Jan-01	CAMP	10-08-076-06-W4	Monitoring Well	575.29	0.66	575.95	86.9	NA	NA	71.3	86.9	77.4	83.5
MW03	27-Jan-01	CAMP	10-08-076-06-W4	Monitoring Well	575.28	0.60	575.88	54.9	NA	NA	41.5	54.9	47.5	53.6
MW04	28-Jan-01	CAMP	10-08-076-06-W4	Monitoring Well	575.13	0.58	575.71	27.4	NA	NA	12.2	27.4	18.3	24.4
MW05	28-Jan-01	CAMP	10-08-076-06-W4	Monitoring Well	575.28	0.64	575.92	7.6	NA	NA	1.5	7.6	3.7	6.7
WSW-CAMP-01	29-Jan-01	CAMP	10-08-076-06-W4	Camp Supply Well	NA	0.58	NA	86.9	79.2	?	79.2	86.9	79.2	84.1
Abandoned	25-Feb-01	CAMP	10-08-076-06-W4	Abandoned	NA	NA	NA	25.9	NA	NA	NA	NA	NA	NA
WSW-CAMP-02	19-Mar-01	CAMP	10-08-076-06-W4	Camp Supply Well	NA	0.50	NA	42.6	29.9	NA	30.0	36.0	30.0	36.0
MW06	31-Jan-01	WSW	08-17-076-06-W4	Monitoring Well	564.57	0.36	564.93	148.4	NA	NA	131.1	148.4	137.2	143.3
MW07	19-Feb-01	WSW	08-17-076-06-W4	Monitoring Well	564.50	0.45	564.95	121.9	NA	NA	104.2	121.9	110.3	116.4
MW08	19-Feb-01	WSW	08-17-076-06-W4	Monitoring Well	566.96	0.50	567.46	79.2	NA	NA	64.0	79.2	70.1	76.2
MW09	19-Feb-01	WSW	08-17-076-06-W4	Monitoring Well	567.54	0.50	568.04	64.0	NA	NA	50.3	64.0	56.4	62.5
MW10	20-Feb-01	WSW	08-17-076-06-W4	Monitoring Well	567.18	0.65	567.83	48.8	NA	NA	30.5	48.8	36.6	45.7
MW11	20-Feb-01	WSW	08-17-076-06-W4	Monitoring Well	563.99	0.98	564.97	24.4	NA	NA	11.0	24.4	17.1	23.2
Abandoned	21-Feb-01	WSW	07-17-076-06-W4	Abandoned	NA	NA	NA	152.4	NA	NA	NA	NA	NA	NA
WSW-09-17B	23-Feb-01	WSW	09-17-076-06-W4	Water Source Well	NA	0.53	NA	138.4	109.7	103.9	109.7	138.4	123.7	135.9
WSW-09-17A	1998	WSW	09-17-076-06-W4	Water Source Well	NA	0.55	NA	139.6	110.3	92.5	110.3	139.6	127.4	139.6
OBW09-17	1998	WSW	09-17-076-06-W4	Observation Well	562.31	0.76	563.07	140.2	NA	NA	121.9	140.2	121.9	139.0
Abandoned	05-Feb-01	WDW	07-16-076-06-W4	Abandoned	NA	NA	NA	92.7	NA	NA	NA	NA	NA	NA
MW12	21-Mar-01	WDW	07-16-076-06-W4	Monitoring Well	566.38	0.57	566.95	158.5	NA	NA	137.8	158.5	143.9	154.5
MW13	06-Mar-01	WDW	07-16-076-06-W4	Monitoring Well	566.49	0.65	567.14	128.0	NA	NA	106.7	128.0	112.8	118.9
MW14	07-Mar-01	WDW	07-16-076-06-W4	Monitoring Well	566.68	0.64	567.32	24.4	NA	NA	15.2	24.4	18.3	24.4
MW15	19-Mar-01	WDW	07-16-076-06-W4	Monitoring Well	566.87	0.54	567.41	13.7	NA	NA	3.0	13.7	6.1	12.2

Reference: Revised from 2003 Annual Groundwater Monitoring and Use Report, Christina Lake Thermal Project, Westwater Environmental Ltd. (2004).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4
5
6
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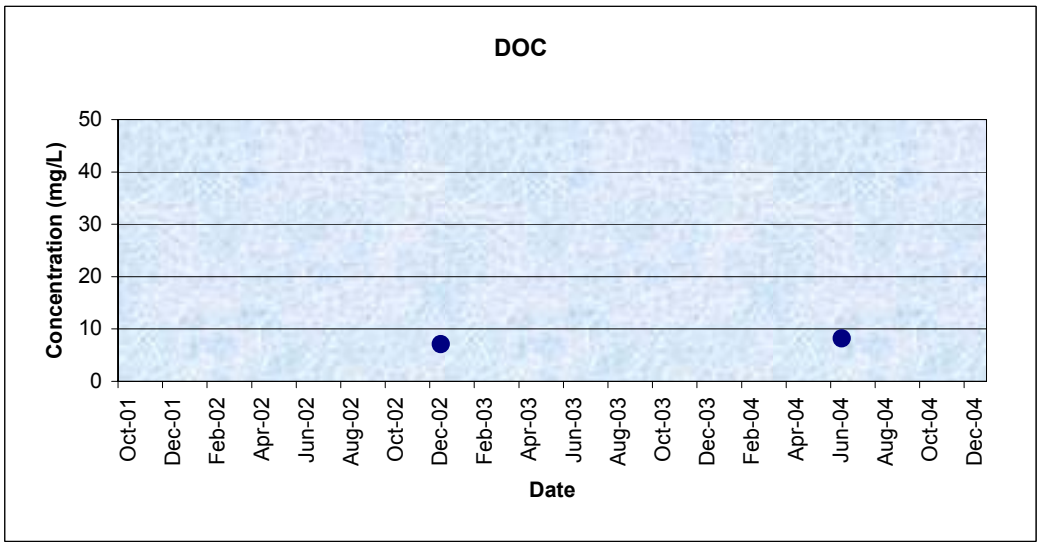
Date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Concentration (mg/L)
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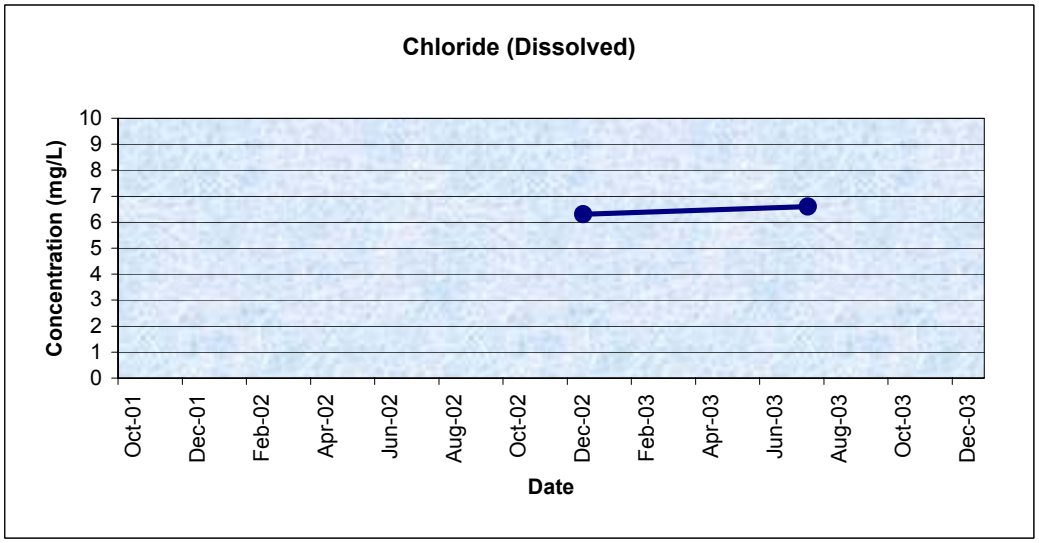
WSW09-17A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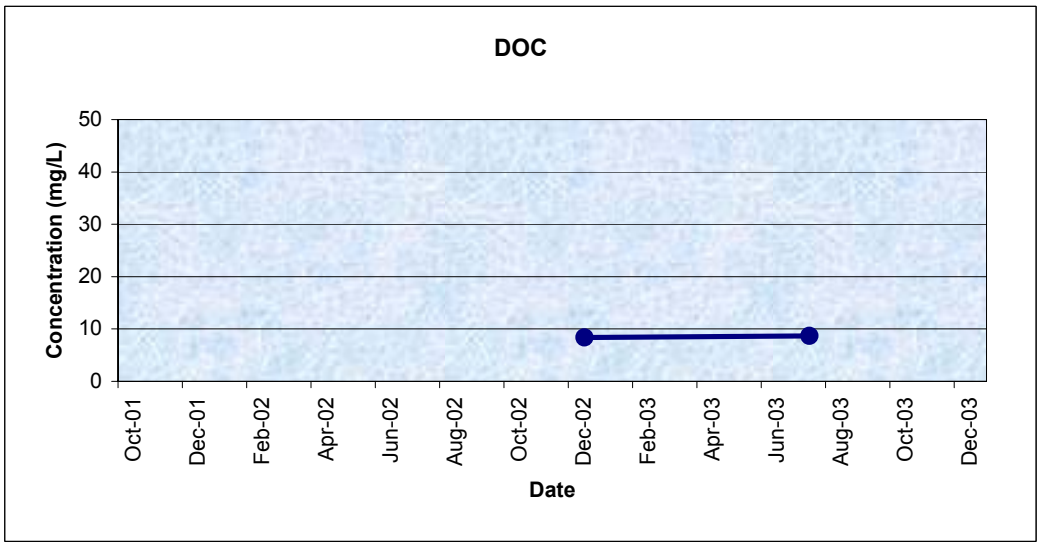
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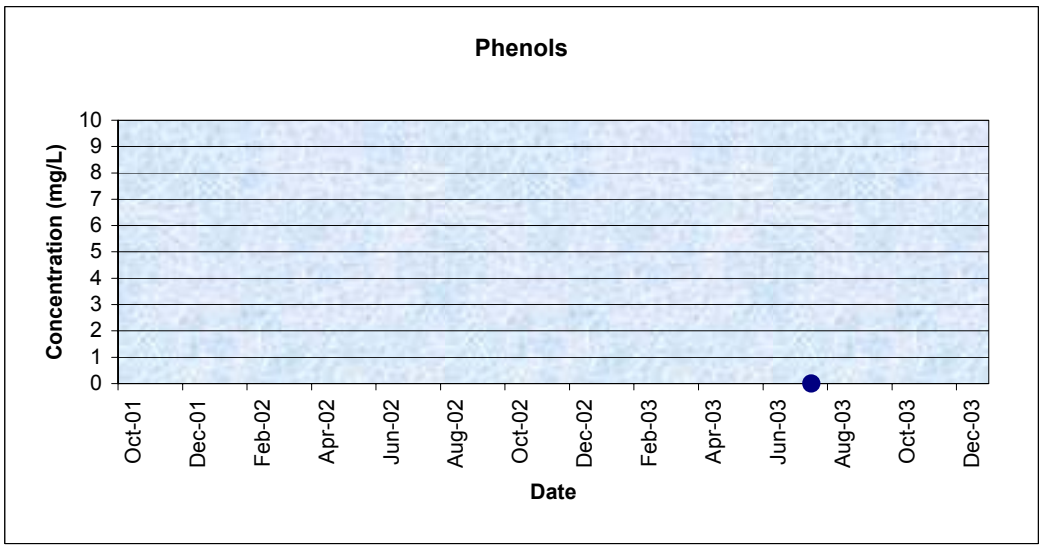
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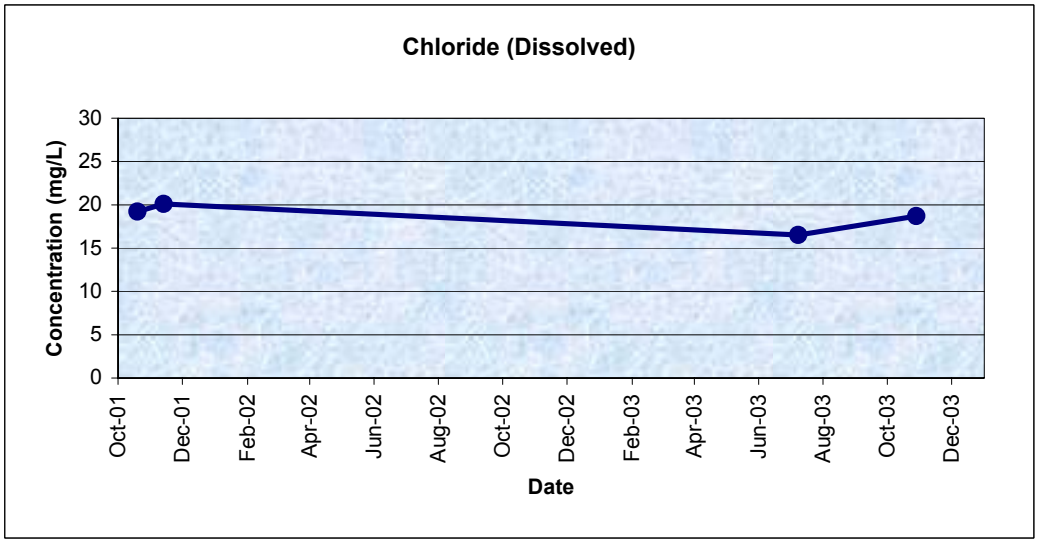
OBW09-17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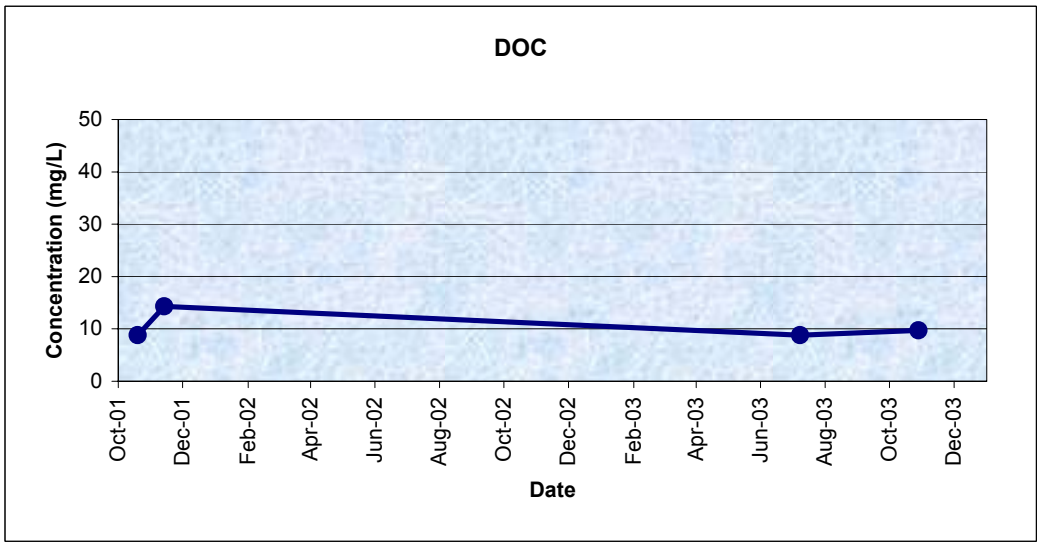
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Concentration (mg/L)
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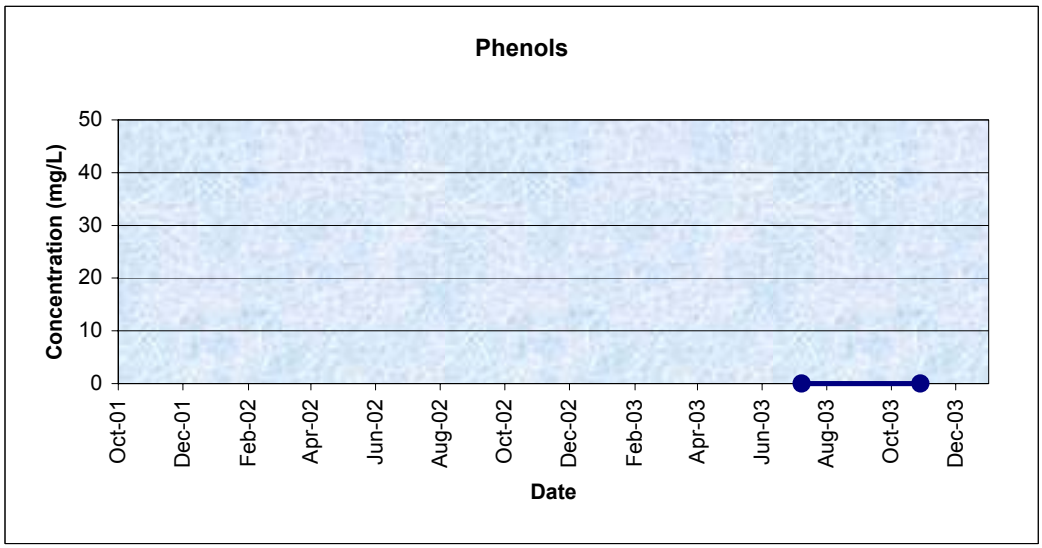
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Concentration (mg/L)
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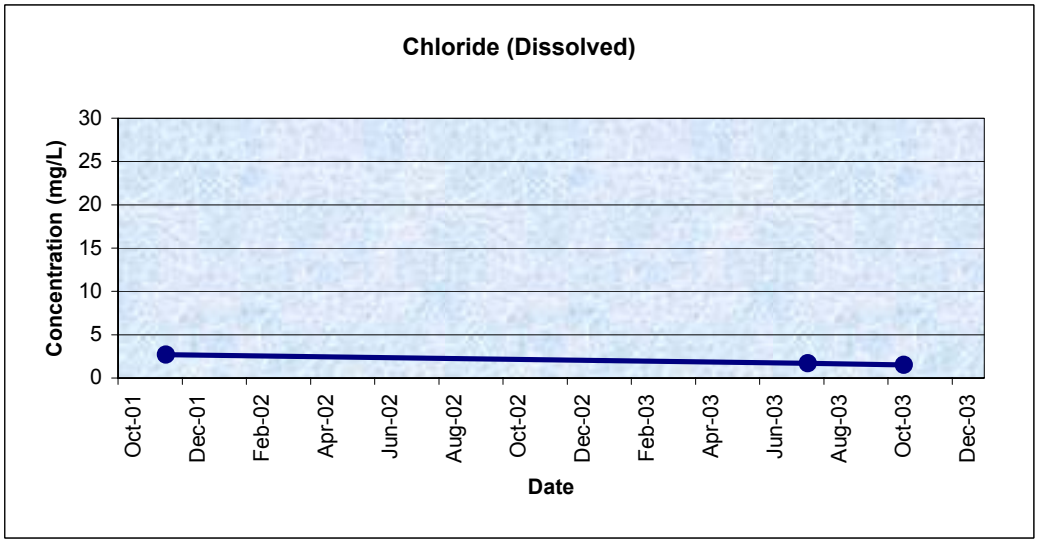
MW-01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Concentration (mg/L)
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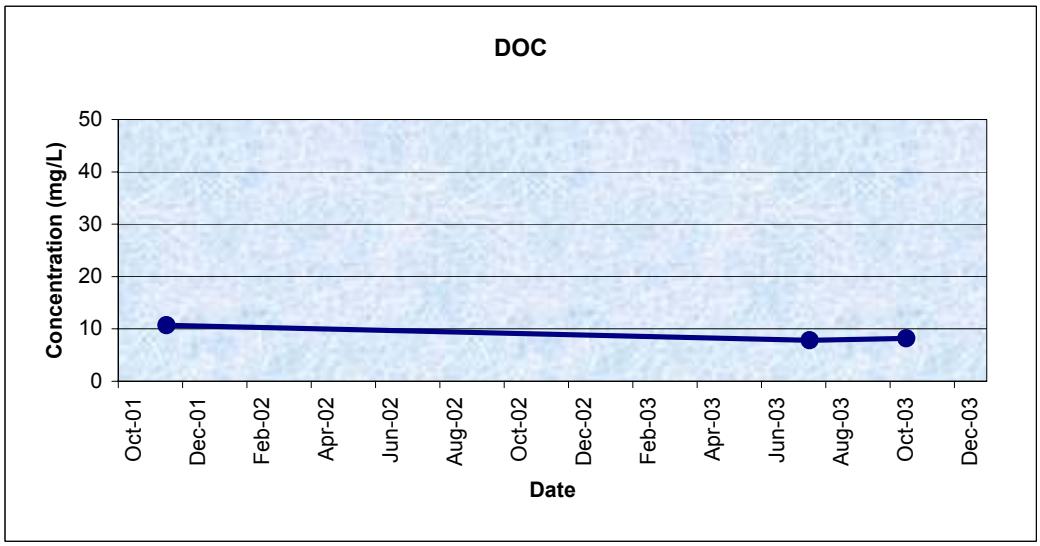
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Concentration (mg/L)
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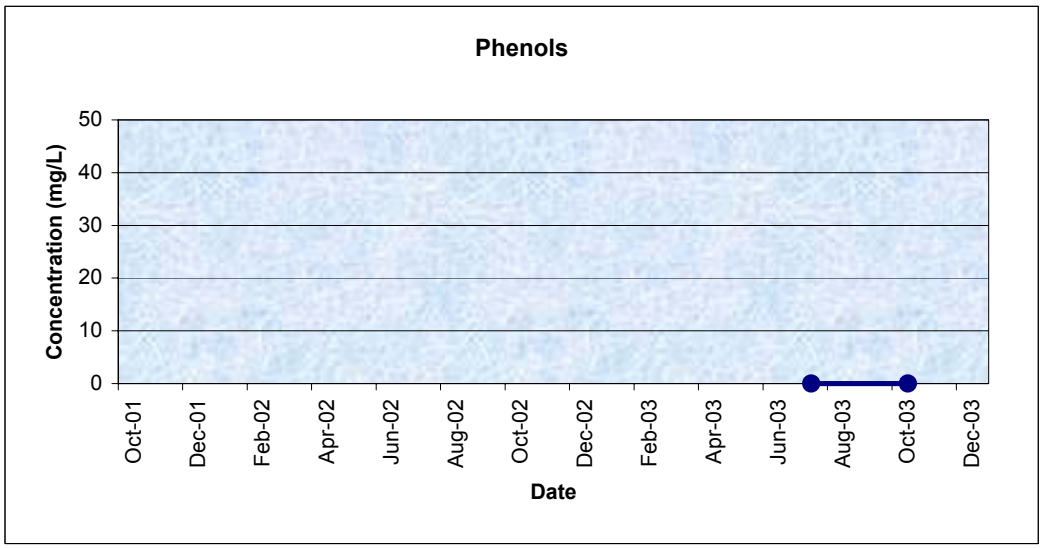
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Concentration (mg/L)
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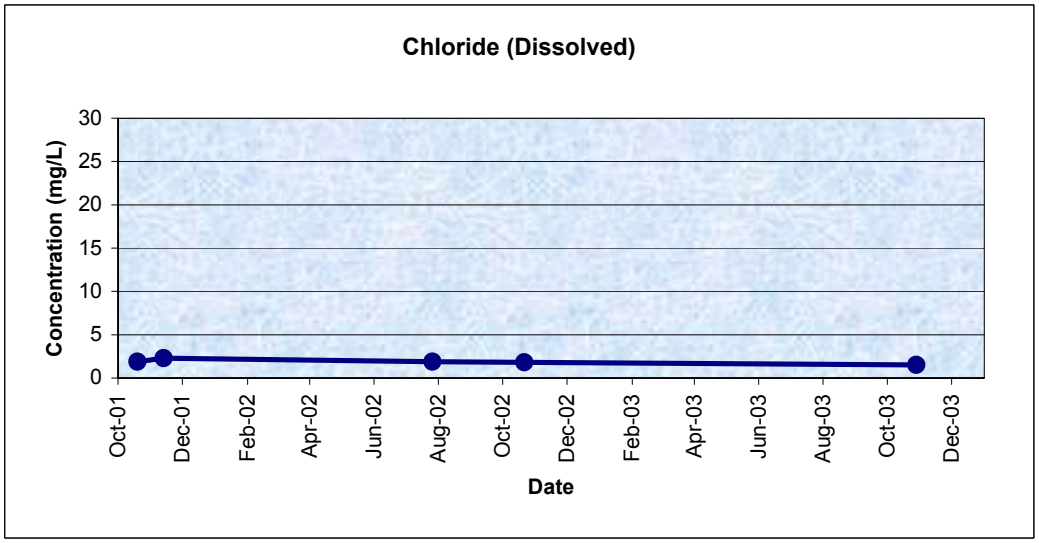
MW-02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Concentration (mg/L)
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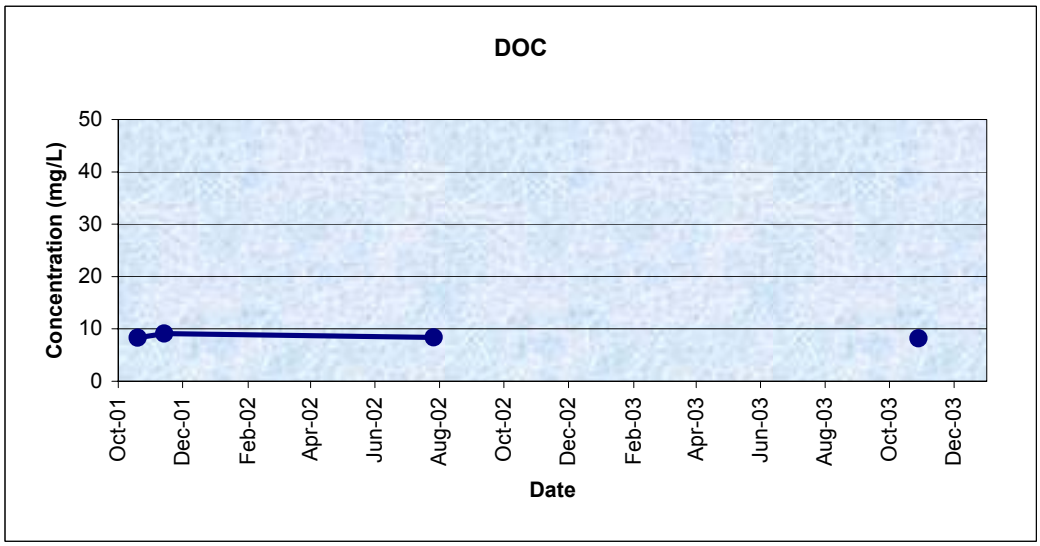
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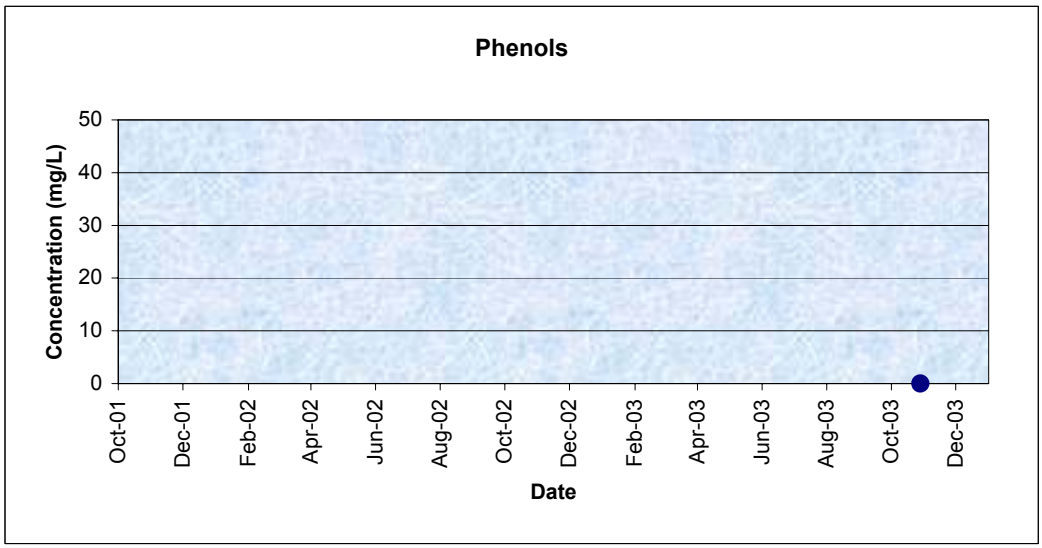
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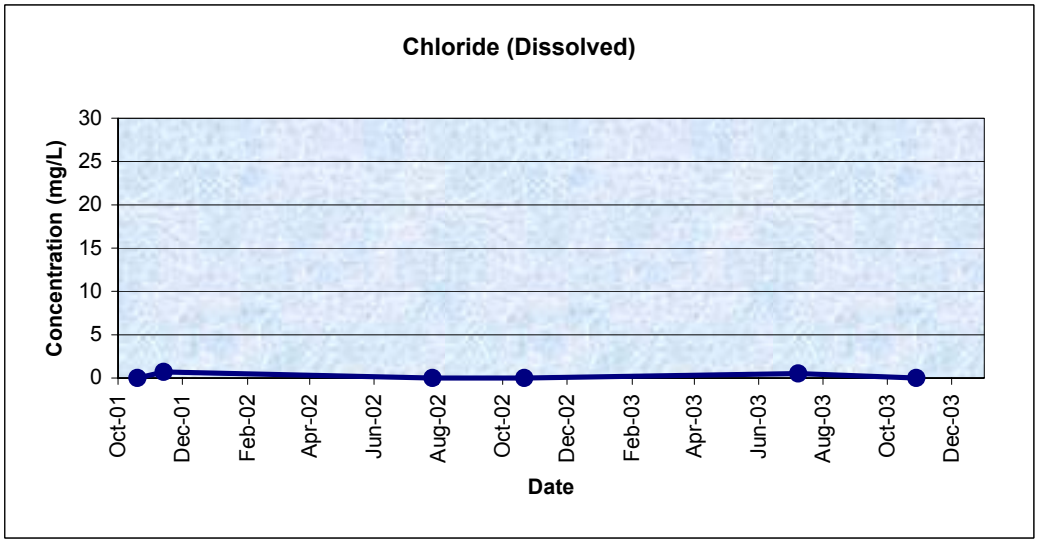
MW-03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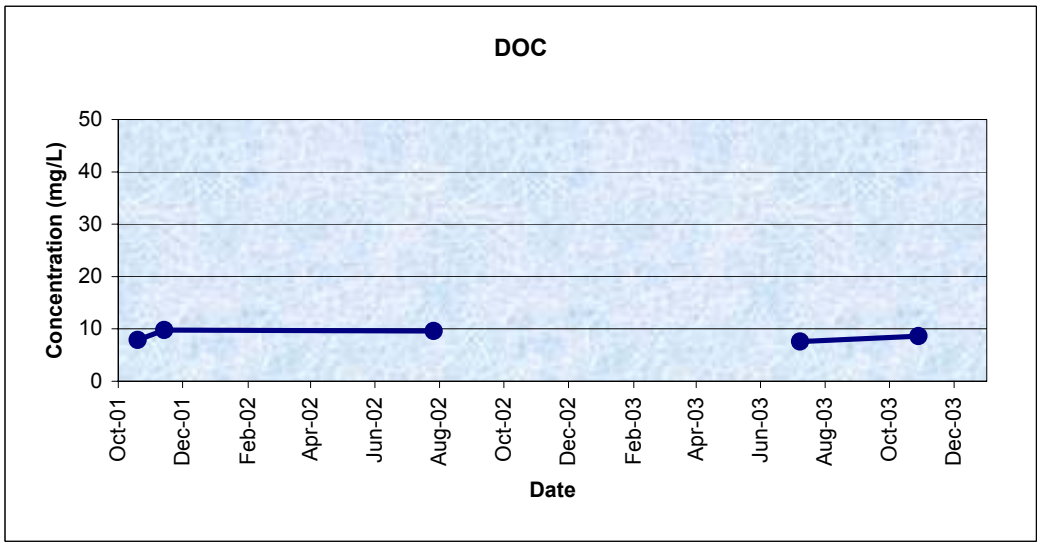
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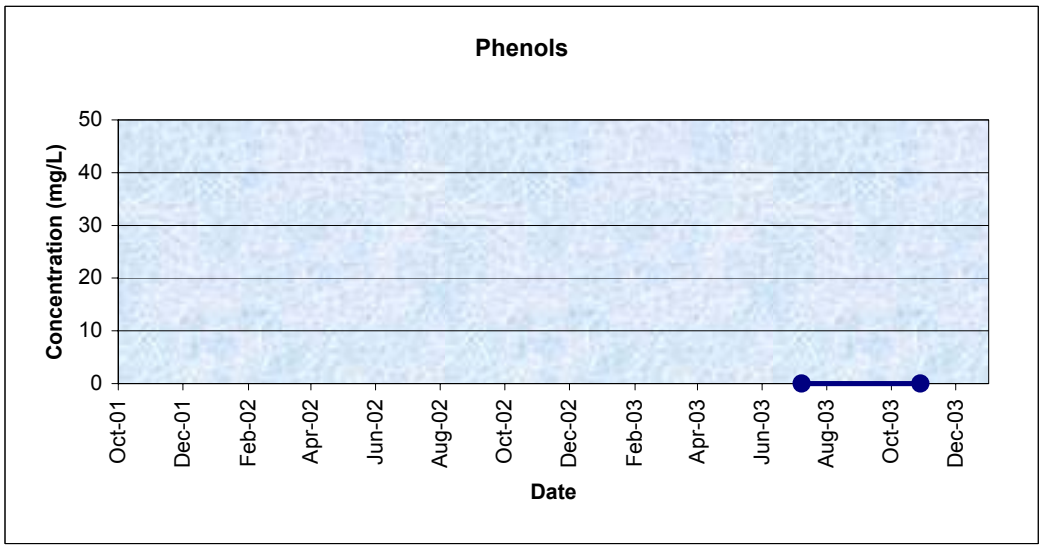
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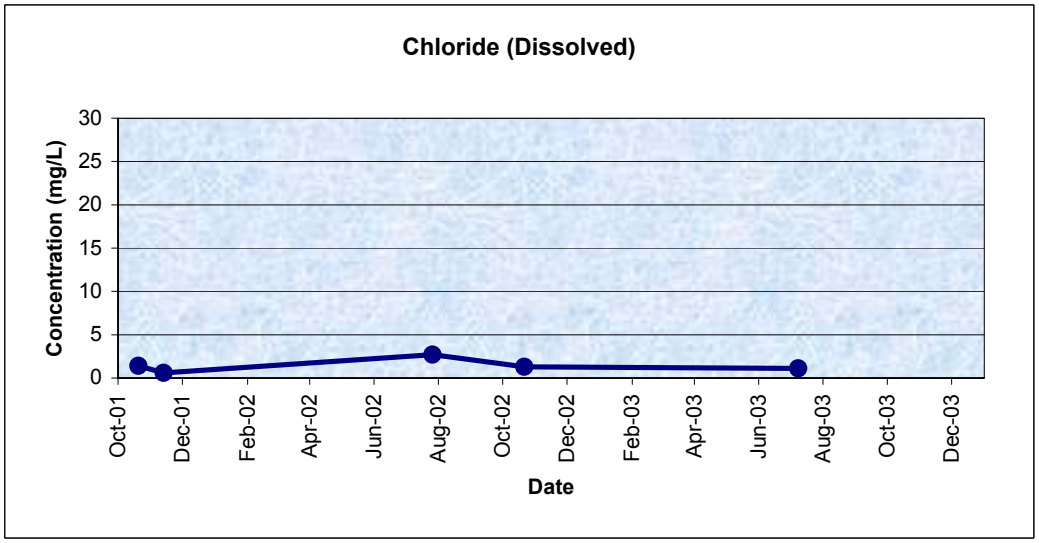
MW-04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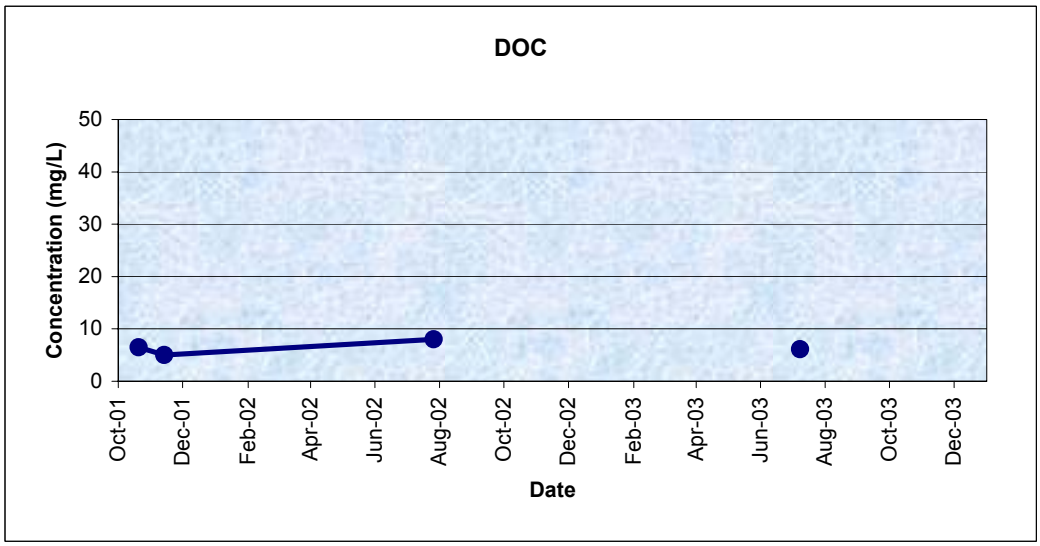
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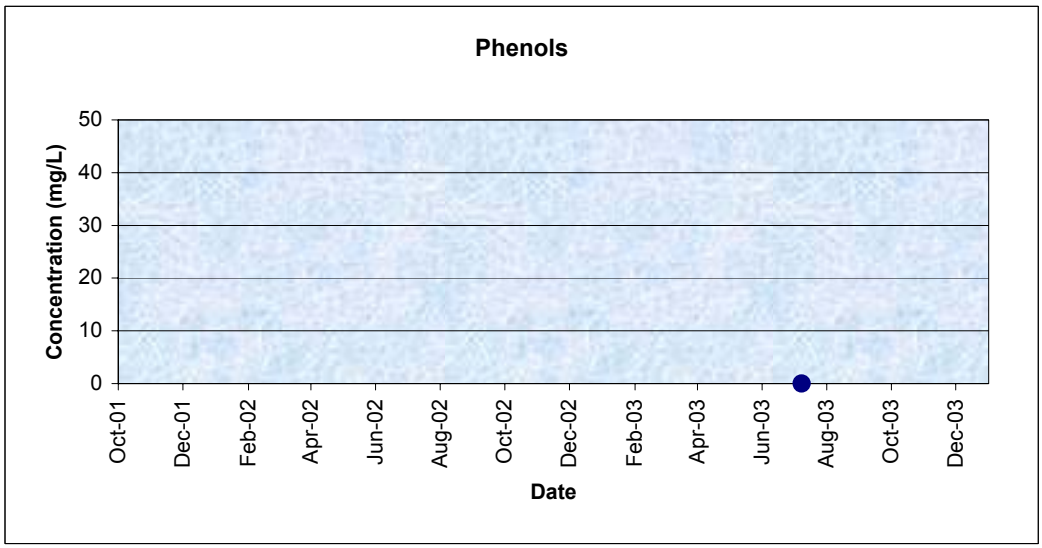
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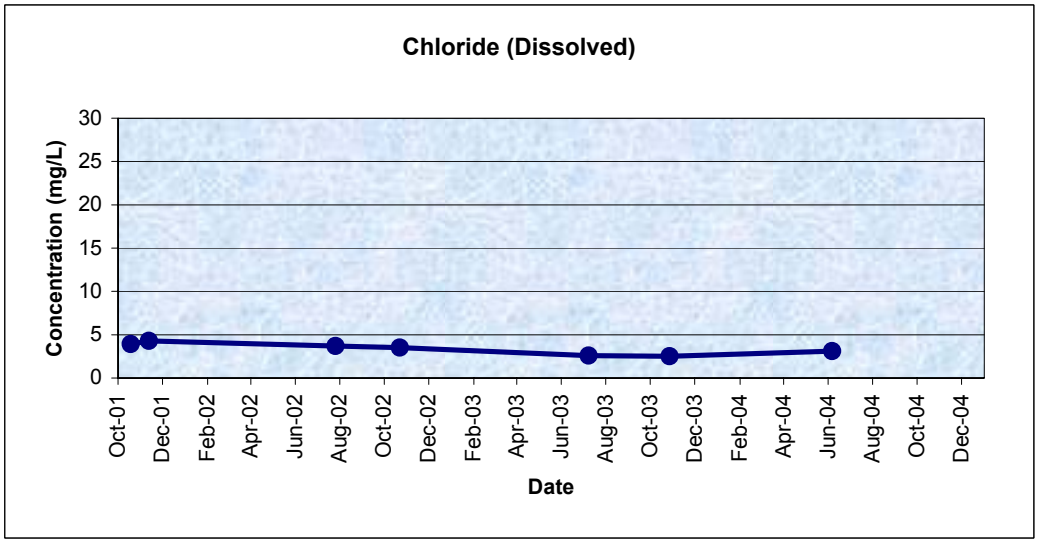
MW-05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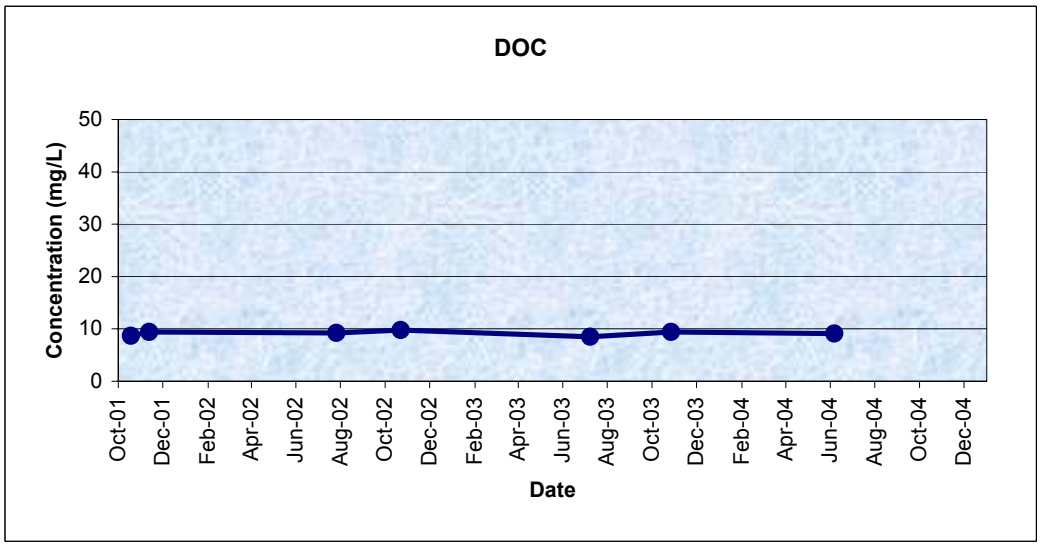
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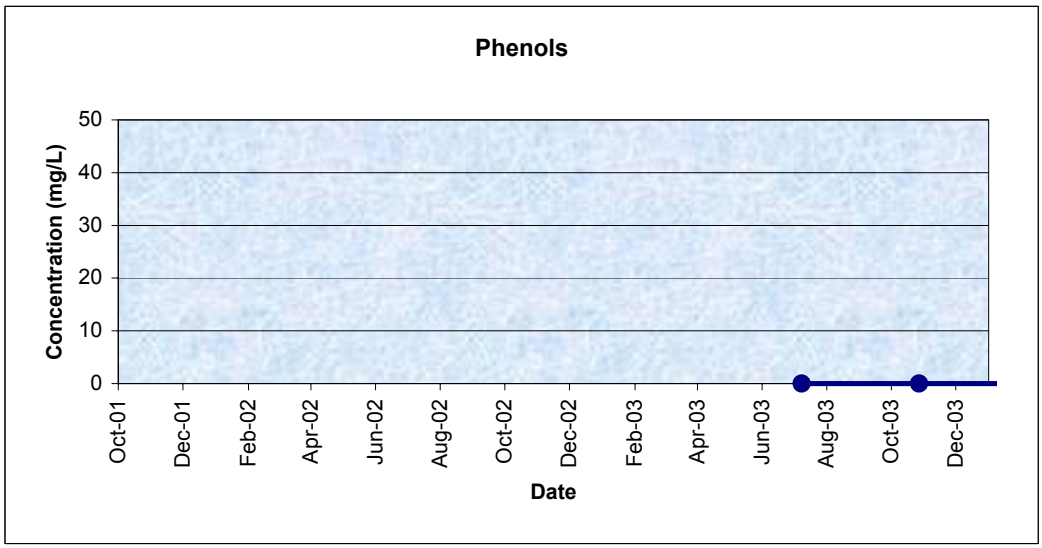
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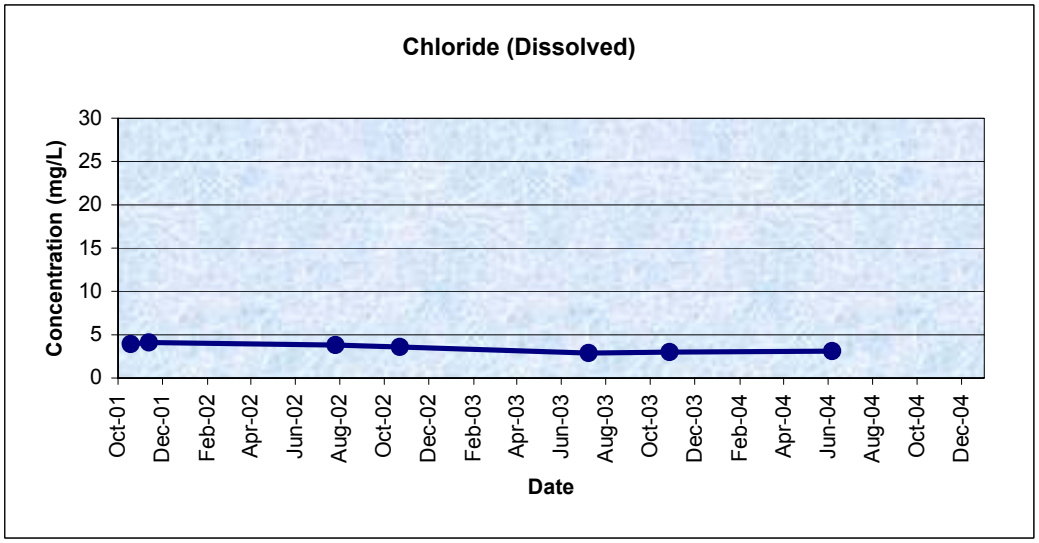
MW-06


Chloride (Dissolved)
Concentration (mg/L)
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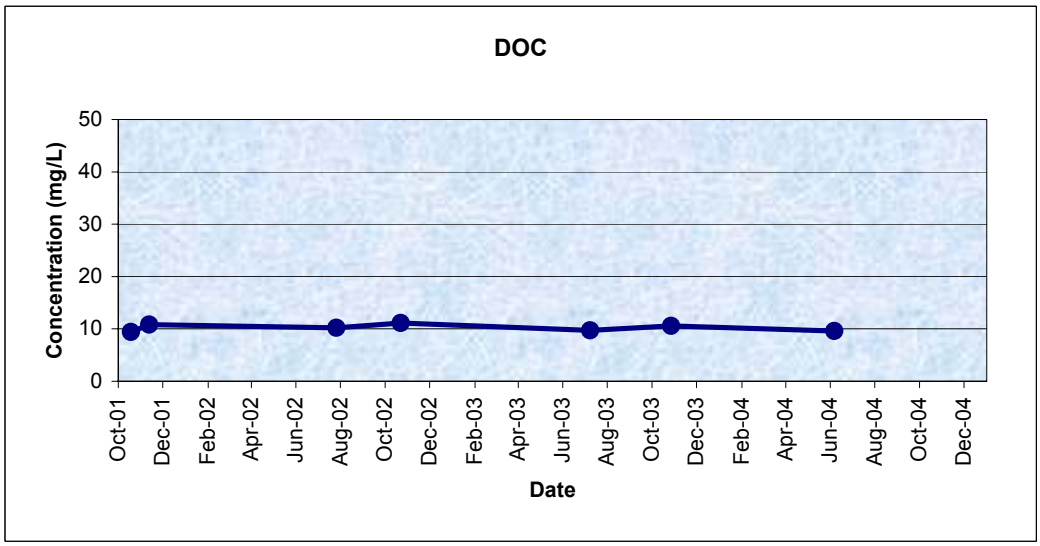
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Concentration (mg/L)
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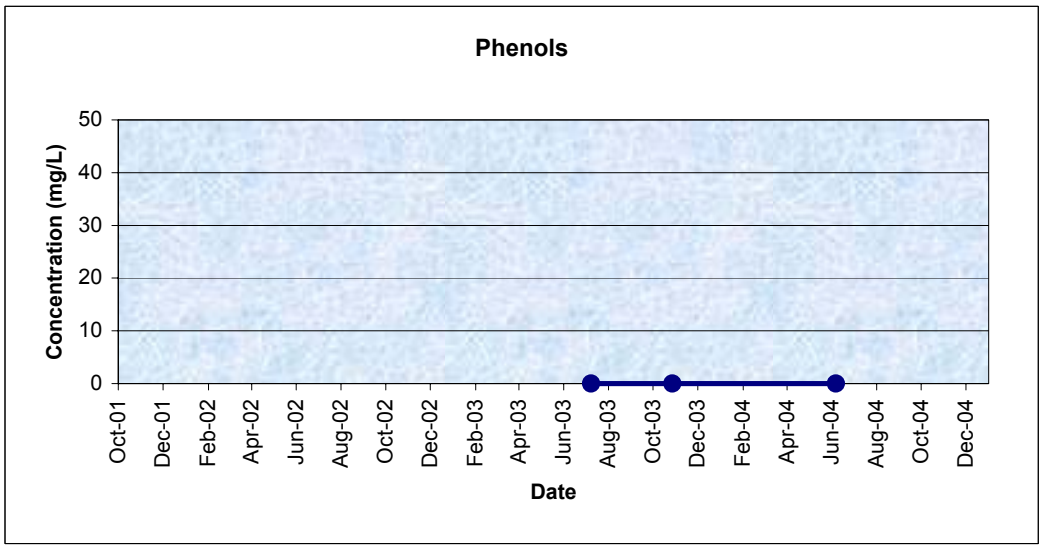
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Concentration (mg/L)
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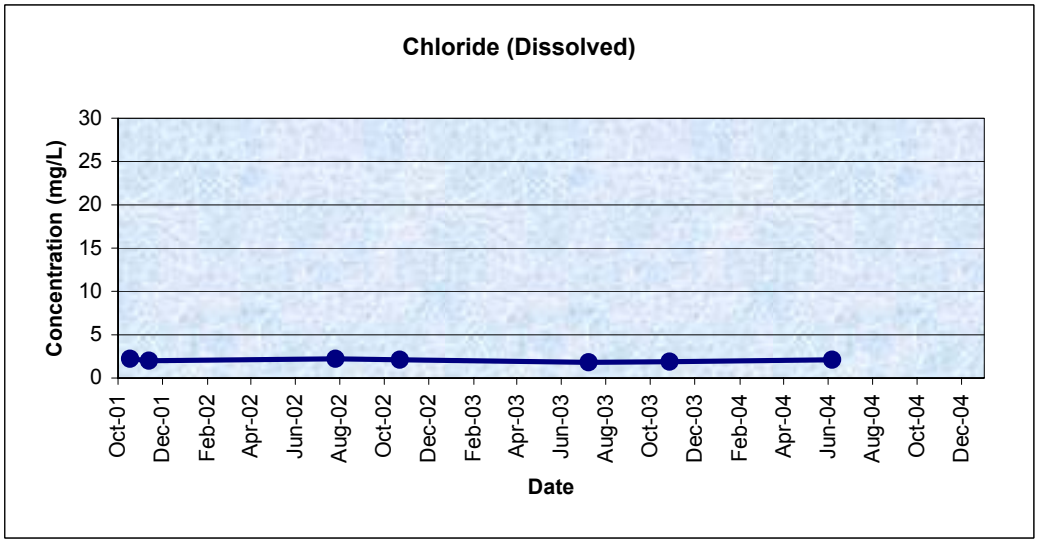
MW-07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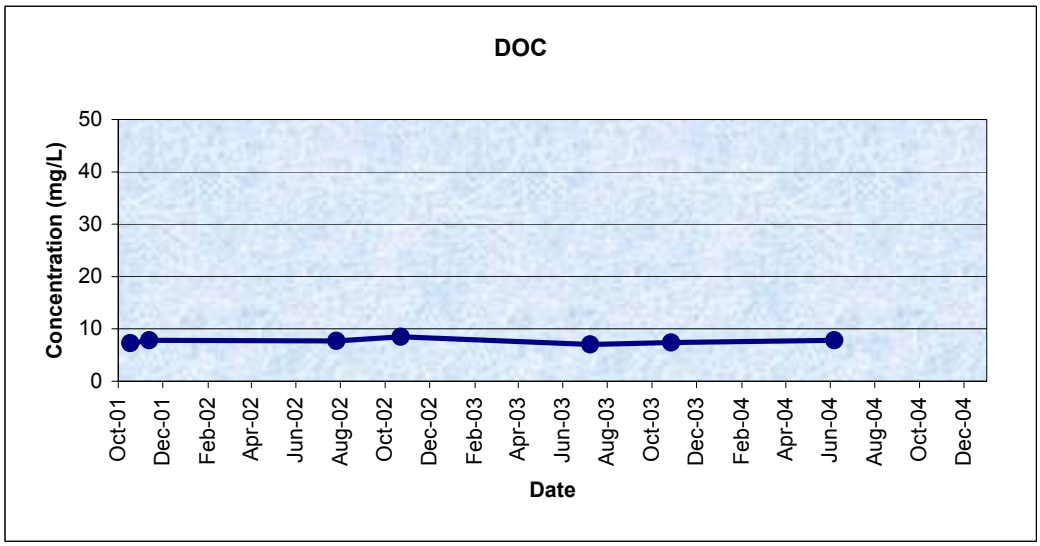
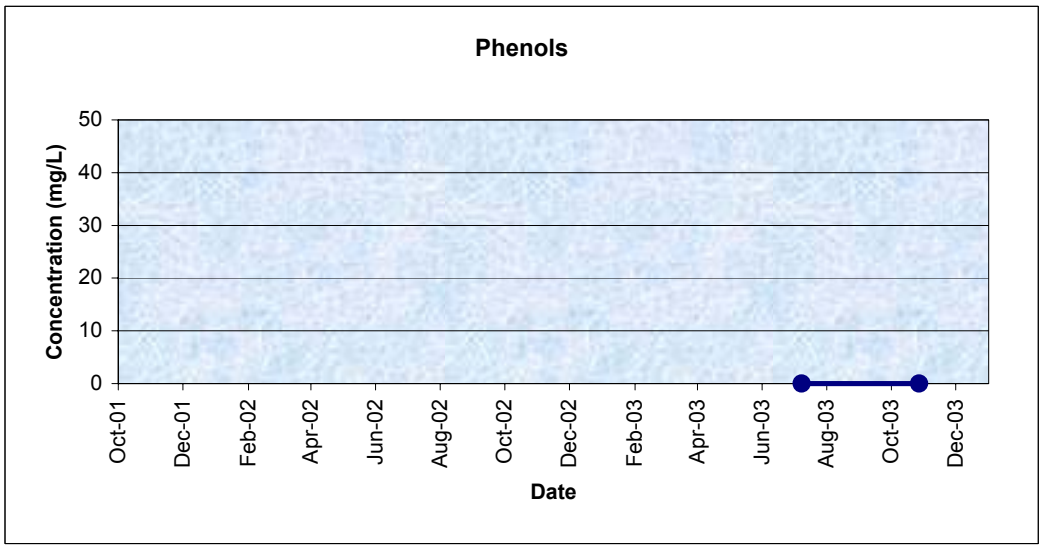
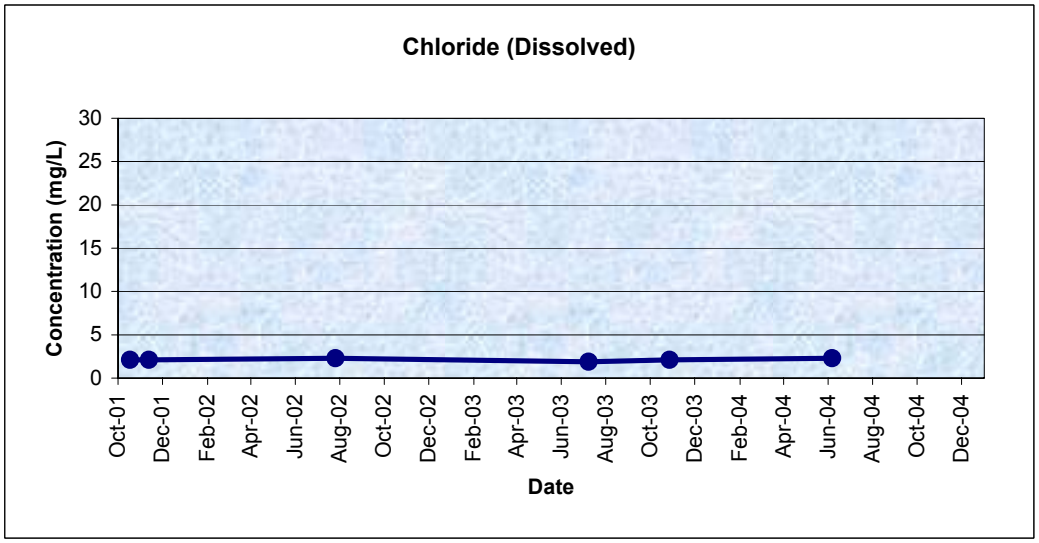
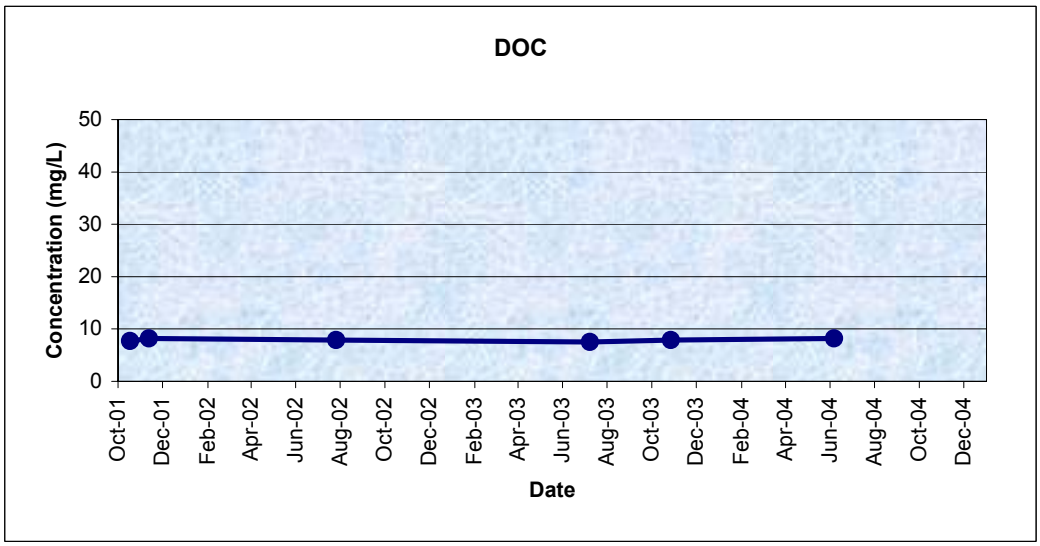
Dec-04
Date

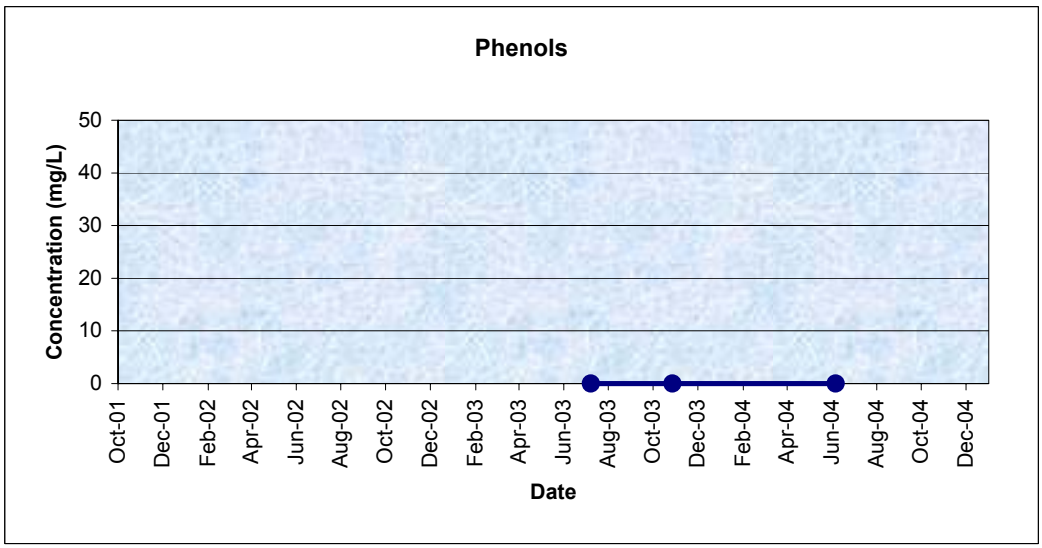

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

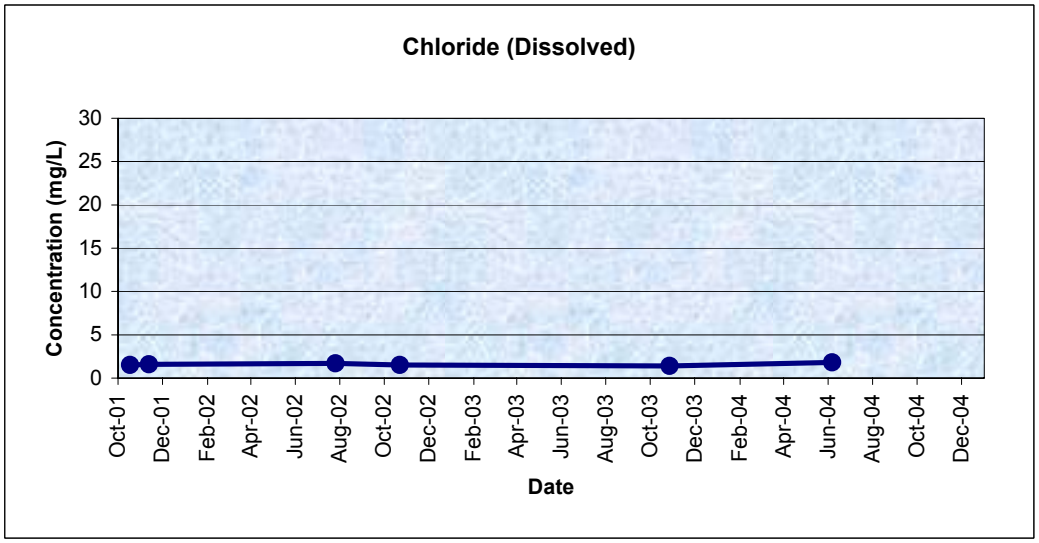
MW-08

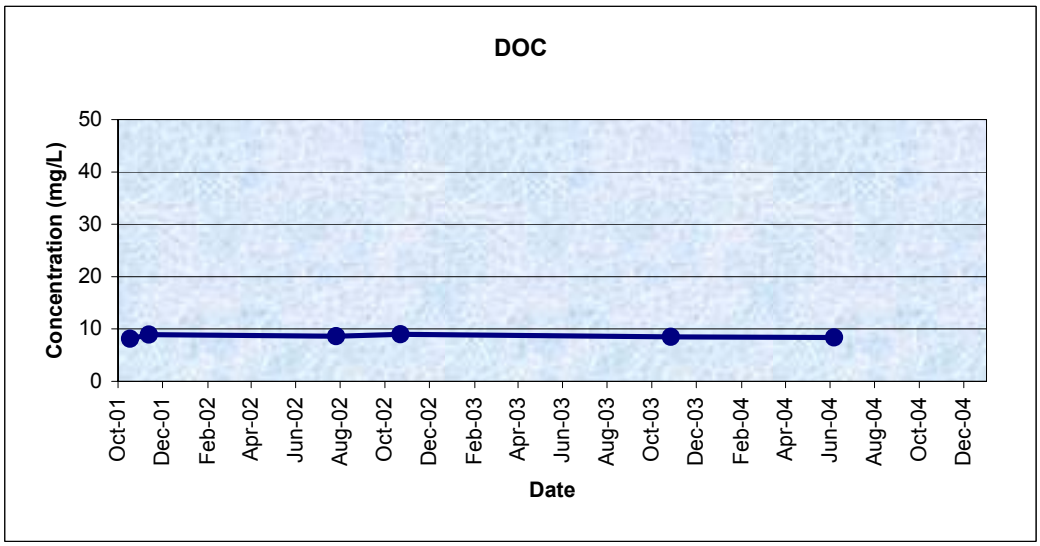

Chloride (Dissolved)
Concentration (mg/L)
30
25
20
15
10
5
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

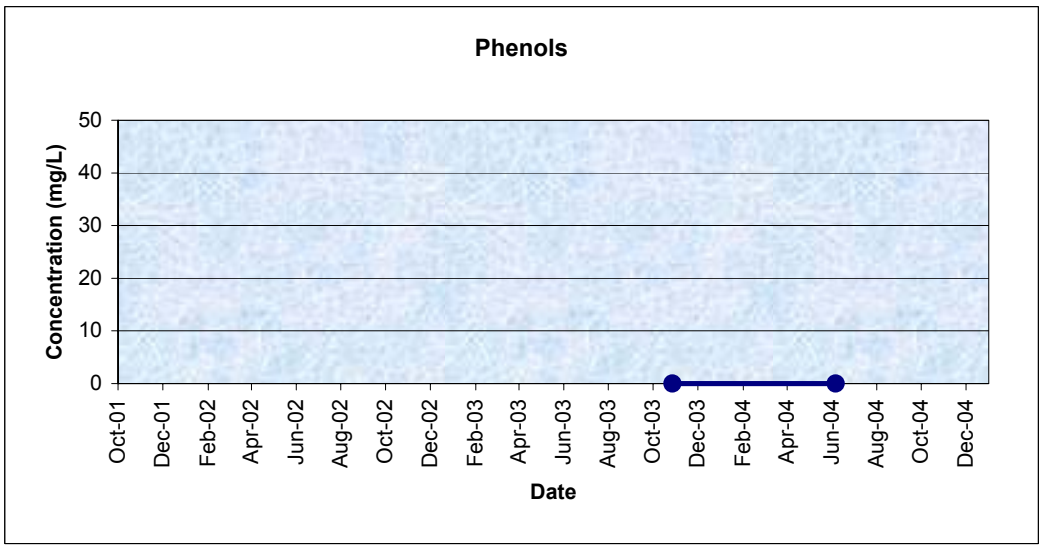

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

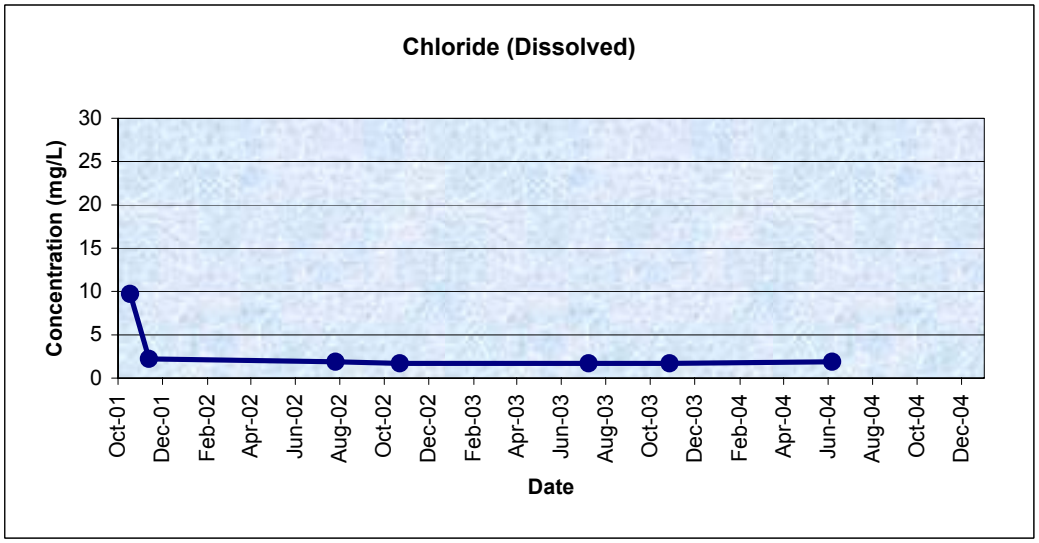
MW-09

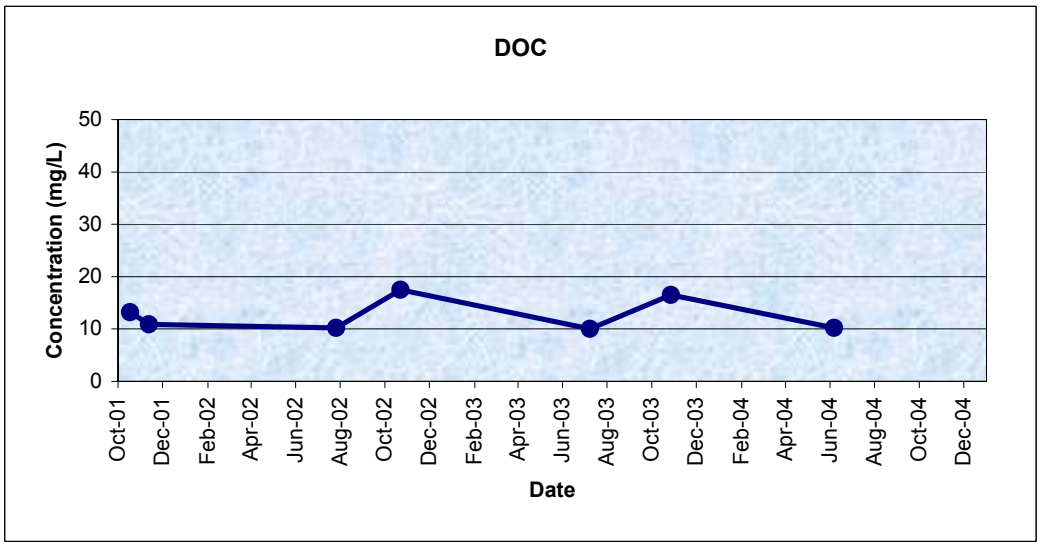

Chloride (Dissolved)
Concentration (mg/L)
30
25
20
15
10
5
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

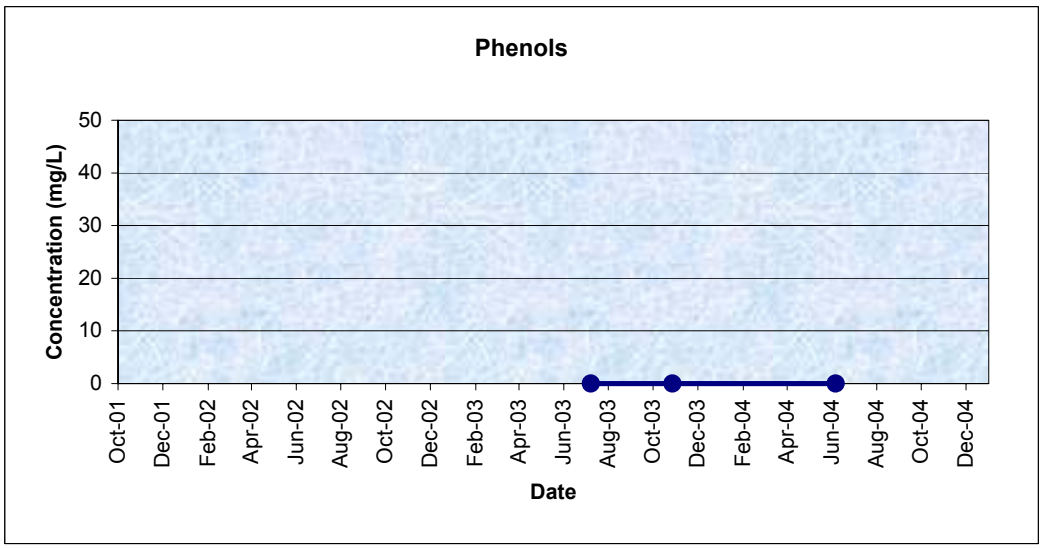

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

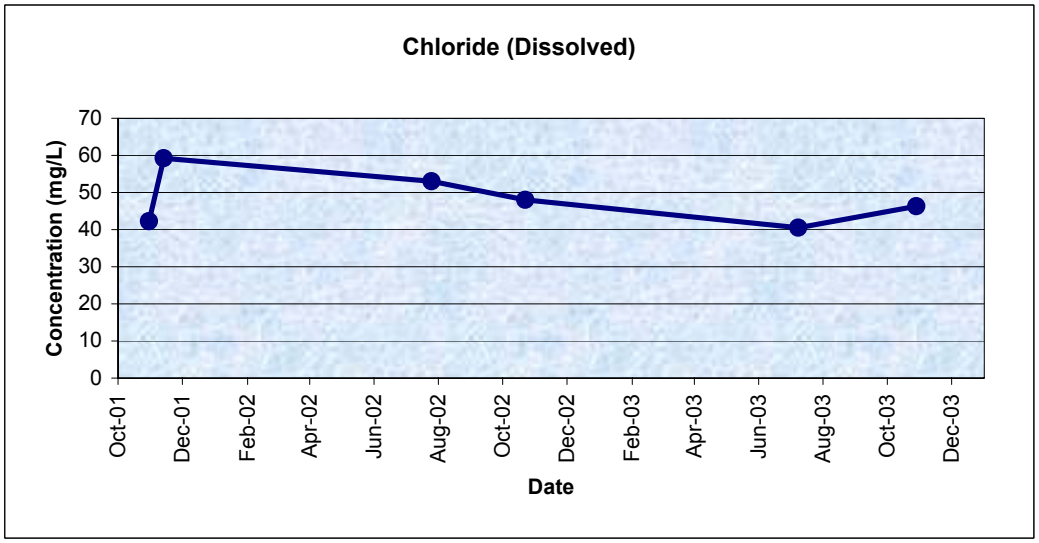
MW-10

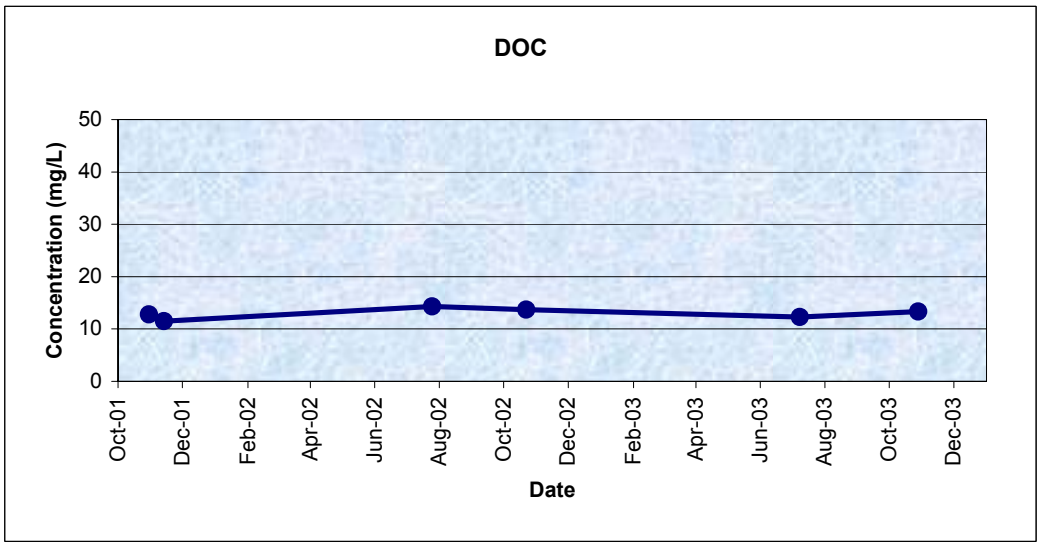

Chloride (Dissolved)
Concentration (mg/L)
30
25
20
15
10
5
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

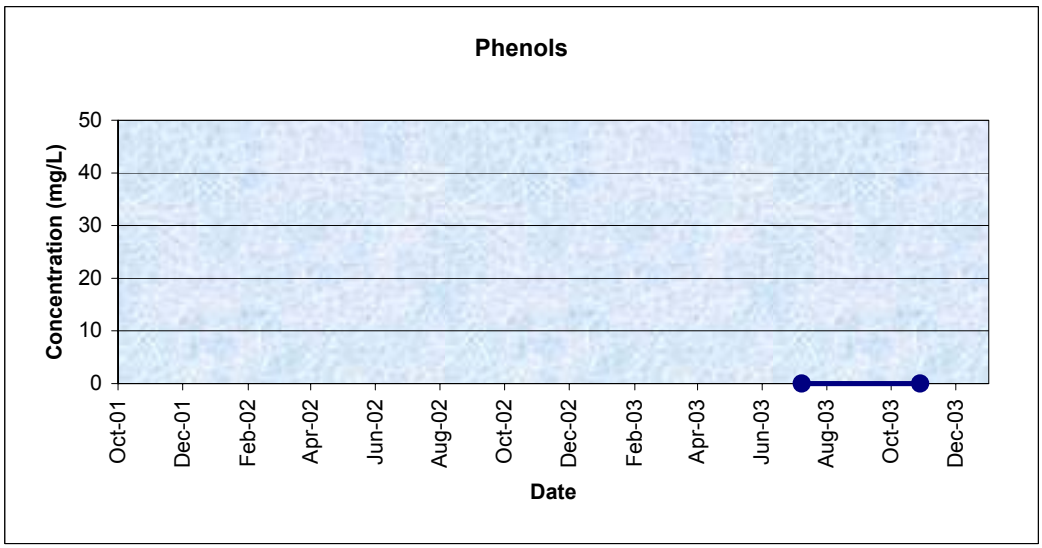

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Feb-04
Apr-04
Jun-04
Aug-04
Oct-04
Dec-04
Date

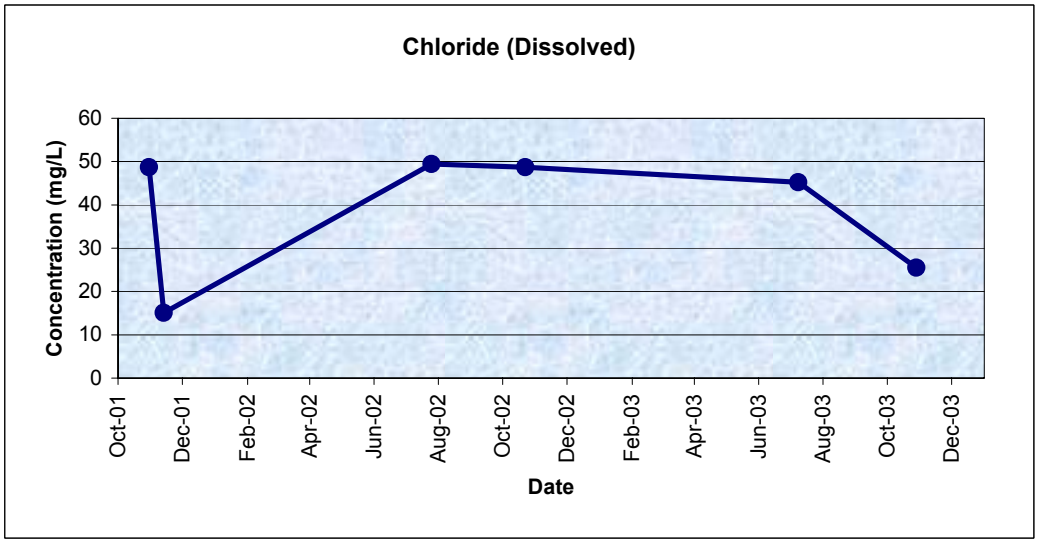
MW-11

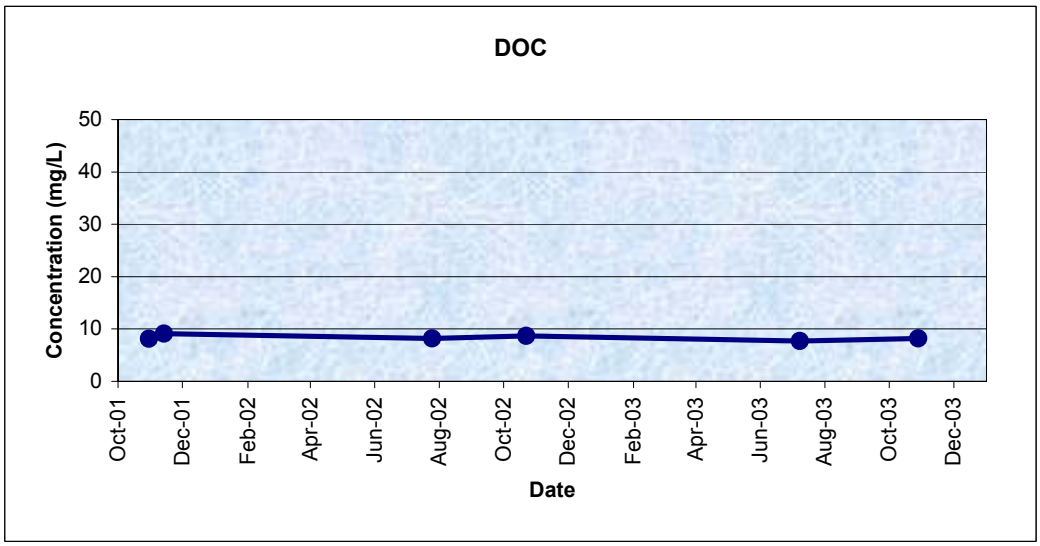

Chloride (Dissolved)
Concentration (mg/L)
70
60
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

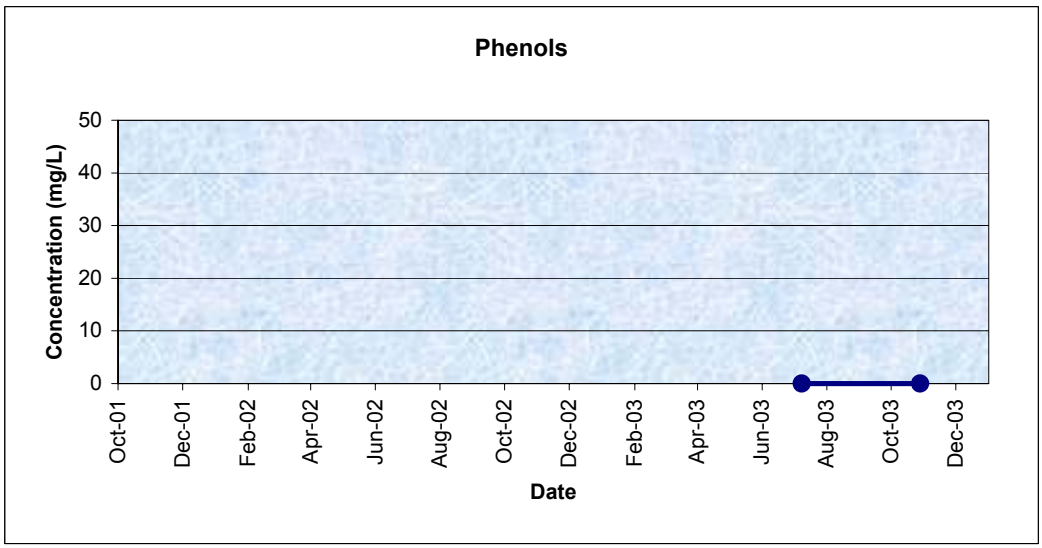

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

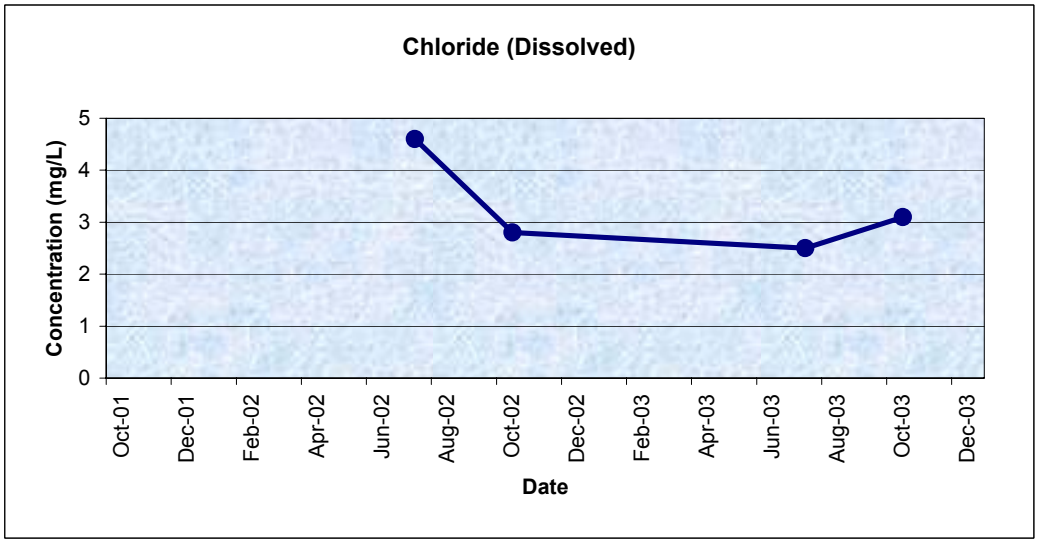
MW-12

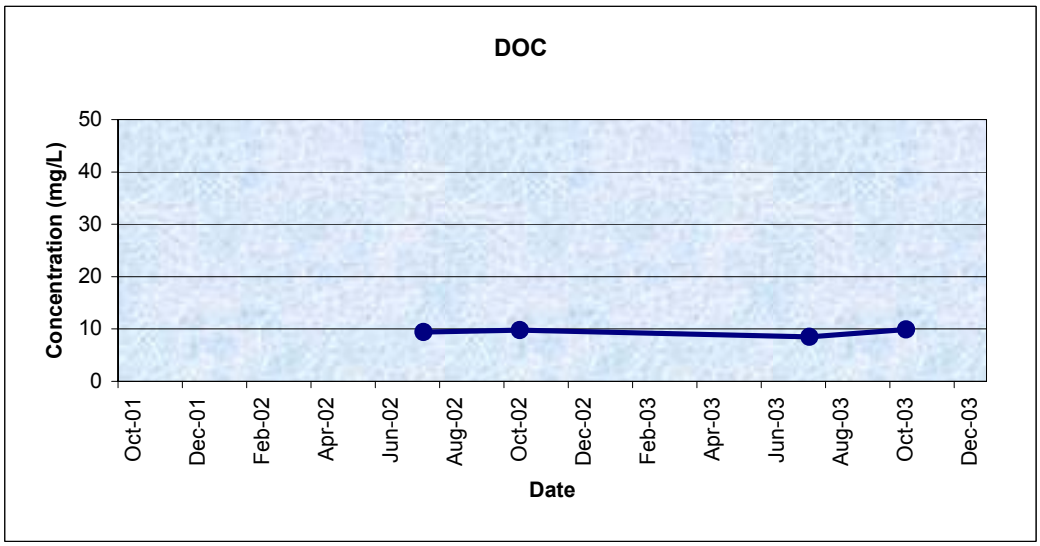

Chloride (Dissolved)
Concentration (mg/L)
60
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

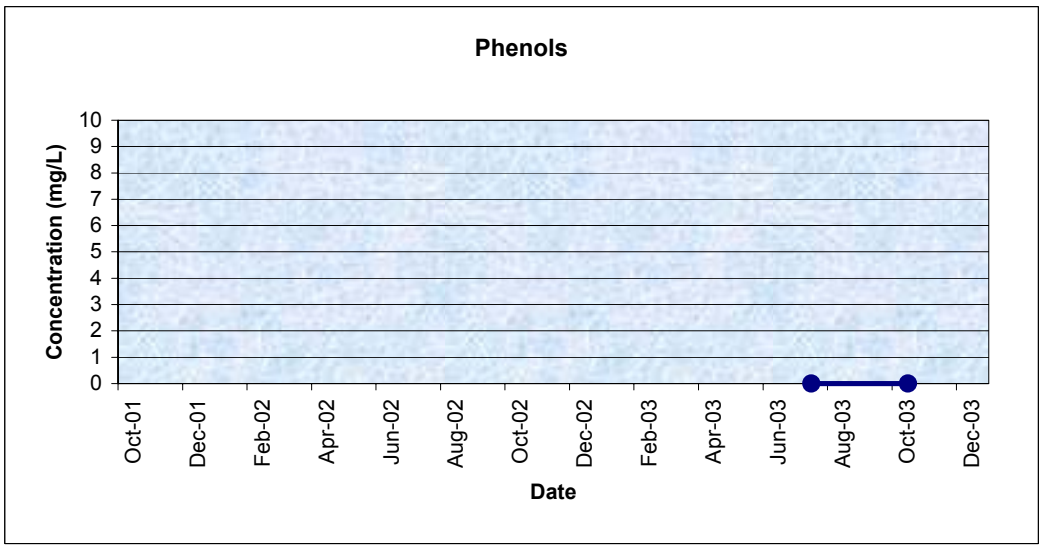

DOC
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date


Phenols
Concentration (mg/L)
50
40
30
20
10
0
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

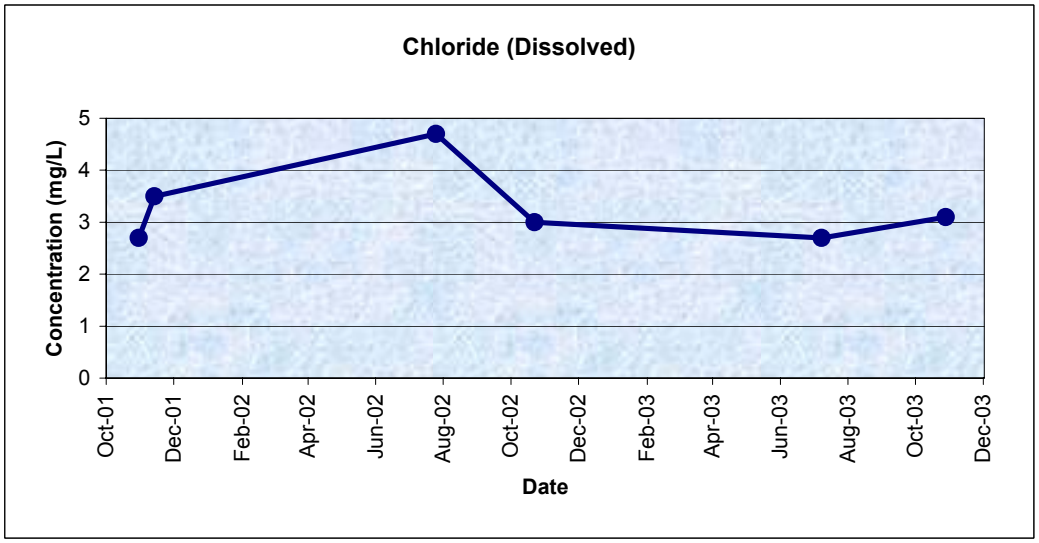
MW-13

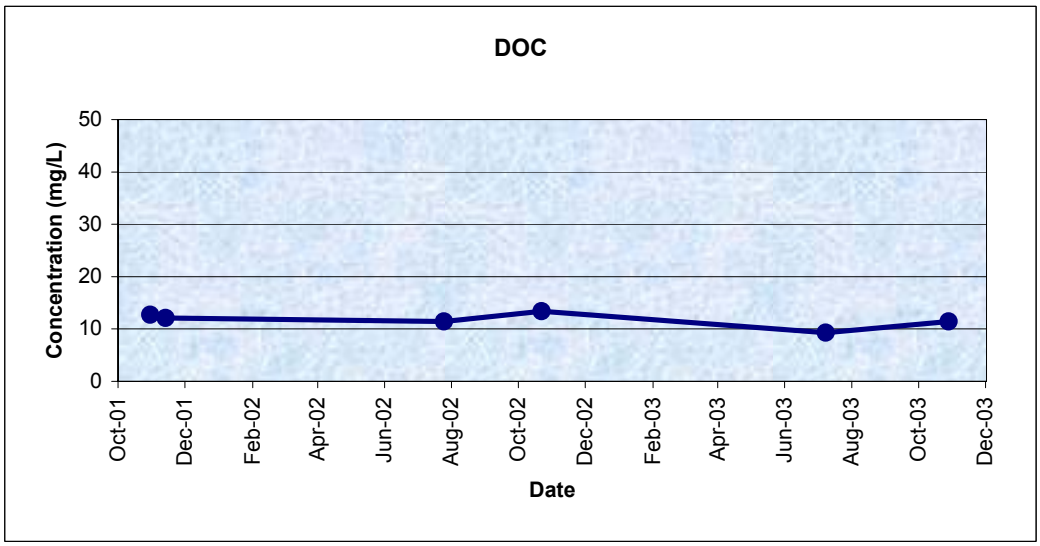

Chloride (Dissolved)
Concentration (mg/L)
0
1
2
3
4
5
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

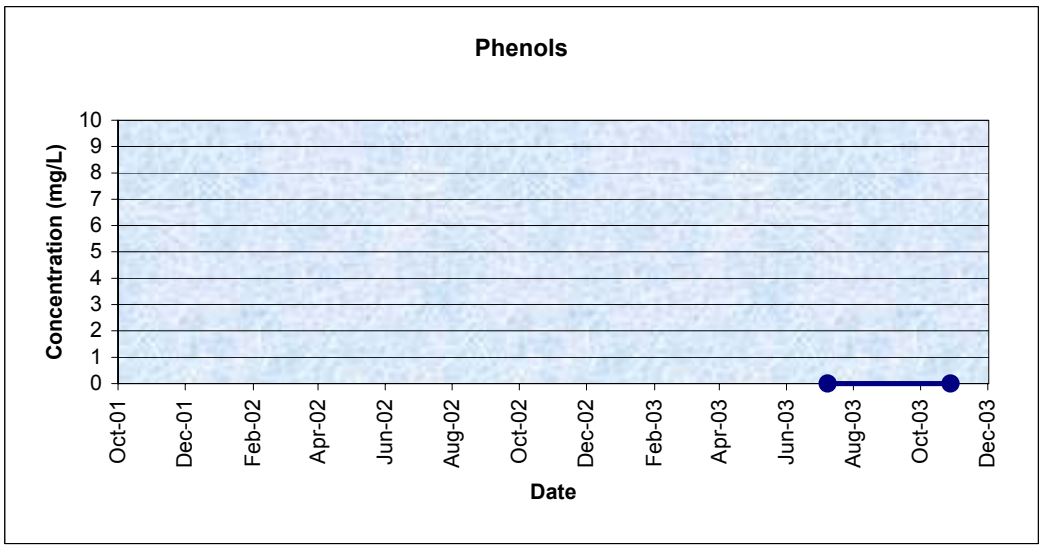

DOC
Concentration (mg/L)
0
10
20
30
40
50
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date


Phenols
Concentration (mg/L)
0
1
2
3
4
5
6
7
8
9
10
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

MW-14


Chloride (Dissolved)
Concentration (mg/L)
0
1
2
3
4
5
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date


DOC
Concentration (mg/L)
0
10
20
30
40
50
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date


Phenols
Concentration (mg/L)
0
1
2
3
4
5
6
7
8
9
10
Oct-01
Dec-01
Feb-02
Apr-02
Jun-02
Aug-02
Oct-02
Dec-02
Feb-03
Apr-03
Jun-03
Aug-03
Oct-03
Dec-03
Date

MW-15

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW01	MW01	MW01	MW01	MW02	MW02	MW02	MW03	MW03	MW03	MW03	MW03	MW04	MW04	MW04	MW04
	Date Sampled	19/10/2001	13/11/2001	8/7/2003	28/10/2003	13/11/2001	8/7/2003	28/10/2003	19/10/2001	13/11/2001	26/7/2002	21/10/2002	28/10/2003	19/10/2001	13/11/2001	26/7/2002	21/10/2002
Parameters	**Units**																
Routine																	
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	8.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Alkalinity (Total as CaCO3)	mg/L	465	456	468	478	350	517	527	507	499	524	484	528	416	399	405	523
Bicarbonate (HCO3)	mg/L	567	557	549	583	427	630	642	618	609	639	590	645	507	487	495	638
Carbonate (CO3)	mg/L	<0.5	<0.5	10.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl)Dissolved	mg/L	19.2	20.1	16.5	18.7	2.7	1.7	1.5	1.9	2.3	1.9	1.8	1.5	<0.5	(0.7)	<0.5	<0.5
Conductivity	mg/L	875	873	887	843	636	890	849	897	893	915	899	876	741	718	712	913
Hardness (CaCO3)	mg/L	68	57	59	72	160	280	330	56	72	52	50	61	270	250	270	260
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		1.04	1.04	0.92	1.05	0.98	0.90	1.05	1.04	1.02	0.95	1.00	0.95	1.10	1.00	0.99	0.72
Nitrate (N)Dissolved	mg/L	0.011	<0.003	<0.003	<0.003	0.017	<0.003	<0.003	0.009	(0.004)		<0.003	<0.003	0.015	0.010		<0.003
Nitrate plus Nitrite (N)	mg/L	0.018	<0.003	<0.003	(0.003)	0.025	<0.003	<0.003	0.012	0.007	<0.003	<0.003	<0.003	0.025	0.014	<0.003	<0.003
Nitrite (N)Dissolved	mg/L	0.007	<0.003	<0.003	(0.003)	0.008	<0.003	<0.003	(0.003)	(0.003)		<0.003	<0.003	0.010	(0.004)		<0.003
pH		8.29	8.13	8.43	8.23	8.04	8.14	7.91	8.17	8.14	8.16	7.88	8.02	7.97	8.01	7.94	8.06
Sulphate (SO4)Dissolved	mg/L	<0.1	(0.1)	0.2	<0.1	2.4	(0.1)	<0.1	1.0	0.5	0.5	0.5	0.2	7.8	6.0	6.0	6.7
Total Dissolved Solids	mg/L	527	519	536	542	358	534	538	546	531	543	542	545	445	406	410	502
Metals																	
Aluminum (Al)Dissolved	mg/L	0.008	0.002	0.005	0.020	(0.001)	0.014	0.022	0.008	<0.001	0.010		0.027	0.092	0.002	0.007	
Antimony (Sb)Dissolved	mg/L	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	
Arsenic (As)Dissolved	mg/L	<0.0002	<0.005	<0.0002	<0.0002	<0.005	(0.0002)	<0.0002	<0.0002	<0.005	<0.005		(0.0002)	0.0010	<0.005	<0.005	
Barium (Ba)Dissolved	mg/L	0.0879	0.0734	0.0920	0.0921	0.156	0.295	0.313	0.164	0.157	0.167		0.188	0.160	0.141	0.139	
Beryllium (Be)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	(0.0003)	<0.0002	
Boron (B)Dissolved	mg/L	0.56	0.59	0.60	0.82	0.31	0.29	0.48	0.41	0.44	0.45		0.64	0.26	0.25	0.23	
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	
Calcium (Ca)Dissolved	mg/L	16.8	13.8	14.4	18.0	37.1	69.1	83.8	13.5	17.1	12.9	12.2	15.4	65.1	59.6	65.6	62.9
Chromium (Cr)Dissolved	mg/L	0.004	<0.001	<0.001	(0.001)	<0.001	<0.001	0.002	0.003	0.015	<0.001		(0.001)	0.003	<0.001	<0.001	
Cobalt (Co)Dissolved	mg/L	(0.0004)	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	(0.0003)	(0.0005)	(0.0005)	(0.0004)		0.0008	0.0006	(0.0004)	<0.0003	
Copper (Cu)Dissolved	mg/L	<0.0002	0.0007	<0.0002	(0.0003)	0.0014	0.0005	0.0007	<0.0002	0.0017	0.0004		(0.0003)	0.0004	0.0009	(0.0002)	
Iron (Fe)Dissolved	mg/L	0.29	0.17	0.23	0.25	0.40	1.33	1.57	0.46	<0.01	0.47	0.44	0.54	3.51	2.47	3.21	2.99
Lead (Pb)Dissolved	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	(0.0003)	<0.0003	<0.0003		<0.0003	(0.0004)	<0.0003	<0.0003	
Lithium (Li)Dissolved	mg/L	0.035	0.036	<0.004	0.022	0.046	<0.004	0.038	0.066	0.064	0.060		0.050	0.055	0.051	0.048	
Magnesium (Mg)Dissolved	mg/L	6.4	5.5	5.6	6.6	16.3	25.2	28.2	5.5	7.2	4.8	4.9	5.5	25.2	24.9	25.7	24.5
Manganese (Mn)Dissolved	mg/L	0.015	0.009	0.014	0.016	0.088	0.042	0.048	0.050	0.083	0.047	0.037	0.043	0.373	0.352	0.404	0.384
Molybdenum (Mo)Dissolved	mg/L	0.0042	0.0046	0.0045	0.0044	0.0013	0.0008	0.0008	0.0013	0.0012	0.0009		0.0009	0.0012	0.0017	0.0017	
Nickel (Ni)Dissolved	mg/L	(0.0009)	0.0017	0.0011	<0.0005	0.0035	(0.0008)	(0.0009)	(0.0007)	0.0025	0.0010		(0.0009)	0.0041	0.0052	0.0021	
Phosphorus (P)Dissolved	mg/L	1.9	1.5	1.7	1.8	(0.1)	0.5	0.5	0.9	0.6	0.9		0.9	0.6	0.4	0.5	
Potassium (K)Dissolved	mg/L	3.8	3.1	2.9	3.5	4.8	5.9	6.5	4.3	3.6	3.3	3.3	3.5	5.2	4.2	4.3	4.1
Selenium (Se)Dissolved	mg/L	<0.007	<0.007		<0.007	<0.007		<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007	<0.007	
Silicon (Si)Dissolved	mg/L	11.6	10.8	11.0	12.5	7.16	10.7	11.9	8.56	8.04	7.93		9.32	10.6	9.57	9.77	
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	
Sodium (Na)Dissolved	mg/L	201	202	189	209	84.4	95.2	99.9	215	200	205	207	201	88.5	68.1	61.0	63.2
Strontium (Sr)Dissolved	mg/L	0.211	0.188	0.23	0.26	0.425	0.75	0.88	0.278	0.347	0.297		0.34	0.486	0.453	0.482	
Sulphur (S)Dissolved	mg/L	0.4	0.6	(0.3)	(0.3)	1.2	(0.3)	(0.3)	0.7	0.6	0.4		(0.3)	3.4	2.3	2.3	
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	
Titanium (Ti)Dissolved	mg/L	0.010	0.008	(0.001)	0.003	(0.001)	(0.001)	0.002	0.005	0.004	0.002		0.002	0.006	0.003	0.002	
Uranium (U)Dissolved	mg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004		<0.0004	<0.0004	<0.0004	<0.0004	
Vanadium (V)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001		<0.001	<0.001	<0.001	<0.001	
Zinc (Zn)Dissolved	mg/L	0.0024	0.0180	0.0042	0.0083	0.0229	0.0024	0.0063	0.0091	0.0086	0.0111		0.0075	0.0060	0.0283	0.0019	
Zirconium (Zr)Dissolved	mg/L	0.0014	0.0004	0.0038	0.0010	<0.0002	0.0009	0.0010	0.0013	0.0010	0.0008		0.0009	0.0019	0.0016	0.0006	
Hydrocarbon Indicators																	
Organic Carbon (C)Dissolved	mg/L	8.8	14.3	8.8	9.7	10.7	7.8	8.2	8.3	9.1	8.4		8.2	7.9	9.8	9.6	
Phenols				<0.002	<0.002		<0.002	<0.002					<0.002				

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW04	MW04	MW05	MW05-DUP	MW05	MW05-DUP	MW05	MW05	MW05	MW06	MW06	MW06	MW06-DUP	MW06	MW06	MW06
	Date Sampled	8/7/2003	28/10/2003	20/10/2001	20/10/2001	13/11/2001	13/11/2001	26/7/2002	21/10/2002	8/7/2003	18/10/2001	12/11/2001	26/7/2002	25/7/2002	22/10/2002	8/7/2003	27/10/2003
Parameters	**Units**																
Routine																	
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	2.9	10.0	13.3	<0.5	12.3	<0.5
Alkalinity (Total as CaCO3)	mg/L	429	439	310	298	260	261	542	410	487	439	436	453	454	449	459	482
Bicarbonate (HCO3)	mg/L	523	535	378	364	318	318	662	500	594	530	525	528	522	547	530	588
Carbonate (CO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.6	3.5	12.0	15.9	<0.5	14.8	<0.5
Chloride (Cl)Dissolved	mg/L	(0.5)	<0.5	1.4	1.0	(0.6)	(0.8)	2.7	1.3	1.1	3.9	4.3	3.7	3.7	3.5	2.6	2.5
Conductivity	mg/L	770	752	610	574	501	504	1140	722	885	862	867	886	888	871	891	897
Hardness (CaCO3)	mg/L	200	230	290	260	230	230	540	400	380	40	29	32	32	32	52	77
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		0.91	1.02	1.03	1.10	0.98	0.99	0.96	0.95	0.92	1.08	0.97	0.99	0.97	0.97	0.99	1.02
Nitrate (N)Dissolved	mg/L	<0.003	<0.003	0.009	0.013	0.013	0.022		<0.003	<0.003	0.009	(0.004)			<0.003	0.084	<0.003
Nitrate plus Nitrite (N)	mg/L	<0.003	<0.003	0.013	0.022	0.019	0.031	<0.003	<0.003	<0.003	0.017	0.017	<0.003	<0.003	<0.003	0.084	(0.004)
Nitrite (N)Dissolved	mg/L	<0.003	<0.003	(0.004)	0.009	0.006	0.009		<0.003	<0.003	0.008	0.013			<0.003	<0.003	(0.004)
pH		8.04	7.81	7.92	7.95	8.00	8.00	7.84	7.88	7.67	8.31	8.32	8.44	8.51	7.76	8.51	8.12
Sulphate (SO4)Dissolved	mg/L	11.3	11.5	28.0	25.9	14.8	14.9	137	65.5	25.8	26.2	29.1	27.2	27.8	29.8	32.4	39.0
Total Dissolved Solids	mg/L	463	462	345	343	270	272	711	504	495	525	503	522	520	516	531	569
Metals																	
Aluminum (Al)Dissolved	mg/L	<0.001	0.010	0.101	0.243	0.002	0.004	<0.001		0.011	0.007	0.015	0.005	0.009	<0.001	0.002	0.005
Antimony (Sb)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005		<0.0002	(0.0003)	<0.0002	<0.0002	<0.0002	<0.0002	0.0008	0.0006
Arsenic (As)Dissolved	mg/L	0.0012	0.0008	0.0006	0.0008	<0.005	<0.005	<0.005		0.0004	0.0340	0.044	0.061	0.054	0.047	0.0265	0.0440
Barium (Ba)Dissolved	mg/L	0.142	0.179	0.115	0.139	0.0892	0.0985	0.379		0.182	0.0911	0.0771	0.142	0.0838	0.0992	0.0880	0.0820
Beryllium (Be)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron (B)Dissolved	mg/L	0.32	0.52	0.08	0.04	0.07	0.06	0.08		0.04	0.52	0.66	0.77	0.71	0.86	0.65	0.78
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (Ca)Dissolved	mg/L	48.6	56.4	74.6	65.3	57.7	58.5	143	104	97.7	9.3	6.5	7.3	7.3	7.4	12.3	18.6
Chromium (Cr)Dissolved	mg/L	<0.001	<0.001	0.004	0.004	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	(0.001)
Cobalt (Co)Dissolved	mg/L	<0.0003	<0.0003	0.0033	0.0048	0.0017	0.0019	<0.0003		0.0039	<0.0003	<0.0003	0.0006	<0.0003	<0.0003	<0.0003	<0.0003
Copper (Cu)Dissolved	mg/L	(0.0003)	0.0005	0.0010	0.0412	0.0084	0.0079	<0.0002		0.0021	<0.0002	<0.0002	0.0004	0.0005	<0.0002	0.0004	(0.0003)
Iron (Fe)Dissolved	mg/L	1.36	2.08	0.69	1.82	<0.01	<0.01	0.02	0.08	0.04	0.43	0.31	0.57	0.56	0.40	0.33	0.21
Lead (Pb)Dissolved	mg/L	<0.0003	<0.0003	0.0010	0.0028	(0.0003)	(0.0005)	<0.0003		<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Lithium (Li)Dissolved	mg/L	(0.006)	0.046	0.014	0.010	0.011	0.011	0.024		<0.004	0.037	0.034	0.036	0.036	0.031	<0.004	0.032
Magnesium (Mg)Dissolved	mg/L	19.8	21.0	25.3	24.7	21.0	21.4	45.6	33.8	31.9	4.1	3.2	3.4	3.3	3.4	5.3	7.5
Manganese (Mn)Dissolved	mg/L	0.222	0.221	0.791	0.914	0.521	0.535	1.33	0.918	0.597	0.031	0.040	0.040	0.040	0.027	0.054	0.067
Molybdenum (Mo)Dissolved	mg/L	0.0016	0.0013	0.0037	0.0048	0.0031	0.0033	0.0042		0.0021	0.0161	0.0146	0.0183	0.0166	0.0169	0.0168	0.0165
Nickel (Ni)Dissolved	mg/L	(0.0009)	(0.0008)	0.0123	0.0228	0.0101	0.0106	0.0018		0.0070	<0.0005	0.0028	0.0017	<0.0005	<0.0005	(0.0009)	<0.0005
Phosphorus (P)Dissolved	mg/L	0.4	0.6	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	2.8	2.5	2.8	2.8	2.8	2.3	1.9
Potassium (K)Dissolved	mg/L	4.1	4.4	2.6	2.6	1.5	1.4	3.9	2.6	2.1	3.1	1.8	2.3	2.2	2.1	2.4	2.8
Selenium (Se)Dissolved	mg/L		<0.007	<0.007	<0.007	<0.007	<0.007	<0.007			<0.007	<0.007	<0.007	<0.007	<0.007		<0.007
Silicon (Si)Dissolved	mg/L	8.99	10.1	6.87	7.81	5.84	5.93	6.45		6.80	11.1	10.2	10.1	9.95	9.63	10.2	10.8
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)Dissolved	mg/L	98.0	103	25.6	41.8	18.0	17.7	52.3	33.6	43.2	214	196	206	202	200	200	209
Strontium (Sr)Dissolved	mg/L	0.47	0.54	0.256	0.332	0.218	0.239	0.823		0.29	0.143	0.129	0.264	0.154	0.164	0.18	0.23
Sulphur (S)Dissolved	mg/L	4.5	3.7	7.5	12.8	5.0	5.0	47.8		8.3	10.6	10.6	10.0	9.9	9.5	11.7	12.4
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)Dissolved	mg/L	<0.001	0.002	0.004	0.008	<0.001	<0.001	<0.001		<0.001	0.015	0.013	0.007	0.006	(0.001)	0.002	0.002
Uranium (U)Dissolved	mg/L	<0.0004	<0.0004	<0.0004	0.0043	0.0036	0.0037	0.0104		0.0043	<0.0004	<0.0004	(0.0005)	<0.0004	<0.0004	<0.0004	<0.0004
Vanadium (V)Dissolved	mg/L	<0.001	<0.001	(0.001)	0.002	<0.001	<0.001	(0.001)		<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Zinc (Zn)Dissolved	mg/L	0.0042	0.0021	0.139	0.352	0.0777	0.0792	0.0033		0.0179	0.0041	0.0046	0.0091	0.0141	(0.0009)	0.0047	0.0208
Zirconium (Zr)Dissolved	mg/L	0.0018	0.0013	0.0011	0.0015	0.0006	0.0015	0.0006		0.0008	0.0018	0.0005	0.0008	0.0005	0.0008	0.0124	0.0034
Hydrocarbon Indicators																	
Organic Carbon (C)Dissolved	mg/L	7.6	8.6	6.5	5.5	5.0	5.2	8.0		6.1	8.7	9.4	9.2	9.1	9.8	8.5	9.4
Phenols		<0.002	<0.002							<0.002						<0.002	<0.002

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW06	MW07	MW07	MW07	MW07	MW07	MW07	MW07	MW08	MW08	MW08	MW08	MW08	MW08	MW08	MW09
	Date Sampled	6/6/2004	18/10/2001	12/11/2001	26/7/2002	22/10/2002	8/7/2003	27/10/2003	6/6/2004	17/10/2001	12/11/2001	26/7/2002	22/10/2002	8/7/2003	27/10/2003	6/6/2004	17/10/2001
Parameters	**Units**																
Routine																	
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	5.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Alkalinity (Total as CaCO3)	mg/L	477	423	416	430	428	431	435	438	475	475	486	489	479	489	498	463
Bicarbonate (HCO3)	mg/L	583	516	508	525	523	512	531	532	580	580	593	597	584	596	608	565
Carbonate (CO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	6.6	<0.5	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl)Dissolved	mg/L	3.1	3.9	4.1	3.8	3.6	2.9	3.0	3.1	2.2	2.0	2.2	2.1	1.8	1.9	2.1	2.1
Conductivity	mg/L	891	760	763	771	763	777	746	758	833	845	842	835	835	801	829	815
Hardness (CaCO3)	mg/L	79	82	70	68	66	74	85	75	250	230	230	220	230	230	250	220
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		0.99	1.08	1.03	0.99	0.98	0.99	1.03	0.99	1.07	1.01	0.97	0.95	1.01	0.98	1.00	1.06
Nitrate (N)Dissolved	mg/L	<0.003	0.010	0.008		<0.003	<0.003	<0.003	<0.003	0.009	0.082		<0.003	<0.003	<0.003	0.006	0.008
Nitrate plus Nitrite (N)	mg/L	<0.003	0.017	0.011	<0.003	<0.003	<0.003	(0.005)	<0.003	0.016	0.090	(0.003)	<0.003	<0.003	<0.003	0.006	0.012
Nitrite (N)Dissolved	mg/L	<0.003	0.007	(0.003)		<0.003	<0.003	(0.005)	<0.003	0.007	0.008		<0.003	<0.003	<0.003	<0.003	(0.004)
pH		8.21	8.23	8.19	8.21	8.17	8.32	8.09	8.26	8.09	8.17	8.16	8.07	8.21	7.98	7.99	8.05
Sulphate (SO4)Dissolved	mg/L	35.9	1.1	0.8	1.4	1.6	3.0	2.5	2.8	0.2	0.2	(0.1)	0.2	0.3	0.2	<0.1	0.3
Total Dissolved Solids	mg/L	555	466	448	456	453	457	467	465	498	486	490	488	490	493	504	487
Metals																	
Aluminum (Al)Dissolved	mg/L	(0.001)	0.035	<0.001	0.007	<0.001	(0.001)	0.006	0.005	<0.001	<0.001	0.003	<0.001	<0.001	0.012	0.003	0.008
Antimony (Sb)Dissolved	mg/L	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002
Arsenic (As)Dissolved	mg/L	0.0525	0.0034	<0.005	(0.009)	0.0025	0.0034	0.0019	0.0029	(0.0002)	<0.005	<0.005	<0.0002	(0.0002)	(0.0002)	0.0011	(0.0002)
Barium (Ba)Dissolved	mg/L	0.0657	0.0920	0.0894	0.103	0.0953	0.102	0.0997	0.101	0.224	0.255	0.265	0.272	0.283	0.267	0.277	0.214
Beryllium (Be)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron (B)Dissolved	mg/L	0.67	0.41	0.60	0.60	0.75	0.57	0.74	0.63	0.23	0.41	0.43	0.52	0.42	0.57	0.41	0.22
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (Ca)Dissolved	mg/L	19.8	20.7	17.3	17.1	16.4	18.4	22.5	19.2	59.5	52.4	55.3	53.7	55.8	58.3	59.7	56.5
Chromium (Cr)Dissolved	mg/L	<0.001	0.003	<0.001	0.002	0.002	(0.001)	(0.001)	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	(0.001)	<0.001	0.002
Cobalt (Co)Dissolved	mg/L	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0003)
Copper (Cu)Dissolved	mg/L	0.0005	<0.0002	<0.0002	(0.0003)	<0.0002	(0.0003)	(0.0002)	<0.0002	<0.0002	0.0005	(0.0003)	(0.0002)	(0.0003)	0.0005	<0.0002	<0.0002
Iron (Fe)Dissolved	mg/L	0.18	1.84	1.23	0.89	0.86	0.98	0.90	0.83	1.99	1.74	1.77	1.76	2.00	1.58	1.84	1.34
Lead (Pb)Dissolved	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Lithium (Li)Dissolved	mg/L	0.033	0.040	0.038	0.037	0.031	<0.004	0.024	0.028	0.069	0.068	0.066	0.059	0.053	0.047	0.059	0.051
Magnesium (Mg)Dissolved	mg/L	7.1	7.4	6.6	6.1	6.0	6.7	7.0	6.5	24.1	22.9	21.8	22.0	22.6	21.2	23.6	19.0
Manganese (Mn)Dissolved	mg/L	0.063	0.110	0.080	0.074	0.066	0.154	0.118	0.076	0.033	0.025	0.034	0.032	0.034	0.030	0.036	0.039
Molybdenum (Mo)Dissolved	mg/L	0.0166	0.0218	0.0218	0.0169	0.0145	0.0171	0.0201	0.0178	0.0019	0.0026	0.0029	0.0028	0.0029	0.0018	0.0035	0.0006
Nickel (Ni)Dissolved	mg/L	0.0011	0.0015	0.0019	0.0013	<0.0005	0.0011	(0.0007)	(0.0009)	0.0024	0.0040	0.0018	<0.0005	(0.0008)	(0.0007)	0.0024	0.0030
Phosphorus (P)Dissolved	mg/L	2.0	1.7	1.5	1.7	1.8	1.6	1.6	1.7	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Potassium (K)Dissolved	mg/L	3.1	4.7	3.4	3.4	3.2	3.4	3.6	3.7	7.1	6.0	6.0	5.8	6.1	5.8	6.5	7.4
Selenium (Se)Dissolved	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007
Silicon (Si)Dissolved	mg/L	10.0	10.1	9.21	9.75	9.34	10.5	11.3	10.1	11.4	10.7	10.4	10.0	11.3	11.3	10.7	11.1
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)Dissolved	mg/L	199	172	165	165	164	163	166	166	117	115	111	109	114	111	111	122
Strontium (Sr)Dissolved	mg/L	0.21	0.198	0.209	0.255	0.223	0.24	0.25	0.24	0.517	0.619	0.665	0.674	0.72	0.68	0.74	0.444
Sulphur (S)Dissolved	mg/L	12.3	1.0	2.1	1.1	0.9	1.2	1.1	1.3	(0.3)	(0.3)	(0.2)	(0.3)	(0.3)	(0.3)	(0.2)	(0.3)
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)Dissolved	mg/L	0.012	0.009	0.008	0.004	<0.001	(0.001)	0.002	0.010	0.003	0.003	(0.001)	<0.001	<0.001	0.002	0.003	0.002
Uranium (U)Dissolved	mg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Vanadium (V)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (Zn)Dissolved	mg/L	0.0120	0.0062	0.0040	0.0084	(0.0007)	0.0080	0.0044	0.0020	0.0034	0.0044	0.0032	(0.0010)	0.0018	0.0120	0.0043	0.0042
Zirconium (Zr)Dissolved	mg/L	0.0014	0.0009	(0.0003)	(0.0002)	0.0004	0.0021	0.0017	<0.0002	0.0007	0.0004	<0.0002	0.0006	0.0020	0.0024	<0.0002	0.0009
Hydrocarbon Indicators																	
Organic Carbon (C)Dissolved	mg/L		9.4	10.8	10.2	11.1	9.7	10.6		7.3	7.8	7.7	8.5	7.0	7.4		7.7
Phenols		<0.002					<0.002	<0.002	<0.002					<0.002	<0.002	<0.002	

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW09	MW09	MW09	MW09	MW09	MW10	MW10	MW10	MW10	MW10	MW10	MW11	MW11	MW11	MW11	MW11
	Date Sampled	12/11/2001	26/7/2002	8/7/2003	27/10/2003	6/6/2004	17/10/2001	12/11/2001	26/7/2002	22/10/2002	27/10/2003	6/6/2004	17/10/2001	12/11/2001	26/7/2002	22/10/2002	8/7/2003
Parameters	**Units**																
Routine																	
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.9	<0.5	12.3
Alkalinity (Total as CaCO3)	mg/L	464	479	471	482	485	491	489	496	501	504	507	612	612	641	642	627
Bicarbonate (HCO3)	mg/L	566	584	575	588	592	599	596	605	612	614	618	746	747	760	784	735
Carbonate (CO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	10.7	<0.5	14.8
Chloride (Cl)Dissolved	mg/L	2.1	2.3	1.9	2.1	2.3	1.5	1.6	1.7	1.5	1.4	1.8	9.7	2.2	1.9	1.7	1.7
Conductivity	mg/L	825	828	825	795	814	852	863	863	860	822	848	1070	1100	1120	1100	1090
Hardness (CaCO3)	mg/L	200	210	220	230	220	190	170	180	180	210	190	73	86	91	61	67
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		1.00	0.96	1.05	1.03	0.99	1.05	0.99	0.97	0.95	1.03	0.97	1.03	1.02	0.96	0.92	1.02
Nitrate (N)Dissolved	mg/L	(0.003)		<0.003	<0.003	0.009	0.022	(0.003)		<0.003	<0.003	(0.004)	0.009	(0.003)		<0.003	<0.003
Nitrate plus Nitrite (N)	mg/L	0.006	<0.003	<0.003	<0.003	0.009	0.039	(0.003)	<0.003	<0.003	<0.003	(0.004)	0.019	0.006	<0.003	<0.003	<0.003
Nitrite (N)Dissolved	mg/L	(0.003)		<0.003	<0.003	<0.003	0.017	<0.003		<0.003	<0.003	<0.003	0.010	(0.003)		<0.003	<0.003
pH		8.10	8.13	8.17	7.94	8.01	8.10	8.13	8.13	8.06	7.92	8.01	8.30	8.23	8.31	8.31	8.38
Sulphate (SO4)Dissolved	mg/L	(0.1)	0.2	0.2	0.2	(0.1)	<0.1	<0.1	<0.1	(0.1)	<0.1	<0.1	2.4	6.1	8.5	1.5	0.6
Total Dissolved Solids	mg/L	477	484	492	499	494	514	502	504	504	522	513	670	658	675	658	668
Metals																	
Aluminum (Al)Dissolved	mg/L	0.003	0.032	0.037	0.067	<0.001	<0.001	0.003	0.006	<0.001	0.006	0.002	(0.001)	0.002	0.007	0.004	0.130
Antimony (Sb)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	0.0005	0.0008	<0.0002	<0.0002	0.0009
Arsenic (As)Dissolved	mg/L	<0.005	<0.005	0.0005	(0.0002)	0.0009	<0.0002	<0.005	<0.005	<0.0002	<0.0002	0.0007	0.0010	<0.005	<0.005	0.0006	0.0009
Barium (Ba)Dissolved	mg/L	0.234	0.226	0.262	0.255	0.253	0.209	0.210	0.208	0.238	0.247	0.246	0.0805	0.0887	0.108	0.0793	0.0938
Beryllium (Be)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron (B)Dissolved	mg/L	0.40	0.37	0.37	0.52	0.38	0.19	0.36	0.33	0.38	0.55	0.34	0.62	0.97	0.88	1.23	0.93
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (Ca)Dissolved	mg/L	49.7	53.9	56.5	59.1	57.4	47.6	39.8	45.7	44.3	51.1	48.7	18.4	20.9	22.8	15.5	17.0
Chromium (Cr)Dissolved	mg/L	<0.001	<0.001	<0.001	(0.001)	<0.001	0.002	<0.001	<0.001	<0.001	(0.001)	<0.001	0.003	<0.001	<0.001	(0.001)	<0.001
Cobalt (Co)Dissolved	mg/L	<0.0003	(0.0003)	(0.0004)	(0.0005)	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	0.0006	0.0007	(0.0003)	(0.0004)	0.0006
Copper (Cu)Dissolved	mg/L	(0.0002)	0.0004	0.0007	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	(0.0003)	(0.0003)	<0.0002	<0.0002	0.0006	(0.0003)	(0.0002)	0.0006
Iron (Fe)Dissolved	mg/L	1.05	1.34	1.55	1.55	1.18	1.91	1.56	1.80	1.72	1.88	1.87	0.23	0.13	0.68	0.97	1.03
Lead (Pb)Dissolved	mg/L	(0.0003)	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0004)	<0.0003	<0.0003	0.0012
Lithium (Li)Dissolved	mg/L	0.050	0.051	0.036	0.044	0.043	0.059	0.059	0.058	0.052	0.053	0.048	0.053	0.052	0.053	0.045	0.035
Magnesium (Mg)Dissolved	mg/L	17.9	17.5	18.7	19.1	18.7	18.2	16.4	16.8	16.9	18.8	17.7	6.6	8.2	8.2	5.4	6.0
Manganese (Mn)Dissolved	mg/L	0.029	0.030	0.044	0.050	0.017	0.052	0.042	0.058	0.062	0.074	0.062	0.110	0.127	0.122	0.107	0.095
Molybdenum (Mo)Dissolved	mg/L	0.0009	0.0009	0.0008	0.0007	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	(0.0002)	<0.0002	0.0019	0.0025	0.0018	0.0025	0.0019
Nickel (Ni)Dissolved	mg/L	0.0042	0.0027	0.0011	0.0010	0.0027	0.0021	0.0032	0.0012	<0.0005	(0.0007)	0.0017	(0.0007)	0.0036	0.0016	0.0031	0.0022
Phosphorus (P)Dissolved	mg/L	0.2	0.2	0.3	0.2	0.2	0.9	0.8	0.9	0.9	0.9	0.8	1.3	1.1	1.4	1.7	1.9
Potassium (K)Dissolved	mg/L	6.3	6.1	6.7	6.5	6.7	5.7	4.4	4.6	4.4	5.2	5.0	4.1	3.0	3.1	2.6	2.9
Selenium (Se)Dissolved	mg/L	<0.007	<0.007		<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	
Silicon (Si)Dissolved	mg/L	10.5	10.2	11.1	11.5	10.4	8.69	8.20	8.06	7.78	9.20	8.25	9.34	8.23	8.64	8.20	9.68
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)Dissolved	mg/L	121	115	123	121	117	145	145	136	134	141	134	261	249	245	245	262
Strontium (Sr)Dissolved	mg/L	0.521	0.493	0.59	0.61	0.58	0.398	0.427	0.439	0.490	0.56	0.52	0.175	0.218	0.238	0.216	0.22
Sulphur (S)Dissolved	mg/L	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.2)	(0.3)	0.4	(0.2)	1.1	2.4	3.3	0.9	0.6
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)Dissolved	mg/L	0.002	0.002	(0.001)	0.006	0.002	<0.001	0.005	0.002	<0.001	0.002	0.006	0.007	0.006	0.003	<0.001	0.005
Uranium (U)Dissolved	mg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	(0.0006)	<0.0004	<0.0004	<0.0004
Vanadium (V)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	(0.001)	<0.001	<0.001	<0.001
Zinc (Zn)Dissolved	mg/L	0.0111	0.0035	0.0050	0.0066	0.0384	<0.0006	0.0119	0.0049	0.0017	0.0035	0.0014	0.0033	0.0120	0.0052	0.0017	0.0255
Zirconium (Zr)Dissolved	mg/L	0.0016	0.0004	0.0032	0.0032	<0.0002	<0.0002	0.0007	<0.0002	0.0032	0.0010	<0.0002	0.0016	0.0026	(0.0002)	0.0046	0.0186
Hydrocarbon Indicators																	
Organic Carbon (C)Dissolved	mg/L	8.2	7.9	7.5	7.9		8.1	8.9	8.6	9.0	8.5		13.2	10.9	10.2	17.5	10.0
Phenols				<0.002	<0.002	<0.002					<0.002	<0.002					<0.002

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW11	MW11	MW12	MW12	MW12	MW12	MW12	MW12	MW13	MW13	MW13	MW13	MW13	MW13	MW14	MW14
	Date Sampled	27/10/2003	6/6/2004	30/10/2001	13/11/2001	25/7/2002	22/10/2002	8/7/2003	28/10/2003	30/10/2001	13/11/2001	25/7/2002	22/10/2002	8/7/2003	28/10/2003	25/7/2002	22/10/2002
Parameters	**Units**																
Routine																	
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	6.1	<0.5	12.2	8.1	15.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Alkalinity (Total as CaCO3)	mg/L	643	646	558	494	595	587	567	581	455	408	460	463	457	436	512	519
Bicarbonate (HCO3)	mg/L	785	788	667	603	696	696	654	708	556	498	562	565	558	532	625	633
Carbonate (CO3)	mg/L	<0.5	<0.5	7.3	<0.5	14.6	9.7	18.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl)Dissolved	mg/L	1.7	1.9	42.2	59.2	53.0	48.0	40.5	46.3	48.7	15.1	49.4	48.7	45.2	25.5	4.6	2.8
Conductivity	mg/L	1050	1080	1130	1060	1200	1170	1130	1090	964	777	942	947	954	794	879	882
Hardness (CaCO3)	mg/L	71	64	45	76	35	35	43	50	150	130	150	150	150	160	300	290
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		1.02	0.95	1.03	1.02	0.96	0.94	1.00	1.03	1.01	1.02	0.97	0.96	1.00	1.02	0.99	0.96
Nitrate (N)Dissolved	mg/L	0.012	<0.003	<0.003	(0.003)		<0.003	<0.003	<0.003	<0.003	<0.003		<0.003	<0.003	<0.003		<0.003
Nitrate plus Nitrite (N)	mg/L	0.019	<0.003	(0.004)	0.007	<0.003	<0.003	<0.003	<0.003	(0.005)	(0.004)	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Nitrite (N)Dissolved	mg/L	0.007	<0.003	(0.004)	(0.004)		<0.003	<0.003	<0.003	(0.005)	(0.004)		<0.003	<0.003	<0.003		<0.003
pH		8.20	8.20	8.32	8.23	8.42	8.36	8.48	8.20	8.18	8.15	8.16	8.23	8.22	8.00	8.05	8.04
Sulphate (SO4)Dissolved	mg/L	0.9	0.9	0.2	0.6	<0.1	<0.1	(0.1)	<0.1	0.5	0.5	(0.1)	0.2	0.4	0.8	0.4	0.5
Total Dissolved Solids	mg/L	684	669	667	619	705	679	665	697	552	449	547	547	547	493	517	513
Metals																	
Aluminum (Al)Dissolved	mg/L	0.664	0.003	0.015	0.010	0.007	(0.001)	0.009	0.006	0.012	0.005	0.009	<0.001	0.004	0.003	0.399	0.002
Antimony (Sb)Dissolved	mg/L	0.0009	<0.0002	0.0010	0.0012	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	0.0150	<0.0002
Arsenic (As)Dissolved	mg/L	0.0017	0.0014	<0.0002	<0.005	<0.005	0.0004	<0.0002	<0.0002	<0.0002	<0.005	<0.005	<0.0002	<0.0002	<0.0002	<0.005	<0.0002
Barium (Ba)Dissolved	mg/L	0.121	0.0800	0.0704	0.0741	0.0664	0.0548	0.0885	0.0888	0.160	0.114	0.142	0.180	0.180	0.147	0.281	0.186
Beryllium (Be)Dissolved	mg/L	(0.0003)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron (B)Dissolved	mg/L	1.20	1.02	1.27	0.66	1.34	1.48	1.00	1.05	0.64	0.48	0.57	0.80	0.61	0.60	0.30	0.34
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	(0.0002)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (Ca)Dissolved	mg/L	18.2	16.5	12.4	19.2	9.5	9.5	11.9	13.9	38.8	31.4	37.5	36.7	37.3	39.6	76.7	75.0
Chromium (Cr)Dissolved	mg/L	0.002	<0.001	<0.001	<0.001	(0.001)	(0.001)	<0.001	0.002	<0.001	<0.001	(0.001)	(0.001)	<0.001	(0.001)	0.002	<0.001
Cobalt (Co)Dissolved	mg/L	0.0023	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	(0.0003)	<0.0003	<0.0003	(0.0003)	(0.0003)	<0.0003	0.0006	0.0022	0.0008
Copper (Cu)Dissolved	mg/L	0.0043	<0.0002	0.0008	0.0021	(0.0002)	(0.0003)	0.0006	<0.0002	0.0005	0.0015	0.0004	(0.0003)	(0.0003)	(0.0003)	0.0046	0.0009
Iron (Fe)Dissolved	mg/L	2.12	0.61	0.76	0.04	0.63	0.45	0.74	0.73	1.37	0.33	0.79	1.09	1.32	0.57	1.97	0.19
Lead (Pb)Dissolved	mg/L	0.0030	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.0024	<0.0003
Lithium (Li)Dissolved	mg/L	0.046	0.041	0.039	0.044	0.039	0.033	0.021	0.030	0.051	0.053	0.053	0.046	0.035	0.045	0.037	0.030
Magnesium (Mg)Dissolved	mg/L	6.3	5.6	3.5	6.7	2.7	2.7	3.3	3.7	13.9	12.5	13.4	13.3	13.6	14.0	26.5	26.1
Manganese (Mn)Dissolved	mg/L	0.141	0.048	0.053	0.072	0.044	0.043	0.037	0.039	0.051	0.033	0.048	0.040	0.048	0.067	0.166	0.106
Molybdenum (Mo)Dissolved	mg/L	0.0015	0.0016	0.0298	0.0173	0.0340	0.0349	0.0324	0.0326	0.0031	0.0050	0.0028	0.0032	0.0030	0.0054	0.0016	0.0017
Nickel (Ni)Dissolved	mg/L	0.0062	0.0016	0.0013	0.0029	0.0011	(0.0005)	0.0014	<0.0005	0.0015	0.0032	0.0020	<0.0005	(0.0009)	0.0011	0.0074	0.0017
Phosphorus (P)Dissolved	mg/L	1.2	1.9	2.9	0.9	3.3	3.1	3.4	3.0	0.8	0.5	0.7	0.8	0.9	0.6	0.3	<0.1
Potassium (K)Dissolved	mg/L	3.3	2.7	3.4	4.3	2.9	2.7	3.1	3.5	5.2	4.8	5.1	4.8	5.1	5.2	5.6	4.7
Selenium (Se)Dissolved	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	<0.007
Silicon (Si)Dissolved	mg/L	10.8	8.97	10.6	9.17	9.86	9.47	11.0	11.5	10.9	10.7	10.6	10.1	11.3	11.7	9.13	8.34
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)Dissolved	mg/L	266	253	270	232	279	264	265	281	170	140	164	164	169	146	93.9	92.0
Strontium (Sr)Dissolved	mg/L	0.23	0.22	0.149	0.228	0.136	0.148	0.17	0.18	0.390	0.366	0.377	0.438	0.45	0.46	0.749	0.727
Sulphur (S)Dissolved	mg/L	0.9	0.5	0.4	0.7	0.5	0.4	0.4	0.4	(0.3)	0.5	(0.3)	(0.3)	0.5	1.2	0.6	0.4
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	(0.0002)	<0.0002
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)Dissolved	mg/L	0.013	0.010	0.007	0.004	0.007	0.002	0.002	0.003	0.003	0.003	0.002	<0.001	(0.001)	0.002	0.007	<0.001
Uranium (U)Dissolved	mg/L	(0.0006)	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Vanadium (V)Dissolved	mg/L	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Zinc (Zn)Dissolved	mg/L	0.0140	0.0019	0.0133	0.0199	0.0026	0.0762	0.0269	0.0051	0.0144	0.0153	0.0044	0.0016	0.0032	0.0056	0.0171	0.317
Zirconium (Zr)Dissolved	mg/L	0.0033	(0.0003)	0.0018	0.0116	0.0004	0.0021	0.0028	0.0012	0.0007	0.0015	<0.0002	0.0004	(0.0003)	0.0006	0.0028	0.0006
Hydrocarbon Indicators																	
Organic Carbon (C)Dissolved	mg/L	16.5		12.8	11.5	14.3	13.7	12.3	13.3	8.1	9.1	8.2	8.7	7.7	8.2	9.4	9.8
Phenols		(0.002)	<0.002					<0.002	(0.002)					<0.002	<0.002		

Table B-6
Regional Monitoring Well Analytical Results
EnCana Christina Lake Thermal Project

	Well ID	MW14	MW14	MW15	MW15	MW15	MW15	MW15	MW15	OBW09-17	OBW09-17
	Date Sampled	8/7/2003	28/10/2003	30/10/2001	13/11/2001	25/7/2002	22/10/2002	8/7/2003	28/10/2003	18/12/2002	8/7/2003
Parameters	Units										
Routine											
Alkalinity (PP as CaCO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	(0.8)	<0.5	4.0	13.5
Alkalinity (Total as CaCO3)	mg/L	504	518	451	464	472	505	495	507	423	425
Bicarbonate (HCO3)	mg/L	615	632	551	566	576	616	602	619	507	486
Carbonate (CO3)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	4.8	16.2
Chloride (Cl)Dissolved	mg/L	2.5	3.1	2.7	3.5	4.7	3.0	2.7	3.1	6.3	6.6
Conductivity	mg/L	872	848	829	845	832	867	857	837	834	848
Hardness (CaCO3)	mg/L	290	310	280	270	280	290	290	290	43	40
Hydroxide (OH)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ion Balance		0.99	1.04	1.03	1.02	0.99	0.97	0.98	0.99	0.93	1.07
Nitrate (N)Dissolved	mg/L	<0.003	<0.003	(0.003)	<0.003		<0.003	<0.003	<0.003	<0.003	0.037
Nitrate plus Nitrite (N)	mg/L	<0.003	<0.003	0.009	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.037
Nitrite (N)Dissolved	mg/L	<0.003	<0.003	0.006	<0.003		<0.003	<0.003	<0.003	<0.003	<0.003
pH		8.16	7.90	8.06	8.07	8.19	8.03	8.27	7.97	8.3	8.56
Sulphate (SO4)Dissolved	mg/L	0.4	<0.1	15.6	12.6	7.7	2.6	1.3	1.1	40.7	28.7
Total Dissolved Solids	mg/L	507	529	484	491	488	506	495	511	500	516
Metals											
Aluminum (Al)Dissolved	mg/L	(0.001)	0.005	0.015	0.005	<0.001	<0.001	0.011	0.011	0.003	0.002
Antimony (Sb)Dissolved	mg/L	<0.0002	0.0007	<0.0002	<0.0002	0.0038	<0.0002	<0.0002	0.0009	<0.0002	0.0008
Arsenic (As)Dissolved	mg/L	<0.0002	0.0004	0.0019	<0.005	<0.005	0.0010	0.0008	0.0006	0.053	0.0262
Barium (Ba)Dissolved	mg/L	0.299	0.222	0.148	0.134	0.0553	0.165	0.226	0.206	0.141	0.144
Beryllium (Be)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	(0.0002)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron (B)Dissolved	mg/L	0.28	0.31	0.27	0.19	0.27	0.30	0.22	0.26	0.91	0.74
Cadmium (Cd)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (Ca)Dissolved	mg/L	74.1	78.3	73.5	69.8	75.4	77.2	74.6	76.4	10.1	9.2
Chromium (Cr)Dissolved	mg/L	<0.001	0.002	<0.001	<0.001	0.069	<0.001	<0.001	(0.001)	<0.001	<0.001
Cobalt (Co)Dissolved	mg/L	0.0009	0.0014	0.0017	0.0014	(0.0004)	0.0019	0.0008	0.0008	<0.0003	<0.0003
Copper (Cu)Dissolved	mg/L	0.0007	0.0008	0.0008	0.0016	(0.0002)	0.0012	0.0008	0.0009	0.0008	(0.0003)
Iron (Fe)Dissolved	mg/L	2.62	0.31	0.41	0.32	0.03	0.68	0.04	0.50	0.66	0.87
Lead (Pb)Dissolved	mg/L	<0.0003	<0.0003	0.0008	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Lithium (Li)Dissolved	mg/L	0.018	0.029	0.025	0.026	0.026	0.022	0.010	0.018	0.015	0.019
Magnesium (Mg)Dissolved	mg/L	26.2	28.5	23.3	24.1	22.8	24.7	24.0	25.1	4.2	4.0
Manganese (Mn)Dissolved	mg/L	0.103	0.088	0.650	0.550	0.514	0.478	0.352	0.354	0.028	0.027
Molybdenum (Mo)Dissolved	mg/L	0.0021	0.0021	0.0081	0.0052	0.0076	0.0060	0.0044	0.0043	0.0185	0.0213
Nickel (Ni)Dissolved	mg/L	0.0029	0.0026	0.0063	0.0066	0.0021	0.0055	0.0023	0.0021	<0.0005	(0.0008)
Phosphorus (P)Dissolved	mg/L	0.5	0.2	<0.1	(0.1)	(0.1)	0.2	<0.1	0.2	2.8	3.3
Potassium (K)Dissolved	mg/L	4.9	5.6	3.7	3.6	4.0	3.5	4.6	4.8	2.4	2.5
Selenium (Se)Dissolved	mg/L		<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	
Silicon (Si)Dissolved	mg/L	9.43	9.67	6.91	7.12	7.60	7.59	7.12	6.73	10.2	11.4
Silver (Ag)Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)Dissolved	mg/L	93.2	102	93.6	97.8	89.9	90.3	90.7	95.6	182	208
Strontium (Sr)Dissolved	mg/L	0.77	0.85	0.458	0.435	0.250	0.569	0.57	0.62	0.186	0.18
Sulphur (S)Dissolved	mg/L	(0.3)	0.4	6.5	4.6	2.3	1.1	0.7	0.6	13.3	10.3
Thallium (Tl)Dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin (Sn)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)Dissolved	mg/L	<0.001	(0.001)	(0.001)	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.002
Uranium (U)Dissolved	mg/L	<0.0004	<0.0004	0.0028	0.0018	0.0010	(0.0005)	0.0008	0.0008	<0.0004	<0.0004
Vanadium (V)Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	0.020	<0.001	(0.001)	(0.001)	<0.001	<0.001
Zinc (Zn)Dissolved	mg/L	0.0296	0.0223	0.0134	0.0200	<0.0006	0.0310	0.0073	0.0051	0.0232	0.0131
Zirconium (Zr)Dissolved	mg/L	0.0007	0.0007	0.0010	0.0020	0.0005	0.0010	0.0011	0.0046	0.0052	0.0134
Hydrocarbon Indicators											
Organic Carbon (C)Dissolved	mg/L	8.5	9.9	12.7	12.1	11.4	13.4	9.3	11.4	8.4	8.7
Phenols		<0.002	(0.002)					<0.002	0.004		<0.002

Table C-1
Arsenic Data
EnCana Christina Lake
Thermal Project

Well ID	Date Sampled	Parameter	Sample Type	Units	Concentration	MDL	RDL
MW01	19/10/2001	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW01	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW01	8/7/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW01	28/10/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW02	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW02	8/7/2003	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW02	28/10/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW03	19/10/2001	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW03	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW03	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW03	28/10/2003	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW04	19/10/2001	Arsenic (As)	Dissolved	mg/L	0.0010	0.0002	0.0004
MW04	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW04	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW04	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0012	0.0002	0.0004
MW04	28/10/2003	Arsenic (As)	Dissolved	mg/L	0.0008	0.0002	0.0004
MW05	20/10/2001	Arsenic (As)	Dissolved	mg/L	0.0006	0.0002	0.0004
MW05	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW05	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW05	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0004	0.0002	0.0004
MW06	18/10/2001	Arsenic (As)	Dissolved	mg/L	**0.0340**	0.0002	0.0004
MW06	12/11/2001	Arsenic (As)	Dissolved	mg/L	**0.044**	0.005	0.01
MW06	26/7/2002	Arsenic (As)	Dissolved	mg/L	**0.061**	0.005	0.01
MW06	22/10/2002	Arsenic (As)	Dissolved	mg/L	**0.047**	0.001	0.002
MW06	8/7/2003	Arsenic (As)	Dissolved	mg/L	**0.0265**	0.0002	0.0004
MW06	27/10/2003	Arsenic (As)	Dissolved	mg/L	**0.0440**	0.0002	0.0004
MW07	18/10/2001	Arsenic (As)	Dissolved	mg/L	0.0034	0.0002	0.0004
MW07	12/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW07	26/7/2002	Arsenic (As)	Dissolved	mg/L	(0.009)	0.005	0.01
MW07	22/10/2002	Arsenic (As)	Dissolved	mg/L	0.0025	0.0002	0.0004
MW07	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0034	0.0002	0.0004
MW07	27/10/2003	Arsenic (As)	Dissolved	mg/L	0.0019	0.0002	0.0004
MW08	17/10/2001	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW08	12/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW08	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW08	22/10/2002	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW08	8/7/2003	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW08	27/10/2003	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW09	17/10/2001	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW09	12/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW09	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW09	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0005	0.0002	0.0004
MW09	27/10/2003	Arsenic (As)	Dissolved	mg/L	(0.0002)	0.0002	0.0004
MW10	17/10/2001	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW10	12/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW10	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW10	22/10/2002	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW10	27/10/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW11	17/10/2001	Arsenic (As)	Dissolved	mg/L	0.0010	0.0002	0.0004
MW11	12/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW11	26/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW11	22/10/2002	Arsenic (As)	Dissolved	mg/L	0.0006	0.0002	0.0004
MW11	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0009	0.0002	0.0004

Table C-1
Arsenic Data
EnCana Christina Lake
Thermal Project

Well ID	Date Sampled	Parameter	Sample Type	Units	Concentration	MDL	RDL
MW11	27/10/2003	Arsenic (As)	Dissolved	mg/L	0.0017	0.0002	0.0004
MW12	30/10/2001	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW12	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW12	25/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW12	22/10/2002	Arsenic (As)	Dissolved	mg/L	0.0004	0.0002	0.0004
MW12	8/7/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW12	28/10/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW13	30/10/2001	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW13	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW13	25/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW13	22/10/2002	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW13	8/7/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW13	28/10/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW14	25/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW14	22/10/2002	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW14	8/7/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
MW14	28/10/2003	Arsenic (As)	Dissolved	mg/L	0.0004	0.0002	0.0004
MW15	30/10/2001	Arsenic (As)	Dissolved	mg/L	0.0019	0.0002	0.0004
MW15	13/11/2001	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW15	25/7/2002	Arsenic (As)	Dissolved	mg/L	<0.005	0.005	0.01
MW15	22/10/2002	Arsenic (As)	Dissolved	mg/L	0.0010	0.0002	0.0004
MW15	8/7/2003	Arsenic (As)	Dissolved	mg/L	0.0008	0.0002	0.0004
MW15	28/10/2003	Arsenic (As)	Dissolved	mg/L	0.0006	0.0002	0.0004
OBW09-17	18/12/2002	Arsenic (As)	Dissolved	mg/L	**0.053**	0.002	0.004
OBW09-17	8/7/2003	Arsenic (As)	Dissolved	mg/L	**0.0262**	0.0002	0.0004
WSW-09-17A	18/12/2002	Arsenic (As)	Dissolved	mg/L	**0.053**	0.002	0.004
WSW-09-17B	18/12/2002	Arsenic (As)	Dissolved	mg/L	**0.054**	0.002	0.004
WSW-CAMP-01	23/3/2001	Arsenic (As)	Total	mg/L	0.0007	0.0002	0.0004
WSW-Camp-01 Untreated	8/7/2003	Arsenic (As)	Total	mg/L	<0.0002	0.0002	0.0004
WSW-Camp-01 Untreated	8/7/2003	Arsenic (As)	Dissolved	mg/L	<0.0002	0.0002	0.0004
WSW-CAMP-02	23/3/2001	Arsenic (As)	Total	mg/L	0.0010	0.0002	0.0004

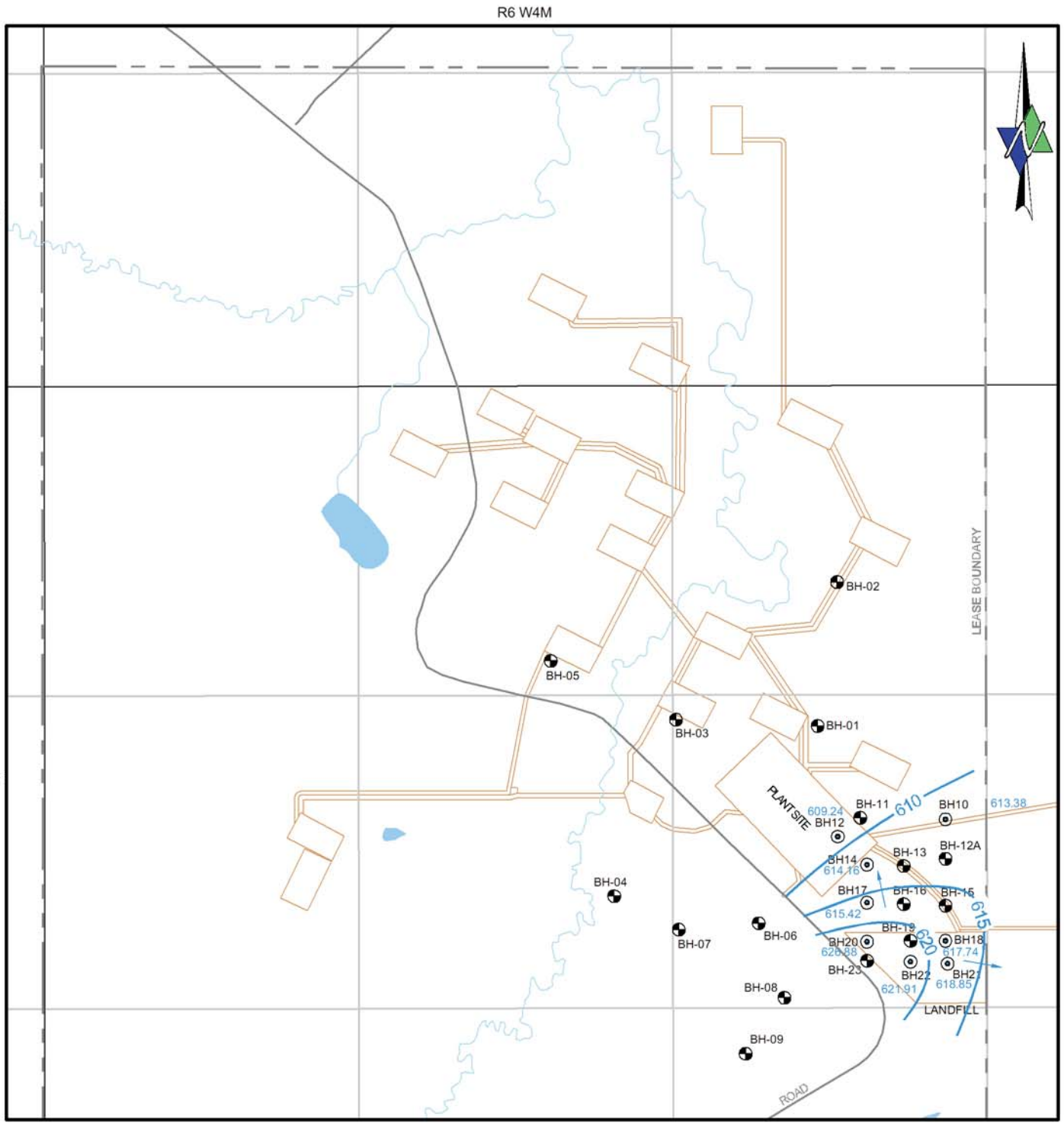
Appendix C

Supporting Documents

Devon Canada Jackfish Project

Appendix C Supporting Documents taken from:

Devon Canada Corporation
Jackfish Project
Supplementary Information
May 2004



LEGEND

- MONITORING WELL
- BOREHOLE
- PROPOSED PROJECT FOOTPRINT
- 609.24 GROUNDWATER ELEVATION (m)
- 610 GROUNDWATER CONTOUR (m)
- DIRECTION OF GROUNDWATER FLOW

SCALE

1:30 000

0 200 400 600 m

devon

Jackfish SAGD Project

GROUNDWATER FLOW MAP MARCH 6, 2003

Prepared by: MATRIX	JOB No: 3499-514
	CAD FILE: 3499-Siteplan-04.dwg
Drawn by: MATRIX	PDF FILE:
	DATE: April 2004

Figure SIR 64.5

Table SIR 64.1: Jackfish Project Monitoring Well Summary

Monitoring Well	Elevation* (masl)				Depth (m)								
	Ground Surface	Top of Casing	06-Mar-04	11-Mar-04	Grnd. to Total Drilled	Grnd. to Top of Screen	Grnd. to Base of Screen	06-Mar-04			11-Mar-04		
			Water Level	Water Level				Top of Casing to Water	Grnd. to Water	Top of Casing to Product	Top of Casing to Water	Grnd. to Water	Top of Casing to Product
BH10 S-7A	615.40	616.50	613.05	–	14.5	13.0	14.5	3.45	2.35	ND	–	–	–
BH10 S-7B	615.30	615.90	613.38	–	9.9	8.4	9.9	2.52	1.92	ND	–	–	–
BH10 S-7C	615.50	616.40	613.72	–	5.3	3.8	5.3	2.68	1.78	ND	–	–	–
BH12	617.70	618.60	609.24	–	9.7	8.3	9.7	9.36	8.46	ND	–	–	–
BH14	617.10	618.00	614.16	–	9.4	7.9	9.4	3.84	2.94	ND	–	–	–
BH17	623.50	624.40	615.42	–	10.2	8.7	10.2	8.98	8.08	ND	–	–	–
BH18 S-4	619.56	620.46	617.74	–	6.7	5.2	6.7	2.72	1.82	ND	–	–	–
BH20 S-6A	638.29	638.89	626.88	–	13.1	11.6	13.1	12.01	11.41	ND	–	–	–
BH21 S-3A	622.05	623.05	618.64	–	14.5	12.9	14.5	4.41	3.41	ND	–	–	–
BH21 S-3B	622.18	622.78	618.85	–	9.9	8.4	9.9	3.93	3.33	ND	–	–	–
BH21 S-3C	622.06	622.86	619.23	–	5.3	3.6	5.3	3.63	2.83	ND	–	–	–
BH21A S-3D	622.18	623.08	619.01	–	33.8	32.3	33.8	4.07	3.17	ND	–	–	–
BH22	627.25	628.15	621.91	–	6.7	5.2	6.7	6.24	5.34	ND	–	–	–
12-28 Obs	604.00	–	–	623.70	110.6	101.5	104.5	–	-19.70	ND	–	–	ND
12-28 PW	604.00	–	–	624.40	109.1	100.9	105.5	–	-20.40	ND	–	–	ND

Notes:

* Elevations are geodetic
masl Metres above sea level
– Not available
ND Not detected

Table SIR 64.2: Jackfish Project Groundwater Quality Results – Field Parameters and Naphthenic Acid

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC* µS/cm	Field DO mg/L	Naphthenic Acid mg/L
BH10 S-7B	07-Mar-04	3499040307003	1.8	6.50	720	2.7	–
BH14	07-Mar-04	3499040307004	2.7	***6.30***	680	2.4	–
BH20 S-6A	07-Mar-04	3499040307005	4.2	***6.30***	660	6.8	–
BH21 S-3B	07-Mar-04	3499040307002	3.3	***6.20***	730	5.5	–
BH21 S-3B dup	07-Mar-04	3499040307007	3.4	***6.17***	730	6.2	–
BH21A S-3D	07-Mar-04	3499040307001	4.1	***6.30***	950	1.7	–
12-28 Obs	17-Mar-04	3499040317002	7.8	***5.80***	1140	0.6	<1
12-28 PW	17-Mar-04	3499040317001	5.2	***5.87***	1050	0.7	<1
Sunday Creek	17-Mar-04	3499040317003	4.5	***5.57***	389	–	–
Detection Limit			**0.1**	**0.1**	**10**	**0.1**	**1**
Canadian Drinking Water Guidelines**			**15$^{(AO)}$**	**6.5-8.5$^{(AO)}$**	**NS**	**NS**	**NS**

Notes:

NS Not specified
AO Aesthetic objective
* Field EC corrected to 25° C
** Summary of Guidelines for Canadian Drinking Water Quality (Health Canada, 2002)
**** Alberta Environment Surface Water Quality Guidelines for use in Alberta (AENV, 1999)
Bold/Italics Indicates values do not meet drinking water guidelines

Table SIR 64.3: Jackfish Project Groundwater Quality Results – Routine and Indicator Parameters

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	SO_4 mg/L	$N0_2$+$N0_3$-N mg/L	TDS mg/L	Hardness mg/L	Phenols mg/L
BH10 S-7B	07-Mar-04	3499040307003	8.1	638	94.0	29.3	12	2.9	<1	<5	432	7.8	<0.1	358	355	<0.001
BH14	07-Mar-04	3499040307004	8.1	602	89.3	29.0	10	1.6	1	<5	390	19.3	<0.1	342	342	<0.001
BH20 S-6A	07-Mar-04	3499040307005	8.1	596	91.5	30.1	4	1.8	1	<5	395	10.3	0.5	335	352	<0.001
BH21 S-3B	07-Mar-04	3499040307002	8.1	649	93.1	33.3	9	2.3	1	<5	430	16.8	<0.1	367	370	<0.001
BH21 S-3B dup	07-Mar-04	3499040307007	8.1	646	86.7	33.1	9	2.3	1	<5	426	16.3	<0.1	358	353	<0.001
BH21A S-3D	07-Mar-04	3499040307001	8.1	827	120	32.1	33	4.5	1	<5	571	13.4	<0.1	485	432	<0.001
12-28 Obs	01-Mar-04	3499040301001	8.34	1220	101	27	160	19	142	20	526	46	–	460	–	–
12-28 Obs	01-Mar-04	3499040301002	8.34	1230	102	28	160	17	144	21	523	46	–	430	–	–
12-28 Obs	17-Mar-04	3499040317002	7.9	1040	74.6	26.1	151	11.5	33	<5	631	40.5	0.1	***647***	294	<0.001
12-28 PW	17-Mar-04	3499040317001	7.9	982	71.4	24.8	144	7.7	2	<5	648	31.4	<0.1	***600***	280	<0.001
Canadian Drinking Water Guidelines**			**6.5-8.5$^{(AO)}$**	**NS**	**NS**	**NS**	**200$^{(AO)}$**	**NS**	**250$^{(AO)}$**	**NS**	**NS**	**500$^{(AO)}$**	**10$^{(MAC)}$*** **	**500$^{(AO)}$**	**NS**	**NS**
Sunday Creek	07-Mar-04	3499040307006	8.1	376	51.3	15.9	13	1.8	1	<5	241	4.7	0.3	208	194	–
Sunday Creek	17-Mar-04	3499040317003	7.7	346	51.9	15.7	13	2.9	2	<5	240	5.1	0.4	211	194	–
Detection Limit			**0.1**	**3.0**	**0.5**	**0.1**	**1.0**	**0.1**	**1**	**5**	**5.0**	**0.5**	**0.1**	**1**	**1**	**0.001**
AENV Freshwater Aquatic Life** **			**6.5-9**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Notes:

NS	Not specified
AO	Aesthetic objective
MAC	Maximum acceptable concentration based on health effects
**	Summary of Guidelines for Canadian Drinking Water Quality (Health Canada, 2002)
***	Value denotes NO_3-N guideline concentration
****	Alberta Environment Surface Water Quality Guidelines for use in Alberta (AENV, 1999)
Bold/Italics	Indicates values do not meet drinking water guidelines

Table SIR 64.4: Jackfish Project Groundwater Quality Results – Total Metals Analyses

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
12-28 Obs	17-Mar-04	3499040317002	0.38	0.0015	0.0060	0.393	<0.001	<0.0001	0.310	<0.0002	<0.0008	0.0015	0.003	***20.4***	0.0037
12-28 PW	17-Mar-04	3499040317001	24.8	0.0013	0.0186	0.549	0.001	0.0004	0.330	0.0005	0.0374	0.0192	0.036	***50.0***	***0.0231***
Detection Limit			**0.01**	**0.0004**	**0.0004**	**0.0001**	**0.001**	**0.0001**	**0.002**	**0.0002**	**0.0008**	**0.0001**	**0.0006**	**0.005**	**0.0001**
Canadian Drinking Water Guidelines**			**NS**	**0.006$^{(IMAC)}$**	**0.025$^{(IMAC)}$**	**1.0$^{(MAC)}$**	**NS**	**NS**	**5$^{(IMAC)}$**	**0.005$^{(MAC)}$**	**0.05$^{(MAC)}$**	**NS**	**1.0$^{(AO)}$**	**0.3$^{(AO)}$**	**0.01$^{(MAC)}$**

Monitoring Well	Sample Date	MSI Sample Number	Mn mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
12-28 Obs	17-Mar-04	3499040317002	***0.24***	0.0094	0.0081	<0.0004	<0.0004	0.770	<0.0001	<0.0004	0.013	<0.0001	0.0014	0.052
12-28 PW	17-Mar-04	3499040317001	***1.04***	0.0061	0.0436	<0.0004	<0.0004	0.823	0.0006	<0.0004	0.464	0.0037	0.0714	0.128
Detection Limit			**0.0002**	**0.001**	**0.001**	**0.0004**	**0.0004**	**0.0001**	**0.0001**	**0.0004**	**0.0004**	**0.0001**	**0.0001**	**0.0006**
Canadian Drinking Water Guidelines**			**0.05$^{(AO)}$**	**NS**	**NS**	**0.01$^{(MAC)}$**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.02$^{(IMAC)}$**	**NS**	**5.0$^{(AO)}$**

Notes:

ND	Not detected
NS	Not specified
AO	Aesthetic objective
MAC	Maximum acceptable concentration based on health effects
IMAC	Interim maximum acceptable concentration based on health effects
**	Summary of Guidelines for Canadian Drinking Water Quality (Health Canada, 2002)
Bold/Italics	Indicates values do not meet drinking water guidelines

Table SIR 64.5: Jackfish Project Groundwater Quality Results – Dissolved Metals Analyses

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
BH10 S-7B	07-Mar-04	3499040307003	<0.01	0.0007	0.0052	0.189	<0.0005	<0.00005	0.054	<0.0001	<0.0004	0.0021	0.0012	***0.89***	0.0006
BH14	07-Mar-04	3499040307004	<0.01	0.0006	0.0006	0.162	<0.0005	<0.00005	0.024	<0.0001	<0.0004	0.0011	0.0025	0.023	0.0006
BH20 S-6A	07-Mar-04	3499040307005	<0.01	0.0008	<0.0004	0.0971	<0.0005	<0.00005	0.018	<0.0001	0.0032	0.0001	0.0020	0.081	0.0001
BH21 S-3B	07-Mar-04	3499040307002	0.02	0.0009	0.0023	0.152	<0.0005	<0.00005	0.042	<0.0001	0.0028	0.0008	0.0031	0.020	0.0008
BH21 S-3B dup	07-Mar-04	3499040307007	<0.01	0.0008	0.0017	0.141	<0.0005	<0.00005	0.044	<0.0001	0.0005	0.0006	0.0018	<0.005	0.0006
BH21A S-3D	07-Mar-04	3499040307001	<0.01	0.0007	0.0037	0.163	<0.0005	<0.00005	0.210	<0.0001	<0.0004	0.0003	0.0011	***3.25***	0.0006
12-28 PW	17-Mar-04	3499040317001	<0.01	0.0008	0.0025	0.210	<0.0005	<0.00005	0.311	<0.0001	<0.0004	0.0013	<0.0006	***6.00***	0.0002
12-28 Obs	17-Mar-04	3499040317002	0.01	0.0010	0.0009	0.175	<0.0005	<0.00005	0.321	<0.0001	<0.0004	0.0004	0.0011	***13.7***	0.0002
Detection Limit			**0.01**	**0.0004**	**0.0004**	**0.0001**	**0.0005**	**0.0005**	**0.002**	**0.0001**	**0.0004**	**0.0001**	**0.0006**	**0.005**	**0.0001**
Canadian Drinking Water Guidelines**			**NS**	**0.006$^{(IMAC)}$**	**0.025$^{(IMAC)}$**	**1.0$^{(MAC)}$**	**NS**	**NS**	**5$^{(IMAC)}$**	**0.005$^{(MAC)}$**	**0.05$^{(MAC)}$**	**NS**	**1.0$^{(AO)}$**	**0.3$^{(AO)}$**	**0.01$^{(MAC)}$**

Monitoring Well	Sample Date	MSI Sample Number	Mn mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
BH10 S-7B	07-Mar-04	3499040307003	***0.507***	0.0013	0.0027	<0.0004	<0.0002	0.265	<0.00005	<0.0002	0.0017	0.0003	0.0007	0.020
BH14	07-Mar-04	3499040307004	***0.590***	0.0013	0.0026	<0.0004	<0.0002	0.114	<0.00005	<0.0002	0.0013	0.0016	0.0007	0.008
BH20 S-6A	07-Mar-04	3499040307005	0.001	0.0015	0.0006	0.0011	<0.0002	0.125	<0.00005	<0.0002	0.0015	0.0018	0.0005	0.008
BH21 S-3B	07-Mar-04	3499040307002	***0.358***	0.0010	0.0014	<0.0004	<0.0002	0.248	<0.00005	<0.0002	0.0021	0.0028	0.0013	0.021
BH21 S-3B dup	07-Mar-04	3499040307007	***0.294***	0.0008	0.0014	<0.0004	<0.0002	0.256	<0.00005	<0.0002	0.0015	0.0033	0.0008	0.018
BH21A S-3D	07-Mar-04	3499040307001	***0.181***	0.0123	0.0007	<0.0004	<0.0002	0.607	<0.00005	<0.0002	0.0019	0.0004	0.0010	0.013
12-28 Obs	17-Mar-04	3499040317002	***0.098***	0.0082	0.0040	<0.0004	<0.0002	0.568	<0.00005	<0.0002	0.0026	<0.0001	0.0041	0.003
12-28 PW	17-Mar-04	3499040317001	***0.254***	0.0029	0.0042	<0.0004	<0.0002	0.623	<0.00005	<0.0002	0.003	<0.0001	0.0051	0.003
Detection Limit			**0.0002**	**0.001**	**0.001**	**0.0004**	**0.0002**	**0.0001**	**0.0005**	**0.0002**	**0.0004**	**0.0001**	**0.0001**	**0.0006**
Canadian Drinking Water Guidelines**			**0.05$^{(AO)}$**	**NS**	**NS**	**0.01$^{(MAC)}$**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.02$^{(IMAC)}$**	**NS**	**5.0$^{(AO)}$**

Notes:

ND	Not detected
NS	Not specified
AO	Aesthetic objective
MAC	Maximum acceptable concentration based on health effects
IMAC	Interim maximum acceptable concentration based on health effects
**	Summary of Guidelines for Canadian Drinking Water Quality (Health Canada, 2002)
Bold/Italics	Indicates values do not meet drinking water guidelines

Table SIR 64.6: Jackfish Project Groundwater Quality Results – Dissolved Hydrocarbons

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1[††] C_6-C_{10} mg/L	F2 $C_{>10}$-C_{16} mg/L
BH10 S-7B	07-Mar-04	3499040307003	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
BH14	07-Mar-04	3499040307004	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
BH20 S-6A	07-Mar-04	3499040307005	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
BH21 S-3B	07-Mar-04	3499040307002	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
BH21 S-3B dup	07-Mar-04	3499040307007	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
BH21A S-3D	07-Mar-04	3499040307001	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05
12-28 Obs	17-Mar-04	3499040317002	<0.0005	0.019	<0.0005	<0.0005	<0.1	<0.05
12-28 PW	17-Mar-04	3499040317001	<0.0005	***0.053***	<0.0005	<0.0005	<0.1	<0.05
Laboratory Detection Limit			**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.1**	**0.05**
Alberta SWQG* - >10 m from Surface Water Body - All Soils			**0.005[#]**	**0.021[+]**	**0.0024[#]**	**0.3[#]**	**4.6[#]**	**2.1[#]**

Notes:

*	Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities (AENV, 2001)
#	Indicates guideline for Human Drinking Water exposure pathway for all soil types
+	Indicates guideline for Freshwater Aquatic Life for Coarse Soils > 10 m from surface waterbody
††	F1 excludes BTEX
Bold/Italics	Indicates that values exceed Alberta groundwater quality guidelines

Table SIR 64.7: Jackfish Project Groundwater Quality Results – Polyaromatic Hydrocarbon Analysis

Sample Point	Date	MSI Sample Number	Naphthalene (mg/L)	Acenaphthylene (mg/L)	Acenaphthene (mg/L)	Fluorene (mg/L)	Phenanthrene (mg/L)	Anthracene (mg/L)	Fluoranthene (mg/L)	Pyrene (mg/L)	Benz[a]anthracene (mg/L)	Chrysene (mg/L)	Benzo[b]fluoranthene (mg/L)	Benzo[k]fluoranthene (mg/L)	Benzo[a]pyrene (mg/L)	Indeno[1,2,3-cd]pyrene (mg/L)	Dibenz[a,h]anthracene (mg/L)
BH10 S-7B	07-Mar-04	3499040307003	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
BH14	07-Mar-04	3499040307004	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
BH20 S-6A	07-Mar-04	3499040307005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
BH21 S-3A	07-Mar-04	3499040307002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
BH21 S-3B	07-Mar-04	3499040307007	<0.00001	<0.00001	<0.00001	<0.00001	0.00006	<0.00001	0.00014	0.00046	<0.00001	0.00003	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
BH21A S-3D	07-Mar-04	3499040307001	0.00007	<0.00001	<0.00001	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Blank	07-Mar-04	3499040307008	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Laboratory Detection Limit			**0.00001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.00002**	**0.00001**	**0.0001**	**0.00001**	**0.00001**	**0.00001**	**0.0001**	**0.00001**
Canadian Drinking Water Guidelines**			**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.00001***	**NS**	**NS**

Notes:

ND	Not detected
NS	Not specified
*	Maximum acceptable concentration based on health effects
**	Summary of Guidelines for Canadian Drinking Water Quality (Health Canada, 2002)
–	Not available
Bold/Italics	Indicates values do not meet drinking water guidelines

Appendix D

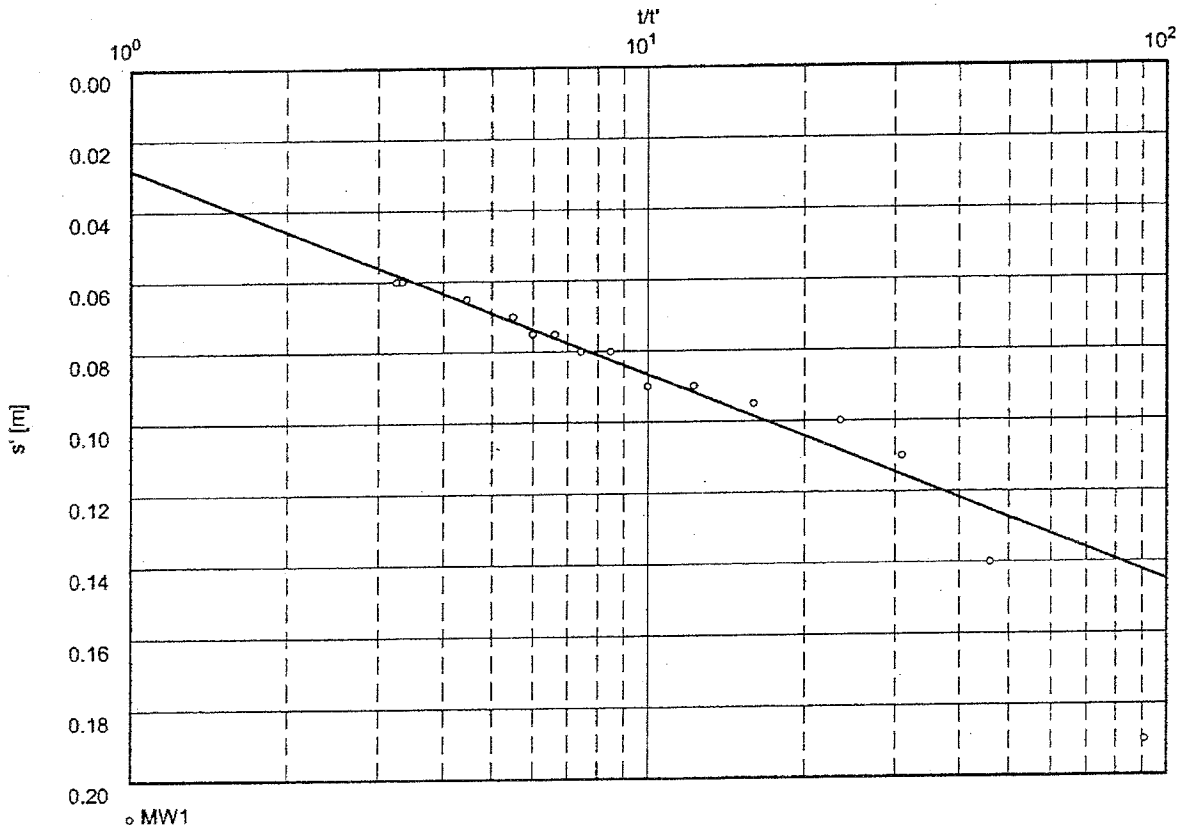
Supporting Data

MEG Energy CLRP Pilot Application

Hydraulic Conductivity Test Results

Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Date: 25.03.2004	Page 1
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

Pumping Test No.	Test conducted on: March 17, 2004
Sec 9/16, MW1	
Discharge 0.14 l/s	
	Pumping test duration: 2700 s



Transmissivity [m²/s]: 4.38×10^{-4}

Hydraulic conductivity [m/s]: 3.00×10^{-4}

Aquifer thickness [m]: 1.460

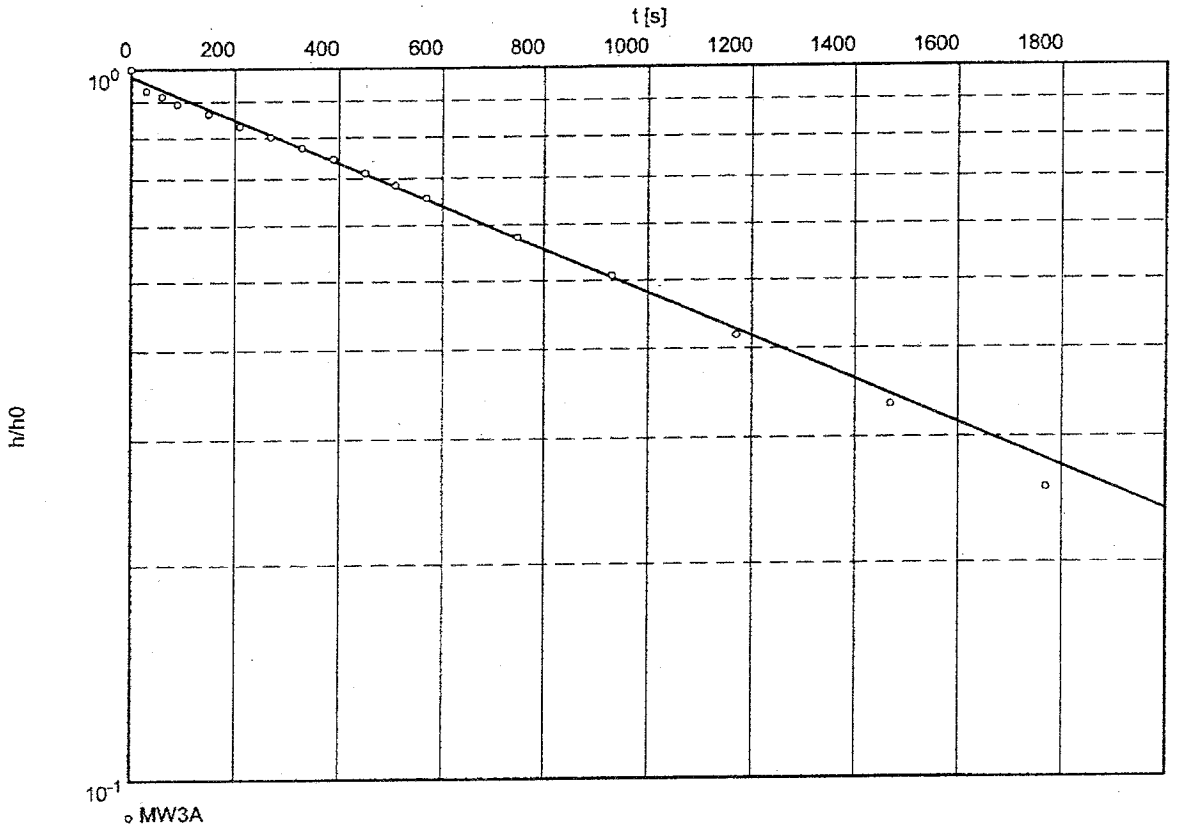
Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Date: 25.03.2004	Page 2
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

Pumping Test No.	Test conducted on: March 17, 2004
Sec 9/16, MW1	MW1
Discharge 0.14 l/s	
Static water level: 6.750 m below datum	Pumping test duration: 2700 s

	Time from end of pumping [s]	Water level [m]	Residual drawdown [m]
1	30	6.940	0.190
2	60	6.890	0.140
3	90	6.860	0.110
4	120	6.850	0.100
5	180	6.845	0.095
6	240	6.840	0.090
7	300	6.840	0.090
8	360	6.830	0.080
9	420	6.830	0.080
10	480	6.825	0.075
11	540	6.825	0.075
12	600	6.820	0.070
13	780	6.815	0.065
14	1160	6.810	0.060
15	1200	6.810	0.060

Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	slug/bail test analysis HVORSLEV's method	Date: 25.03.2004	Page 1
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

Slug Test No.	Test conducted on: March 18, 2004
Sec 9/16, MW3A	



Hydraulic conductivity [m/s]: 3.54×10^{-7}

Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	slug/bail test analysis HVORSLEV's method	Date: 25.03.2004	Page 2
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

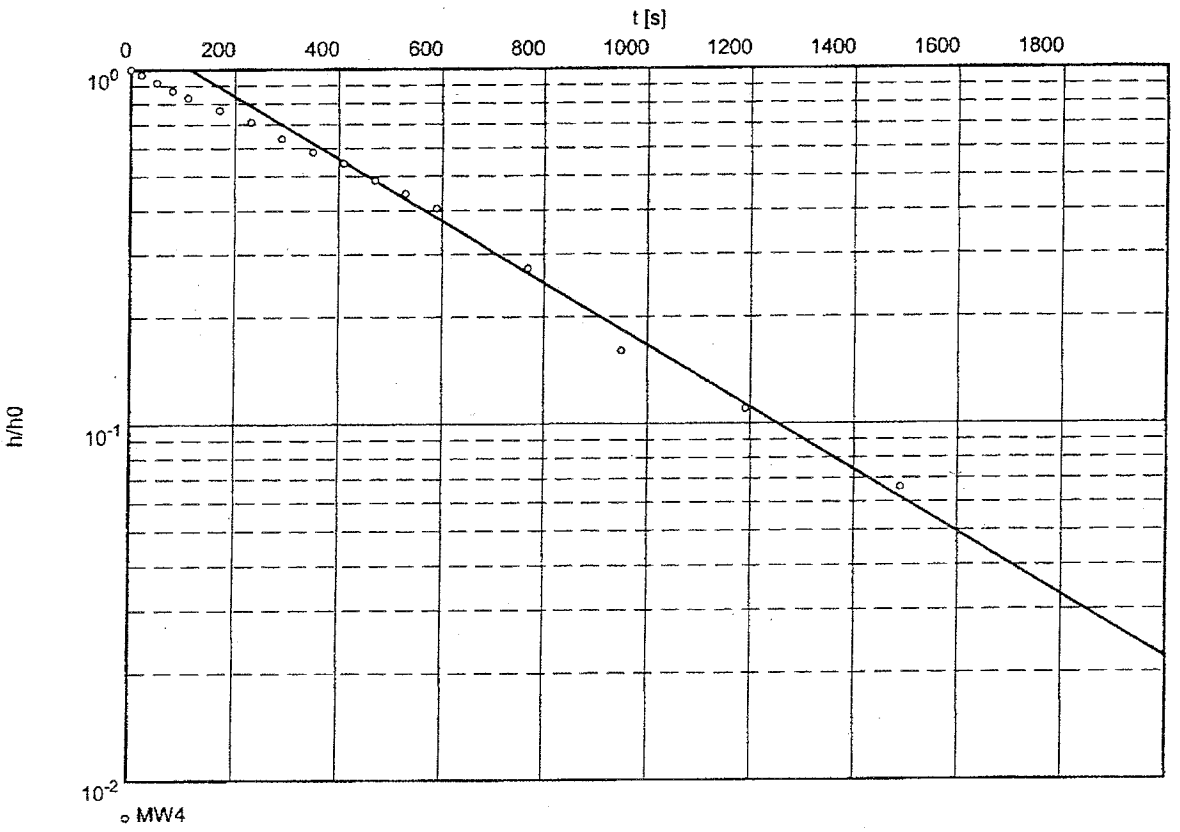
Slug Test No.	Test conducted on: March 18, 2004
Sec 9/16, MW3A	MW3A

Static water level: 3.820 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]	
1	0	5.590	1.770	
2	30	5.470	1.650	
3	60	5.440	1.620	
4	90	5.400	1.580	
5	150	5.350	1.530	
6	210	5.290	1.470	
7	270	5.240	1.420	
8	330	5.190	1.370	
9	390	5.140	1.320	
10	450	5.080	1.260	
11	510	5.030	1.210	
12	570	4.980	1.160	
13	750	4.840	1.020	
14	930	4.720	0.900	
15	1170	4.560	0.740	
16	1470	4.410	0.590	
17	1770	4.270	0.450	

Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	slug/bail test analysis HVORSLEV's method	Date: 25.03.2004	Page 1
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

Slug Test No.	Test conducted on: March 17, 2004
Sec 9/16, MW4	



Hydraulic conductivity [m/s]: 7.81×10^{-7}

Jacques Whitford Environment Ltd. 500; 708 - 11 Avenue SW Calgary, AB T2R 0E4 ph.(519)746-1798	slug/bail test analysis HVORSLEV's method	Date: 25.03.2004	Page 2
		Project: ABC11042	
		Evaluated by: Tyler Swaren	

Slug Test No.	Test conducted on: March 17, 2004
Sec 9/16, MW4	MW4

Static water level: 2.150 m below datum

	Pumping test duration [s]	Water level [m]	Change in Waterlevel [m]
1	0	5.330	3.180
2	20	5.220	3.070
3	50	5.070	2.920
4	80	4.920	2.770
5	110	4.800	2.650
6	170	4.590	2.440
7	230	4.410	2.260
8	290	4.180	2.030
9	350	4.010	1.860
10	410	3.880	1.730
11	470	3.700	1.550
12	530	3.570	1.420
13	590	3.440	1.290
14	770	3.020	0.870
15	950	2.660	0.510
16	1190	2.500	0.350
17	1490	2.360	0.210

Borehole Records

BOREHOLE RECORD

BH1/MW1

CLIENT MEG Energy Corp.
LOCATION 9/16-77-5-W4M
DATES (mm/dd/yy): BORING 03/05/04 WATER LEVEL 5.84 m (03/17/04)
PROJECT No. ABC11042
BH SIZE 150 mm
DATUM 3-16 Wellsite

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
0	586.295					
	586.25	Frozen, muskeg and organic rootmat	BS	1	300	
1		Frozen, brown, SANDY CLAY, some gravel, trace coal, oxide staining, (CL) (TILL)				
2			SS	2	450	15
3		- stiff and moist below 1.5 m				
		- firm below 3.0 m	SS	3	450	7
4						
5		- light brown, wet, fine grained sand from 4.3 m to 4.9 m	SS	4	450	14
	580.50	- stiff below 4.5 m				
6		Dense, light brown, POORLY GRADED SAND, fine grained,	SS	5	425	43
7	579.00	sloughing, saturated, (SP)				
8		Very stiff to hard, dark grey, SANDY CLAY, some cobbles,				
9		trace coal, moist, (CL) (TILL)	BS	6	1200	
10	575.60					
11		Unable to perform SPT below 7.0 m due to sloughing conditions				
12						
13		End of Borehole (10.7 m)				
14		Borehole wet upon completion				
15		Slough to 6.7 m				
16		Water at 5.3 m upon completion				
17		50 mm well screen from 4.3 m to 7.3 m				
18		Bentonite seal above sand pack				
19						
20						
21						
22						
23						
24						
25						

STRATA PLOT | WATER LEVEL | MONITOR WELL/ PIEZOMETER

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
Pocket Penetrometer kPa ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

App'd S.R Apr 28 2004 15:50:53

Jacques Whitford
Consulting Engineers
Environmental Scientists

BOREHOLE RECORD

BH2/MW2

CLIENT MEG Energy Corp.
LOCATION 9/16-77-5-W4M
DATES (mm/dd/yy): BORING 03/03/04 WATER LEVEL Dry (03/17/04)
PROJECT No. ABC11042
BH SIZE 150 mm
DATUM 3-16 Wellsite

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0	586.670								
0	586.59	Frozen, muskeg and organic rootmat			BS	1	300		
1	586.07	Frozen, brown, SILTY SAND, trace to some clay, (SM)			SS	2	225	12	
2		Frozen, brown, SANDY CLAY, some gravel, trace coal, oxide staining, (CL) (TILL)			SS	3	300	8	
3		- stiff and moist below 1.5 m							
4		- occasional sand stringers and lenses below 4.0 m			SS	4	450	16	
5		- increased sand content below 5.2 m			ST	5	300		
6		- brown, moist, coarse grained sand from 6.3 m to 6.4 m			SS	6	400	12	
7									
8		- hard and dark grey below 8.8 m			SS	7	450	13	
9									
10					SS	8	450	62	
11									
12	574.77				SS	9	450	79	
12	574.37	Dense, grey, POORLY GRADED SAND, fine grained, moist, (SP)							
13	573.97	Grey, SANDY CLAY, some gravel, trace coal, oxide staining, moist, (CL) (TILL)			SS	10	400	65	
14		End of Borehole (12.7 m)							
15		Borehole open and dry upon completion							
16		50 mm well screen from 2.4 m to 5.5 m							
17		Bentonite seal above sand pack							
18		Monitoring well installed adjacent to borehole							
19									
20									
21									
22									
23									
24									
25									

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
Pocket Penetrometer kPa ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

App'd S.R. Apr 28 2004 15:52:50

Jacques Whitford
Consulting Engineers
Environmental Scientists

BOREHOLE RECORD

BH3/MW3

CLIENT MEG Energy Corp. PROJECT No. ABC11042

LOCATION 9/16-77-5-W4M BH SIZE 150 mm

DATES (mm/dd/yy): BORING 03/04/04 WATER LEVEL 16.34 m (03/17/04) DATUM 3-16 Wellsite

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %
0	584.405					
	584.36	Frozen, muskeg and organic rootmat	BS	1	250	
1		Frozen, brown, SANDY CLAY, some gravel, trace coal, oxide staining, (CL) (TILL)				
2			SS	2	450	12
3		- stiff and moist below 1.7 m				
4		- firm and wet below 2.7 m	SS	3	450	5
5	579.21		SS	4	450	22
6		- very stiff and grey from 4.9 m to 5.2 m				
		Dense, light brown, POORLY GRADED SAND, fine to medium grained, sloughing, saturated, (SP)	SS	5	450	63
7	577.11					
8			SS	6	375	29
9		Very stiff, grey, SANDY CLAY, gravel, coal inclusions, damp to moist, (CL) (TILL)				
10			SS	7	0	
11			SS	8	350	25
12						
13			SS	9	400	27
14						
15		- hard below 15.0 m				
16			SS	10	375	43
17			SS	11	450	48
18	566.11					
	565.61	Very dense, grey, SILTY SAND, fine grained, moist, (SM)	SS	12	400	53
19		End of Borehole (18.8 m)				
20		Borehole wet upon completion				
21		Slough to 5.5 m				
22		Water at 3.1 m upon completion				
23		50 mm well screen from 16.8 m to 18.3 m				
24		Bentonite seal above sand pack				
25						

STRATA PLOT | WATER LEVEL | MONITOR WELL/ PIEZOMETER

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

Pocket Penetrometer kPa ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd J.A Apr 28 2004 15:54:48

Jacques Whitford
Consulting Engineers
Environmental Scientists

BOREHOLE RECORD

MW3A

CLIENT MEG Energy Corp.

LOCATION 9/16-77-5-W4M

PROJECT No. ABC11042

DATES (mm/dd/yy): BORING 03/04/04 WATER LEVEL 3.04 m (03/17/04)

BH SIZE 150 mm

DATUM 3-16 Wellsite

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0	584.500								
	584.45	Frozen, muskeg and organic rootmat			BS	1	250		
1		Frozen, brown, SANDY CLAY, some gravel, trace coal, oxide staining, (CL) (TILL) - stiff and moist below 1.7 m - firm and wet below 2.7 m							
2					SS	2	450	12	
3				▼					
4					SS	3	450	5	
5	579.30	- very stiff and grey from 4.9 m to 5.2 m			SS	4	450	22	
	578.40	Dense, light brown, POORLY GRADED SAND, fine to medium grained, sloughing, saturated, (SP)							
6		End of Borehole (6.1 m) Borehole wet upon completion Slough to 5.2 m Water at 5.2 m upon completion 50 mm well screen from 2.0 m to 5.0 m Bentonite seal at surface							
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

Pocket Penetrometer kPa *

STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

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Jacques Whitford
Consulting Engineers
Environmental Scientists

BOREHOLE RECORD

BH4/MW4

CLIENT MEG Energy Corp.
LOCATION 9/16-77-5-W4M
DATES (mm/dd/yy): BORING 03/03/04 WATER LEVEL 1.55 m (03/17/04)
PROJECT No. ABC11042
BH SIZE 150 mm
DATUM 3-16 Wellsite

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0	583.025								
0	582.88	Frozen, muskeg and organic rootmat							
1	582.43	Frozen, brown, SILTY SAND, medium grained, trace clay, (SM)		▼	SS	2	300	14	
2					BS	1	1200		
3		Frozen, brown, SANDY CLAY, low plastic, some gravel, trace coal, oxide staining, (CL) (TILL)			ST	3	400		
4					SS	4	450	7	
5		- stiff and moist with occasional wet sand inclusions below 1.4 m			SS	5	450	15	
6									
7		- firm with trace of free water below 2.7 m			SS	6	450	15	
8		- stiff and grey with occasional wet sand stringers below 4.3 m			SS	7	400	15	
9	573.73								
10		Dense, light brown, POORLY GRADED SAND, fine grained, sloughing, saturated, (SP)			SS	8	350	31	
11									
12	570.83								
13		End of Borehole (12.2 m) 50 mm well screen from 2.3 m to 5.3 m Bentonite seal above sand pack Monitoring well installed adjacent to borehole							
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
Pocket Penetrometer kPa ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

App'd J.R. Apr 28 2004 15:56:44

Jacques Whitford
Consulting Engineers
Environmental Scientists

BOREHOLE RECORD

BH5/MW5

CLIENT MEG Energy Corp.
LOCATION 9/16-77-5-W4M
DATES (mm/dd/yy): BORING 03/05/04 WATER LEVEL 4.33 m (03/18/04)

PROJECT No. ABC11042
BH SIZE 150 mm
DATUM 3-16 Wellsite

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES: TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
0	585.225					
	584.93	Frozen, brown, SILTY SAND, trace to some clay, (SM)	BS	1	300	
1		Frozen, brown, SANDY CLAY, some gravel, trace coal, oxide staining, (CL) (TILL)				
2			SS	2	300	7
3		- firm and moist below 1.5 m				
4			ST	3	375	
	580.63					
5		Compact, light brown, POORLY GRADED SAND, fine grained, sloughing, saturated, (SP)	SS	4	450	14
	579.33					
6			SS	5	325	32
7		Very stiff to hard, dark grey, SANDY CLAY, some gravel, trace coal, moist, (CL) (TILL)				
8		- occasional sand stringers below 6.1 m				
9			SS	6	450	14
10		- stiff below 9.1 m				
11						
12						
	572.53	- saturated sand with gravel from 12.2 m to 12.3 m	SS	7	400	23
13		- fine grained saturated sand from 12.4 m to 12.7 m				
14		End of Borehole (12.7 m)				
15		Borehole wet upon completion				
16		Slough to 5.3 m				
17		Water at 3.7 m upon completion				
18		50 mm well screen from 2.3 m to 5.3 m				
19		Bentonite seal above sand pack				
20						
21						
22						
23						
24						
25						

STRATA PLOT | WATER LEVEL | MONITOR WELL/ PIEZOMETER

UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
Pocket Penetrometer kPa ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

App'd S.L. Apr 28 2004 15:58:20

Jacques Whitford
Consulting Engineers
Environmental Scientists

NORWEST LABS

Analytical Report

Norwest Labs
7217 Roper Road
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: MEG Energy Corporation
Report to: MEG Energy Corporation
#910, 734 - 7 Ave SW
Calgary, AB, Canada
T2P 3P8
Attn: Mark Wong
Sampled By: James McTaggart
Company: JW

Project ID: ABC10042
Name:
Location: North of Conklin
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 295913
Control Number: E 187156
Date Received: Mar 19, 2004
Date Reported: Mar 30, 2004
Report Number: 527482

		NWL Number	295913-1	295913-2		
		Sample Date	Mar 18, 2004	Mar 17, 2004		
		Sample Description	North of Conklin / BH2B	North of Conklin / PSB #4		
		Matrix	Water - General	Water - General		
Analyte		**Units**	**Results**	**Results**	**Results**	**Detection Limit**
Routine Water - Continued						
Iron	Dissolved	mg/L	0.53	0.02		0.01
Manganese	Dissolved	mg/L	0.258	0.114		0.005
Chloride	Dissolved	mg/L	1.6	<0.5		0.5
Fluoride		mg/L	0.20	0.30		0.05
Nitrate - N		mg/L	0.1	0.1		0.1
Nitrite - N		mg/L	0.07	<0.05		0.05
Nitrate and Nitrite - N		mg/L	0.2	0.1		0.2
Sulphate (SO4)	Dissolved	mg/L	10.9	9.2		0.2
Hydroxide		mg/L	<5	<5		5
Carbonate		mg/L	<6	<6		6
Bicarbonate		mg/L	308	402		5
P-Alkalinity	as CaCO3	mg/L	<5	<5		5
T-Alkalinity	as CaCO3	mg/L	252	329		5
Total dissolved solids	Calculated	mg/L	252	324		1
Hardness	Dissolved as CaCO3	mg/L	225	319		
Ionic Balance	Dissolved	%	93	99		
Mono-Aromatic Hydrocarbons - Water						
Benzene		mg/L	0.002	<0.001		0.001
Toluene		mg/L	0.022	<0.001		0.001
Ethylbenzene		mg/L	<0.001	<0.001		0.001
Total Xylenes (m,p,o)		mg/L	0.119	<0.001		0.001
Volatile Petroleum Hydrocarbons - Water						
F1 C6-C10		mg/L	0.29	<0.01		0.01
F1 -BTEX		mg/L	0.15	<0.01		0.01
Extractable Petroleum Hydrocarbons - Water						
F2 C10-C16		mg/L	0.4	<0.1		0.1
F3 C16-C34		mg/L	0.1	<0.1		0.1
Polynuclear Aromatic Hydrocarbons - Water						
Benzo(a)anthracene		ug/L	<0.01	<0.01		0.01
Chrysene		ug/L	<0.1	<0.1		0.1
Benzo(b)fluoranthene		ug/L	<0.01	<0.01		0.01
Benzo(j)fluoranthene		ug/L	<0.01	<0.01		0.01
Benzo(k)fluoranthene		ug/L	<0.01	<0.01		0.01
Benzo(a)pyrene		ug/L	<0.01	<0.01		0.01
Indeno(1,2,3-c,d)pyrene		ug/L	<0.1	<0.1		0.1

NORWEST LABS

Analytical Report

Norwest Labs
7217 Roper Road
Edmonton, AB. T6B 3J4
Phone: (780) 438-5522
Fax: (780) 438-0396

Bill to: MEG Energy Corporation
Report to: MEG Energy Corporation
#910, 734 - 7 Ave SW
Calgary, AB, Canada
T2P 3P8
Attn: Mark Wong
Sampled By: James McTaggart
Company: JW

Project ID: ABC10042
Name:
Location: North of Conklin
LSD:
P.O.:
Acct. Code:

NWL Lot ID: 295913
Control Number: E 187156
Date Received: Mar 19, 2004
Date Reported: Mar 30, 2004
Report Number: 527482

	NWL Number	295913-1	295913-2		
	Sample Date	Mar 18, 2004	Mar 17, 2004		
	Sample Description	North of Conklin / BH2B	North of Conklin / PSB #4		
	Matrix	Water - General	Water - General		
Analyte		Units	Results	Results	Results	Detection Limit
Polynuclear Aromatic Hydrocarbons - Water - Con						
Dibenzo(a,h)anthracene		ug/L	<0.01	<0.01		0.01
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01		.01
PAH - Water - Surrogate Recovery						
Nitrobenzene-d5	PAH - Surrogate	%	106	130		23-130
2-Fluorobiphenyl	PAH - Surrogate	%	60	54		30-130
o-Terphenyl-d14	PAH - Surrogate	%	81	89		18-137

Approved by:

Doug Keyes, MSc
Senior Scientist

NORWEST LABS

Analytical Report

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Analyte		Units		Results	Results	Results	Detection Limit
Inorganic Nonmetallic Parameters							
Organic Carbon	Total	mg/L		3.1	3.6		0.5
Organic Carbon	Dissolved	mg/L		3.3	3.3		0.5
Metals Dissolved							
Silicon	Dissolved	mg/L		8.80	6.93		0.05
Sulphur	Dissolved	mg/L		3.63	3.06		0.05
Aluminum	Dissolved	mg/L		<0.005	<0.005		0.005
Antimony	Dissolved	mg/L		<0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L		0.0003	0.0002		0.0002
Barium	Dissolved	mg/L		0.074	0.108		0.001
Beryllium	Dissolved	mg/L		<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L		<0.0005	<0.0005		0.0005
Boron	Dissolved	mg/L		0.020	0.016		0.002
Cadmium	Dissolved	mg/L		0.00012	0.00006		0.00001
Chromium	Dissolved	mg/L		<0.0005	0.0005		0.0005
Cobalt	Dissolved	mg/L		0.0011	0.0008		0.0001
Copper	Dissolved	mg/L		0.002	0.002		0.001
Lead	Dissolved	mg/L		<0.0001	<0.0001		0.0001
Lithium	Dissolved	mg/L		0.008	0.009		0.001
Molybdenum	Dissolved	mg/L		0.001	0.001		0.001
Nickel	Dissolved	mg/L		0.0026	0.0021		0.0005
Selenium	Dissolved	mg/L		0.0002	0.0005		0.0002
Silver	Dissolved	mg/L		<0.0001	<0.0001		0.0001
Strontium	Dissolved	mg/L		0.119	0.116		0.001
Thallium	Dissolved	mg/L		<0.00005	<0.00005		0.00005
Tin	Dissolved	mg/L		<0.001	<0.001		0.001
Titanium	Dissolved	mg/L		<0.0005	<0.0005		0.0005
Uranium	Dissolved	mg/L		0.0013	0.0016		0.0005
Vanadium	Dissolved	mg/L		0.0002	0.0002		0.0001
Zinc	Dissolved	mg/L		0.006	0.088		0.001
Metals Total							
Iron	Total	mg/L		43.9	46.0		0.1
Manganese	Total	mg/L		2.84	1.20		0.005
Silicon	Total	mg/L		37.5	59.0		0.05
Sulphur	Total	mg/L		3.69	2.62		0.05
Mercury	Total	mg/L		<0.0002	<0.0002		0.0002

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			Matrix	Water - General	Water - General		
Analyte		Units		Results	Results	Results	Detection Limit
Metals Total - Continued							
Aluminum	Total	mg/L		20.0	38.3		0.005
Antimony	Total	mg/L		<0.002	<0.002		0.0002
Arsenic	Total	mg/L		0.0209	0.016		0.0002
Barium	Total	mg/L		0.579	0.520		0.001
Beryllium	Total	mg/L		0.0010	0.0014		0.0001
Bismuth	Total	mg/L		<0.005	<0.005		0.0005
Boron	Total	mg/L		0.033	0.042		0.002
Cadmium	Total	mg/L		0.00144	0.00070		0.00001
Chromium	Total	mg/L		0.031	0.0629		0.0005
Cobalt	Total	mg/L		0.0270	0.0213		0.0001
Copper	Total	mg/L		0.026	0.043		0.001
Lead	Total	mg/L		0.0191	0.0313		0.0001
Lithium	Total	mg/L		0.025	0.043		0.001
Molybdenum	Total	mg/L		<0.01	<0.01		0.001
Nickel	Total	mg/L		0.044	0.037		0.0005
Selenium	Total	mg/L		0.0024	0.0020		0.0002
Silver	Total	mg/L		<0.001	<0.001		0.0001
Strontium	Total	mg/L		0.221	0.204		0.001
Thallium	Total	mg/L		0.00065	0.00075		0.00005
Tin	Total	mg/L		<0.01	<0.01		0.001
Titanium	Total	mg/L		0.752	1.14		0.0005
Uranium	Total	mg/L		<0.005	<0.005		0.0005
Vanadium	Total	mg/L		0.0582	0.110		0.0001
Zinc	Total	mg/L		0.083	0.131		0.001
Physical and Aggregate Properties							
Colour	Apparent, Potable	Colour units		>60	>60		5
Turbidity		NTU		1090	1740		0.1
Temp. of observed pH and EC		°C		16.9	17.2		
Routine Water							
pH				7.73	7.51		
Electrical Conductivity		µS/cm at 25C		377	557		1
Calcium	Dissolved	mg/L		60.5	80.4		0.2
Magnesium	Dissolved	mg/L		18.0	28.8		0.2
Sodium	Dissolved	mg/L		8.3	6.5		0.4
Potassium	Dissolved	mg/L		1.6	1.4		0.4