Hydrogeology Baseline
Steepbank Oil Sands Mine

May, 1996

Prepared for:

Suncor Inc.

Prepared by:

Golder Associates

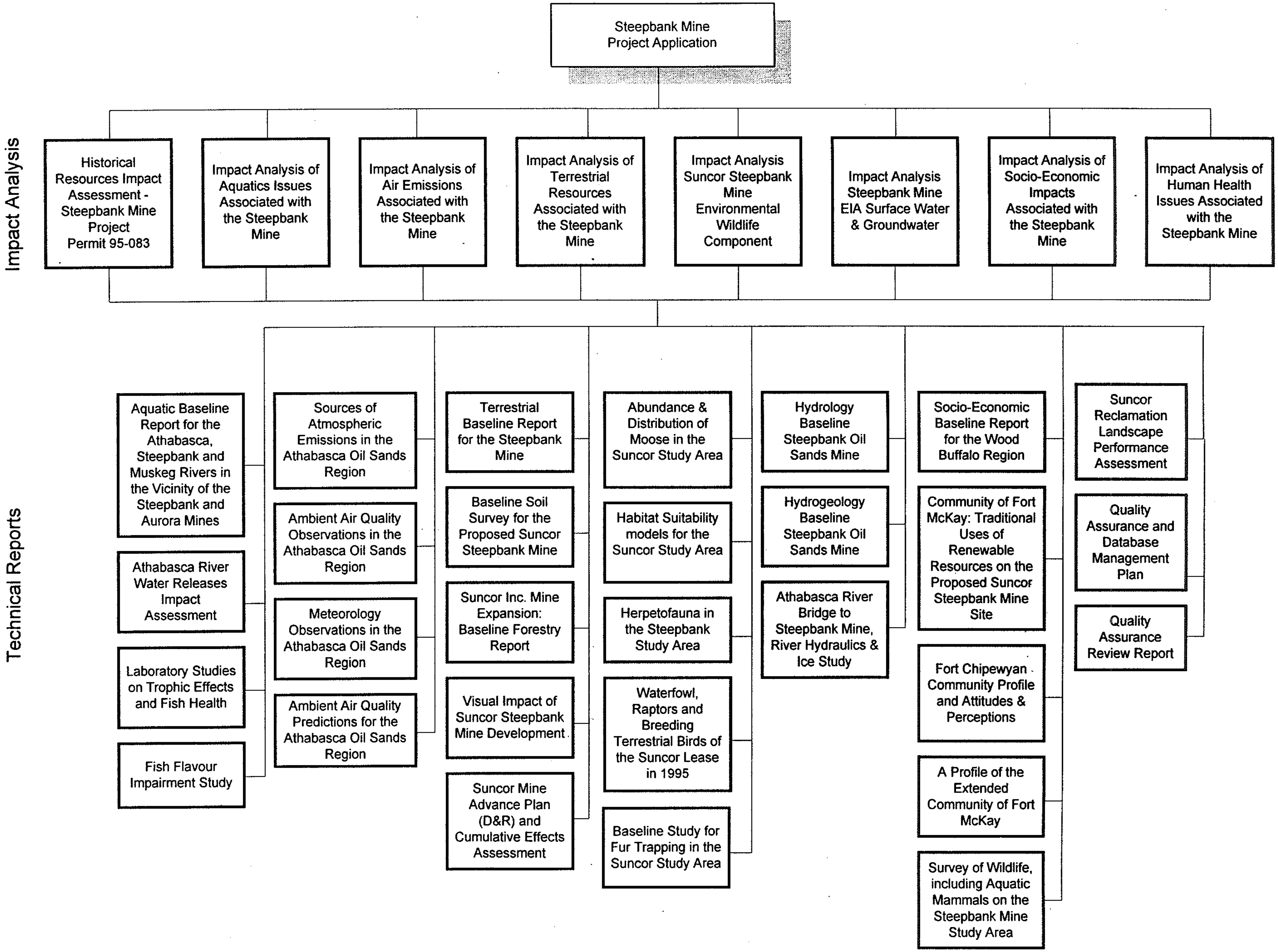
KLOHN-CRIPPEN

952-2307

This report is one of a series of reports prepared for Suncor Inc. Oil Sands Group for the Environmental Impact Assessment for the development and operation of the Steepbank Mine, north of Fort McMurray, Alberta. These reports provided information and analysis in support of Suncor's application to the Alberta Energy Utilities Board and Alberta Environmental Protection to develop and operate the Steepbank Mine, and associated reclamation of the current mine (Lease 86/17) with Consolidated Tailings technology.

For further information, please contact:

Manager, Regulatory Affairs
Suncor Oil Sands Group
P.O. Box 4001
Fort McMurray, AB
T9H 3E3



Reports Prepared for the Steepbank Mine Environmental Assessment

r:\1995\2307\repprep5.040\rpt-sch.vsd

EXECUTIVE SUMMARY

This report is one of a series that addresses the potential impacts of the Suncor Steepbank Mine project. It describes the current (or baseline) conditions of the groundwater system in the Study Area, and identifies the changes that are expected to result from the proposed development of the mine. The impact analysis has assessed the four main stages of the mine development:

- Baseline (1995)
- Construction Phase (1997 to 2001)
- Operational Phase (2001 to 2020)
- Post Reclamation

KEY FACTORS USED TO ASSESS IMPACT

The impacts on groundwater have been evaluated on the basis of changes in:

- direction of groundwater flow;
- rate of groundwater discharge to surface water bodies; and
- groundwater quality.

The three main surface water bodies in the Study Area are the Athabasca River, the Steepbank River, and Shipyard Lake. Shipyard Lake is a large wetlands located in the Athabasca River valley.

The degree of significance of various impacts was assessed by a qualitative evaluation of severity, duration and anticipated areal extent of each impact. Severity was assessed as either high, medium or low, based on the impacts to either flow or water quality. Duration was short term if the impact occurred through the life of the mine and long term if beyond the life of the mine. Areal extent was considered local if the effect was in the immediate mine area and regional if beyond the immediate mine area. A final assessment of the degree of concern was made based on the expected impact on the receiving water body (either the Athabasca or Steepbank Rivers).

RESOURCE INVENTORY

The baseline study included both a review of regional geologic and hydrogeologic information, and a detailed investigation of the study area. The baseline conditions in the Study Area are summarized below.

Geology

The site's landforms are divided into uplands, valley slopes and floodplain. The uplands slopes gently toward the Athabasca River. It is poorly drained, and covered with muskeg. The uplands is cut by the steep valley slopes of the Steepbank and Athabasca Rivers. The Athabasca floodplain is moderately to poorly drained, and overlain in places with muskeg. The stratigraphy of the Study Area is:

- Surficial Deposits
- Clearwater Formation
- McMurray Oil Sands
- Basal Aquifer
- Upper Devonian limestone

Major Aquifers

Three major aquifers have been identified. In the uplands, there is an extensive but discontinuous sand deposit, which ranges in thickness from 1 m to 10 m. In the Athabasca River valley, there is a thick (up to 40 m) sand and gravel deposit, that is in contact with the Athabasca River. In the bedrock, the Basal Aquifer and Upper Devonian limestone appear to behave as a single aquifer. The Basal Aquifer is a discontinuous zone of lean oil sands in the McMurray Formation, that generally rests upon the Upper Devonian surface. The Upper Devonian rock is limestone of the Waterways Formation. Its surface is highly irregular, consisting of depressions in the Upper Devonian surface.

Direction of Groundwater Flow

The direction of groundwater flow in all aquifers is principally horizontal, toward the Athabasca River. As Shipyard Lake is located in the Athabasca River valley, a portion of groundwater flowing toward the river discharges into the wetlands. There is also a small component of groundwater flow toward the Steepbank River.

Groundwater Discharge to Surface Waters

The total rate of groundwater discharge from all aquifers to the Athabasca River, Steepbank River and Shipyard Lake has been calculated to be 2.52 L/s. In comparison to groundwater, the minimum monthly flows recorded in the Athabasca and Steepbank Rivers are:

• Athabasca River	101,000 L/s
• Steepbank River	168 L/s

The average inflow to the Shipyard Lake wetlands is estimated as:

• Shipyard Lake	111 L/s

The groundwater discharge from the mine area is therefore less than 1% of the minimum recorded surface water flow in the Athabasca and Steepbank Rivers, and the average flow in Shipyard Lake.

Groundwater as a Resource

There are no groundwater users in the Study Area. The sand and gravel aquifer in the Athabasca River valley has the potential to be used for water supply purposes. Due to its proximity to the river, wells completed in the aquifer are expected to induce recharge from the Athabasca River.

The sand aquifer in the surficial deposits in the uplands is not a viable resource for water supply. This is bacause it has a low hydraulic conductivity, it is relatively thin, and it is quite shallow. The bedrock aquifers are also not usable for water supply purposes. Although they are more productive than the surficial sand aquifer, the water quality in the bedrock is poor. The bedrock groundwater is brackish, and contains organic compounds, including PAHs and napthenic acids.

IMPACT DESCRIPTION

Construction Phase

The only effect that the construction phase is expected to have on the hydrogeologic system is associated with the water supply wells for the new facility. It is planned that two or three water wells will be constructed in the sand and gravel, between the Athabasca River and the proposed facilities area. None of the other aquifers are affected by mine activity in this time frame. The proposed water demand from the wells is approximately 7.6 L/s (650 m3/day). The change in the water level in the aquifer is expected to be small, because of recharge from the river. There will be very little effect on the aquifer to the east of the water wells. The flow direction, discharge rate and quality of groundwater in the upland surficial aquifer and bedrock aquifers will not be affected by these wells.

Operational Phase

There are three major impacts that will occur as a result of the operation of the mine in the Study Area. These are:

> There will be a change in the direction of groundwater flow in the surficial aquifer, as a result of dewatering of the surficial deposits;
>
> There will be temporary changes in the rate of discharge and direction of flow of groundwater in the bedrock aquifers, while the mine is in operation; and
>
> Pore water from consolidated tailings (CT) placed in the mine pits will seep into the bedrock aquifers and discharge into surface waters.

These three impacts are discussed below:

As a component of the stripping of overburden during the development of Pit 1, the surficial deposits in the area will be dewatered. The surficial aquifer will be intercepted with a diversion system on the east side of the mine, and the groundwater will be diverted to Shipyard Lake through the surface water premine drainage system. The total volume of groundwater discharging from the aquifer to the surface water environment will not change. However, the nature of groundwater discharge from the aquifer to surface water will change. Currently, the discharge occurs as seepage to the Athabasca River, Steepbank River and Shipyard Lake, along the reach of these water bodies adjacent to the Study Area. The broad discharge will be replaced by discharge from point sources into Shipyard Lake and Wood Creek. From there, it will ultimately discharge into the Athabasca River. The groundwater discharge to the Steepbank River will reduce to near zero as the surficial aquifer will have been mined out. Because the groundwater contribution to the surface waters is such a minor component of their flow (less than 1%), the severity of these changes in direction and rate of flow will be very low. The areal extent of this effect will be limited to within approximately 300 m of the diversion system. The change in the direction of flow and rate of discharge from the surficial aquifer will be long term. The diversion of groundwater from the surficial aquifer is expected to continue after the closure of the mine.

In the bedrock aquifers, the groundwater flow in the Basal Aquifer and Upper Devonian will become directed toward the mine pits. The result will be reduced rates of discharge to the Athabasca and Steepbank Rivers and Shipyard Lake. While the pit is being mined, the discharge to these water bodies from the mining area will reduce to near zero. Because the groundwater contribution to the rivers and Shipyard Lake is such a minor component of their flow (less than 1%), the severity of this impact will be very low. The areal extent of this effect will be limited to within 2 km of the mine. The duration of this change in discharge will be relatively short term. Once the pits have been completed, they will be filled with CT. Groundwater from the bedrock aquifers will once again discharge to the surface waters at pre-mine rates.

The CT will interact with the groundwater in the bedrock aquifers once the pits are filled with the tailings. Pore water from the CT is expected to seep from the base of both Ponds 7 and 8. The total rate of seepage of the pore water is estimated to peak at 10.12 L/s in 2020. The duration of any impact associated with seepage of CT water will be long term. The seepage from the ponds will flow through the bedrock aquifers toward the Athabasca and Steepbank Rivers. The result is expected to be increased discharge to these water bodies. The rate of seepage represents less than 1% of the flow in any of these water bodies. The impact of this increased flow on the flow rates in the surface water will be negligible.

Comparison of the chemical composition of the CT water to groundwater chemistry in the bedrock aquifers indicates that although CT has a higher pH, and contains higher levels of organic compounds than the bedrock groundwater, the chemistry is similar. The concentration of naphthenic acids in the CT water ranges from 62 mg/L to 94 mg/L, compared to 8 mg/L to 57 mg/L in the bedrock aquifers. However, the types and concentrations of organic compounds found in the CT are similar to the naturally occurring organic composition of the bedrock groundwater. Therefore, the severity of the impact of introducing CT water to the bedrock groundwater system is low. With respect to its effect on the future use of groundwater, the expected change in the groundwater chemistry will be negligible.

Post Reclamation

There will be no additional impacts to the hydrogeologic system as a result of closure and reclamation of the mine. The two long-term impacts that are expected to occur are:

- Changes in the direction of groundwater flow in the surficial aquifer to discharge points into Shipyard Lake and Wood Creek; and
- Small changes in flow rate and water quality in the bedrock aquifers, as seepage of pore water from the CT in Ponds 7 and 8, flows through the aquifers, to the Athabasca River, Steepbank River, and Shipyard Lake.

The level of concern associated with these impacts is low.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLES

TABLE OF CONTENTS
(continued)

DRAWINGS

APPENDICES

ACKNOWLEDGMENTS

Klohn-Crippen would like to acknowledge the contribution and support of the EIA team in preparing this document. In particular thanks to Don Klym, Sue Lowell, Chris Fordham and John Gulley of Suncor Inc. Oil Sands Group for their continued support and valuable input throughout the EIA procedure. Mr. Gary Billecki of Suncor conducted the groundwater field sampling.

Hal Hamilton and his EIA management team at Golder Associates provided exemplary support for a large multidisciplinary team. Special thanks to the Aquatics, Fisheries and Terrain teams including Randy Shaw, David Fernet, David Kerr, Kevin Seal and Peter Nix. Special thanks also to Brenda Brassard, Bette Beswick and Carole Brittain.

The Klohn-Crippen Hydrogeology team was led by Mr. David Thomson with support from Marcia MacLellan, Scott Martens and Ken Baxter. Independent review and guidance was provided by Mr. Ken Campbell.

The Hydrology analysis and assessment was led by Mr. Roger Kitchin with support from Andrew Szojka, Richard Wong and Sue Lorimer. Independent review was provided by Mr. Wim Veldman.

Neither team could have completed their work without the support of Sandra Housken and Linda Leavell of Klohn-Crippen's clerical staff or the Drafting Services provided by Mr. Colin Baron and Lois Humm. Amaya Supple of Accounting provided her usual strong support in cost control and invoicing.

PART I - BACKGROUND

1. INTRODUCTION

Suncor has evaluated the feasibility and environmental impact of its proposed Steepbank Mine Project. The proposed mine is located on the east side of the Athabasca River, directly across from Suncor's existing Oil Sands operation. The mine is scheduled to begin operation by the year 2000. The planned production rate for the new mine is 90,000 barrels of oil per day.

The hydrogeologic component of the Environmental Impact Assessment (EIA) has evaluated the groundwater environment during three phases of development.

- Baseline Conditions;
- Construction Conditions;
- Mining Conditions; and
- Post-Closure Conditions.

Part II of this report presents the results of the assessment of baseline conditions of the hydrogeologic setting of the Study Area, shown in Drawing A-2779-02-01. Part III of the report presents the assessment of the impacts that are expected to occur as a result of construction of the mine, mining activity, and closure of the mine.

2. TERMS OF REFERENCE

The terms of reference drafted for the hydrogeologic component of the Steepbank Mine EIA are as follows:

- Describe the groundwater regime of the hydrogeology Study Area by summarizing the existing regional databases. Develop and install a site specific monitoring program in the areas in which no program exists and where developments are anticipated to occur. The new monitoring program should be developed such that groundwater quality and quantity can be determined.
- Describe the effects of the proposed Steepbank Mine Project on the existing groundwater regime of the Study Area. Impacts on water quality, quantity, and discharge to the Athabasca River will be evaluated. Discuss the inter-relationship of the groundwater to the surface water in the Study Area. Outline the mitigation procedures that will be implemented to mitigate any issues that are identified.

A number of key issues related to groundwater flow patterns and groundwater quality have been identified.

2.1 Key Groundwater Flow Issues

The groundwater flow regime, under natural conditions and under mining conditions must be determined.

Dewatering of the overburden, particularly permeable sand and gravel deposits, could locally reduce baseflow to the Steepbank River, and possibly wetlands.

Depressurizing the Basal Aquifer may also have an effect on baseflow in the Steepbank River and wetlands.

2.2 Key Groundwater Quality Issues

Groundwater quality could potentially be impacted as a result of contaminant migration from facilities, including tailings and plant maintenance.

There is also the potential impact that degradation in groundwater quality may have on water quality in the Athabasca River, Steepbank River and associated wetlands.

PART II - BASELINE STUDY

1. METHODOLOGY

The hydrogeologic baseline study has been conducted in two stages:

- a literature review of regional data; and
- a detailed investigation of the Suncor Study Area.

Regional geologic and hydrogeologic information was compiled from sources such as Suncor's Lease 86, Alsands, OSLO, and Alberta Research Council. This information was used to characterize the regional setting of the mine area. A summary of the regional information is provided in Section 3.

The detailed hydrogeologic investigation of the Study Area comprised the following, which are discussed in the proceeding paragraphs:

- Geophysical surveys (electromagnetic and ground penetrating radar);
- Interpretation of geologic logs from over 300 boreholes;
- Installation of standpipe and pneumatic piezometers; and
- Aerial reconnaissance by helicopter;
- Ground truthing;

- Analysis of groundwater samples for major ions, dissolved metals, organic compounds, toxicity, and stable isotopes; and
- Calculations to determine aquifer productivity and groundwater discharge rates to surface water bodies.

Site specific bedrock geology data was compiled from 316 borehole logs located in Leases 19, 25 and 97, Fee Lots 1 and 3. Of these, 57 boreholes were drilled and cored in the 1995 winter field season. The surficial material was logged in 46 of the boreholes. The borehole logs of holes completed with piezometers are presented in Appendix 1. The geologic information was used to create geologic cross sections, and structure and isopach maps of geologic units that are important to the EIA. The results of the geologic interpretation are discussed in Section 6.

Two surface geophysical surveys were conducted on the site in 1995. Drawing B-2779-02-02 shows the locations of the two surveys. A ground penetrating radar survey (GPR) was run along the east bank of the Athabasca River, as an extension of site investigation work for the proposed bridge across the river. The GPR survey was used to provide information about the bedrock topography, (AGI, 1995). A fixed frequency electromagnetic survey was run along cut lines, roads and on the uplands, (Associated Mining, 1995).

Piezometers, either standpipe or pneumatic, were installed at 20 locations in the Suncor Study Area, as shown in Drawing B-2779-02-02. Twelve 2 inch diameter standpipes were constructed, with response intervals in the following zones:

- 1 limestone piezometer
- 3 Basal Aquifer piezometers
- 6 piezometers in surficial deposits.

Pneumatic piezometers were installed at 10 locations, in the following units:

- 6 nested pairs of pneumatic piezometers in limestone
- 3 single pneumatic piezometers in limestone
- 1 single pneumatic piezometers in Oil Sands

The completion details for all the piezometers constructed in 1995 are presented in Appendix I. With the exception of piezometer FL1-BRDG-#4, the piezometers installed in surficial material were constructed in holes drilled with a small auger rig. The piezometers are all installed in the uppermost sand deposit. All piezometers completed in bedrock were installed in holes originally cored for bitumen exploration. Following coring, the holes were reamed, using a mud rotary drill rig, to permit the construction of 2 inch piezometers.

All standpipe piezometers were tested to determine hydraulic conductivity or transmissivity. Three sampling programs were conducted in March, July and September, of 1995. During each sampling event, water levels were measured in all standpipe and pneumatic piezometers. Water samples were collected from all standpipie piezometers for analysis of major ions, dissolved metals, organic compounds, toxicity (by Microtox), naphthenic acids and stable isotopes. The analyses of inorganics were conducted by Chemex Labs in Calgary. The analyses of organic compounds were performed by Envirotest Labs in Edmonton. The toxicity and naphthenic acids analyses were performed by Syncrude staff, in their Edmonton laboratory. Analyses of samples for the stable isotopes oxygen-18 and deuterium were conducted at the University of Calgary. The results of all field measurements and laboratory analyses are presented in Section 5 of this report.

Two field reconnaissance trips were made to the Study Area by Klohn-Crippen staff, in the spring and fall of 1995. The objectives of the trip were to familiarize the EIA team with the general conditions at the site, and to groundtruth interpretations of the site geology and hydrogeology made from desktop studies. Observations made during the trips have been incorporated in the discussions of results presented in Sections 4 and 5.

Calculations were made to determine aquifer productivity, and the rates of groundwater discharge to surface water. The productivity of the aquifers in surficial deposits and bedrock was assessed using calculations to determine their 20-year yield. The rates of groundwater discharge to the Athabsca River, Steepbank River, Shipyard Lake, Leggett Creek, Wood Creek and an unnamed creek in the Study Area were estimated, using values hydraulic gradients and hydraulic conductivity determined on-site. The results of these calculations are presented in Sections 5.3 and 5.4.

2. BACKGROUND INFORMATION

2.1 Study Area

The Study Area consists of approximately 175 km^2, located on the east side of the Athabasca River, in Townships 91 and 92, Range 9 W4M. The areas that Suncor is evaluating for mining are Leases 97, 25 and 19, and Fee Lots 1 and 3. The Study Area is shown in Drawing A-2779-02-01.

The physiography of the site is divided into uplands, valley slopes and floodplain, as shown in Drawing A-2779-02-01. The uplands slope gently toward the Athabasca River, from an elevation of 425 masl in the east, to 315 masl above the Athabasca River valley. The uplands are poorly drained, and covered with muskeg.

The upland, which includes most of the Study Area, is cut by the valleys of the Steepbank and Athabasca Rivers. The valley walls are 80 m high at the confluence of the two rivers. The slopes of the valleys are commonly steeper than 50°.

The Athabasca flood plain is at an elevation of approximately 235 masl. The floodplain is moderately to poorly drained, and locally covered with extensive muskeg-wetland (Schwartz, 1980). The river has irregular meanders, with occasional islands and bars.

2.2 Drainage

The Athabasca River, which forms the western boundary of the Study Area, flows northward and discharges into Lake Athabasca. There are seven drainage basins in the Study Area, which all drain into the Athabasca River. The size of each of these basins is listed in Table 1. Approximately 40% of the Study Area is drained by the Steepbank River, which discharges into the Athabasca River opposite the existing Suncor mine, as shown in Drawing B-2779-02-02. Twenty percent of the Study Area is drained by three small water courses to the south of the Steepbank River. These are Leggett Creek, Wood Creek, McLean Creek and an unnamed watercourse which drains to a large wetland (Shipyard Lake) in the Athabasca River valley. More information about the hydrology of the Study Area is presented in a separate hydrology baseline report (Klohn-Crippen, 1996).

Table 1
Major Drainage Basins in the Suncor Sutdy Area

Basins	Leases and Lots Affected	Total Drainage Area (km^2)
Steepbank River	Leases 19, 25 and 97: Fee Lot #1	1 320
An unnamed creek (Shipyard Lake)	Leases 19, 25 and 97: Fee Lots # 1 and #3	44.1
Leggett Creek	Lease 19	35.0
Wood Creek	Lease 19: Fee Lot #4	36.8
McLean Creek	Lease 19: Fee Lot #4	53.4
Athabasca 1	Lease 97: Fee Lot #1	4.0
Athabasca 2	Leases 19 and 97: Fee Lot #3	1.0
Athabasca 3	Lease 19	7.2

Note: Drainage areas measured to gauging station or, where ungauged, to the outlet.

2.3 Climate

The climate in the Athabasca Oil Sands area is characterized by long cold winters and short cool summers. Mean daily temperatures at Fort McMurray in January, average about -20°C while July temperatures average 17°C. The mean annual temperature at this location is 0.2°C. There are usually less than 120 frost-free days per year (Atmospheric Environment Service, 1993).

The average annual precipitation in the Study Area has been estimated to be 398 mm, of which almost three-quarters is rainfall (Klohn-Crippen 1996).

3. REGIONAL GEOLOGY AND HYDROGEOLOGY

3.1 Surficial Geology

The surficial geology of the Oil Sands region has been mapped by Bayrock (1971), Bayrock and Reimchen (1973) and McPherson and Kathol (1977). The work by McPherson and Kathol, because it is the most recent, is accepted here as the most accurate. An excerpt of the surficial geology map from McPherson and Kathol is shown in Drawing A-2779-02-03. This map shows the type of surficial material that is expected to occur in the shallow subsurface. A summary of the stratigraphic succession of surficial deposits in the region is provided in Table 2. The distribution of surficial sediments in the region can be characterized into three physiographic settings; uplands, valley slopes and floodplain.

3.1.1 Uplands

The majority of the region on the east side of the Athabasca River is an upland plain, with an elevation of 315 masl or greater. On the east side of the Athabasca River, the topography of the uplands is gently sloped toward the river. Much of the ground in the region is covered with muskeg. Thin, discontinuous deposits of aeolian sand are also common in the region, particularly where glaciofluvial sand is near the ground surface. The aeolian deposits may be too small and discontinuous to appear on the surficial geology map in Drawing A-2779-02-03. As indicated in Table 2, the surficial stratigraphy is the result of the advance and retreat of at least three glaciations. With each glacial advance, till was deposited. The till is an assorted mix of clay, silt, sand and cobbles. The three tills that have been identified in the region from the oldest to youngest are known as the unnamed till, the Firebag and the Fort Hills. The unnamed and Firebag tills are present in most of the region. The Fort Hills till is not believed to extend south of the Muskeg River (McPherson and Kathol, 1977).

As the glaciers retreated, stratified fluvial and lacustrine sediments were deposited. These deposits included glaciofluvial sands and gravels, and glaciolacustrine sands, silts and clays, which overly the till.

Table 2

Succession of Surficial Geologic Deposits in the Oil Sands Region

PERIOD	PHYSIOGRAPHIC SETTINGS	DESCRIPTION OF UNITS	
Quaternary	Uplands	Recent Sediments	Muskeg; generally less than 3 m thick aeolian deposits; fine to medium grained sand, in discontinuous thin sheets and dunes outwash deposits; commonly very fine to fine grained sand, with minor coarse sand.
		Upper Sediments	Stratified sand and gravel layers, till fragments, pebbles and boulders; mixed glacio-lacustrine deposits; stratified clay, silt and sand, with pebbles and till-like layers.
		Fort Hills Till	Low relief till; composed of sand silt and clay (68% silt), commonly with thin lenses of lacustrine clay and/or glaciofluvial sand.
		Lower Sediments (?)	Stratified glacio-lacustrine deposits; stratified clay, silt and sand.
			Outwash deposits; commonly very fine to fine grained sand, with minor coarse sand and gravel layers, till fragments, pebbles and boulders.
			Kames and kame moraine; composed primarily of stratified sand and silt, with minor gravel, clay and till lenses.
		Firebag Till	Low relief till, composed of sand, silt and clay, with gravel and boulders, usually in contact with bedrock.
		Unnamed Till	
		Undifferentiated till and stratified sediments	The existence of these deposits is inferred, based on the presence of vert thick drift sequences, and complex geophysical responses in boreholes in areas of thick drift.
	Valley Slopes	Recent Sediments	Eroded slope and gulley; discontinuous colluvial cover on slopes.
	Floodplains	Recent Sediments	Stream valley; discontinuous alluvial gravel, sand, silt and clay along streams.
			Alluvial sand; with minor silt and clay, confined mainly to the floodplain of the Athabasca River.
			Alluvial silt and clay; with minor sand and gravel, common along most streams usually discontinuous and less than 3 m thick.
		stratified Sediments	Meltwater channel sediment; fine to coarse-grained sand, with minor silt and clay, overlying thin sand and gravel and lag gravel with boulders, possibly early Athabasca river alluvium.
Cretaceous		Sandstone, siltstone and shale	

3.1.2 Valley Slopes

The valley slopes of the Athabasca and Steepbank Rivers are covered by a discontinuous layer of colluvium, chiefly composed of sandy and silty material, with some bituminous sand. Where the slopes are particularly steep, bedrock is exposed.

3.1.3 Floodplain

The Athabasca River valley has been incised into the Upper Devonian. The Athabasca floodplain is covered with an alluvial deposit of fine sand. Meltwater channel sediments, composed primarily of fine to coarse grained sand, are found below the alluvial deposits. The meltwater sediments are more or less continuous throughout the Athabasca River valley. The meltwater channel sediments are in contact with the Upper Devonian limestone.

The floodplains of smaller streams in the Oil Sands area are filled with thin, discontinuous alluvial deposits of silt and clay. The occurrence of these deposits in the Steepbank River valley is shown in Drawing A-2779-02-03.

3.1.4 Drift Thickness

An excerpt of McPherson and Kathol's (1977) map of the thickness of surficial deposits is shown in Drawing A-2779-02-04. In the uplands, the surficial deposits are commonly 7.5 m to 30 m thick. McPherson and Kathol identified an area south of the Steepbank River, near the middle of Lease 19, (Drawing A-2779-02-04) where the surficial deposits are up to 45 m thick.

In the Athabasca River valley, the surficial materials are generally less than 6 m thick (McPherson and Kathol, 1977). Outcrops of Upper Devonian and Cretaceous rock are visible in numerous places along the river valley. However, near Suncor's Tar Island Dike, over 40 m of surficial sand and gravel has been logged beneath the floodplain.

3.2 Regional Bedrock Geology

3.2.1 Regional Bedrock Topography

The bedrock surface in the region has been shaped by three main processes:

- glaciation
- fluvial erosion
- collapse of karst features

Beneath the uplands, the bedrock surface slopes gently toward the Athabasca River. On the east side of the Athabasca River, the elevation of the bedrock beneath the uplands ranges from approximately 460 masl 20 km from the river, to 315 masl at the edge of the escarpment. This surface has been incised by both preglacial and postglacial fluvial processes. The most obvious of these incisions are the courses of present-day rivers, including the Athabasca and Steepbank Rivers. In other investigations (McPherson and Kathol, 1977), channels in the bedrock surface commonly contain aquifer material. The elevation of the bedrock surface beneath the Athabasca River is approximately 220 masl.

Throughout the region, (McPherson and Kathol, 1977; Carrigy, 1973), depressions in the bedrock surface have been observed, that have been interpreted to be collapse structures in the underlying Upper Devonian surface.

The present-day surface topography masks all but the most pronounced structural features of the bedrock surface. The bedrock outcrops only in river valleys, where slopes are very steep.

3.2.2 Regional Bedrock Stratigraphy

The Cretaceous and Devonian geology in the Oil Sands region has been described by Cotterill and Hamilton (1995), Crickmay (1957), Carrigy (1959, 1973) and Norris (1963). The stratigraphy of the northern part of the Oil Sands region is presented in Table 3. A simplified geologic cross section of the regional bedrock stratigraphy is shown in Drawing B-2779-02-05. The thickness of the Cretaceous and Devonian section decreases toward the east. The depth to the underlying Precambrian surface also decreases to the east.

The Cretaceous deposits in the Oil Sands area consist of a succession of sandstones and shales that rest upon the eroded surface of the Devonian. Over most of the region, the Cretaceous strata are comprised of the Grand Rapids, Clearwater and McMurray Formations. The Grand Rapids Formation is an uncemented feldspathic sandstone. It is present only in areas where the bedrock elevation exceeds approximately 410 m (Carrigy, 1973). The Clearwater Formation is a glauconitic shale of marine origin. A glauconitic sandstone deposit at the base of the shale is known as the Wabiskaw Member. Commonly, the Wabiskaw sandstone contains heavy oil. It is therefore frequently considered part of the Oil Sands. In the Athabasca River valley, the bottom of the Clearwater Formation occurs at approximately 305 masl elevation.

The McMurray Formation, commonly referred to as the Oil Sands, is a series of quartz sandstone units, impregnated with heavy oil. As shown in the cross section in Drawing B-2779-02-05, the McMurray Formation is thickest where it has been deposited in depressions and channels in the surface of the underlying Devonian. In Suncor's active lease area, the McMurray Formation typically ranges in thickness from 45 m to 80 m. To the north, in the former Alsands area, the Oil Sands deposit is as great as 100 m thick.

In the lower portion of the McMurray Formation is a widespread, relatively continuous occurrence of sandstone which contains little or no heavy oil. This is known as the basal water sand, or commonly, the Basal Aquifer.

The Devonian strata form a wedge of westward dipping rock that sits directly on the Precambrian. The Upper Devonian strata consist of the Waterways, Slave Point and Fort Vermillion Formations. The Waterways Formation is also referred to as the Beaverhill Lake Group by some authors (Carrigy, 1963; Hackbarth and Nastasa, 1979). As shown in Table 3, the Waterways Formation has been subdivided into five limestone members. In the Athabasca River valley, the upper-most unit is the Moberly Member, which is a clastic limestone with beds of clastic lime mudstone, skeletal wackestone and shale (Cotterill and Hamilton, 1995). The rock outcrops along the Athabasca River and major tributaries between the Clearwater River and Fort MacKay. Exposures of the rock are described as rubbly and weathered (Carrigy, 1973). The subcrop of the Upper Devonian strata has been eroded, and exhibits a highly irregular surface. Relief on the Upper Devonian is as great as 100 m over distances as short as 1000 m (Hackbarth and Nastasa, 1979). The highly irregular surface is believed to be partly the result of karstification.

Below the Waterways Formation is the Slave Point Formation, which consists of wackestone and argillaceous lime mudstone. The Fort Vermillion Formation is made up of anhydrite, dolostone, and mudstone. Below this, the Middle Devonian deposits are present. As shown in Table 3, the Middle Devonian in the Oil Sands area is the Elk Point Group, which is comprised of the Watt Mountain, Prairie Evaporite, Methy and Contact Rapids Formations. The Watt Mountain Formation is a thin (10 m) layer of dolomitic shale. The Prairie Evaporite Formation is predominantly an anhydrite deposit. As shown in Drawing B-2779-02-05, it is believed to be discontinuous or absent on the east side of the Athabasca River. The Methy Formation is a reefal dolomite. The Contact Rapids Formation consists of dolomite, dolomitic siltstone, shale, anhydride and gypsum.

3.3 Regional Hydrogeology

3.3.1 Regional Hydraulic Conductivity Data

Hydraulic conductivity is a measure of a material's permeability to water. Materials with hydraulic conductivity values as high as 1×10^{-2} m/s are extremely permeable. Very coarse gravel is an example of such a material. Low values, in the order of 1×10^{-10} m/s are typical of low permeability material such as clay or unfractured shale. Transmissivity is another term used in this report in discussing permeability of aquifers. The transmissivity is the product of the hydraulic conductivity and the thickness of an aquifer. It is commonly determined from pumping tests, and is more indicative of the ability of an aquifer to produce water than hydraulic conductivity.

Table 3

Subsurface Stratigraphy of the Northern Part of the Athabasca Oil Sands Area, After Carrigy (1973), McPherson and Kathol (1975) and Cotterill and Hamilton (1995)

System or Series	Formation	Member	Lithology
Pleistocene and Recent			Clay, silt, sand, silt and gravel
	Erosional unconformity		
Cretaceous	Smoky Group		Shale
	LaBiche		Shale
	Dunvegan		Sandstone, siltstone and shale
	Shaftesbury		Shale, with sandstone and siltstone
	Manville Group		Sandstone
	Grand Rapids		Shale
	Clearwater	Wabiskaw	Glauconitic Sandstone
	McMurray	Upper	Sand, very fine, silt
		Middle	Sand, medium cross-bedded
		Lower	Sand, coarse, gravel, silt
	Erosional Unconformity		
Upper Devonian	Beaverhill Lake Group		
	Waterways	Mildred	Argillaceous Limestone
		Mobertly	Limestone
		Christina	Calcareous Shale
		Calumet	Clastic Limestone
		Firebag	Argillaceous Limestone
	Disconformity		
	Slave Point		Wackestone, mudstone and shale
	Fort Vermillion		Anhydrite, dolostone, minor mudstone
Middle Devonian	Elk Point Group		
	Watt Mountain		Dolomitic shale
	Prairie Evaporite		Salt, anhydride, gypsum, silty shale
	Winnipegosis (Methy)		Dolomite, in part reefal
	Contact Rapids		Dolomite, dolomitic siltstone, shale with minor anhydride and gypsum
Lower Devonian	Granite Wash (La Loche)		Arkosic Sandstone
	Erosional Unconformity		
Precambrian	Metasedimentary Rocks and Granite		

Hydraulic conductivity data from the Oil Sands region has been collected from published sources such as Hackbarth and Nastasa (1979), as well as from Alsands (1978b) and OSLO projects and Suncor's Lease 86. This information will provide an important basis with which to compare hydraulic conductivity measurements made at the Steepbank Mine site, presented in Section 5.

3.3.1.1 Surficial Materials

Table 4 provides a summary of hydraulic conductivity values measured in surficial materials in the region. The hydraulic conductivity of till, measured at the OSLO site, ranges from 5.3 x 10^{-8} m/s to 6.8 x 10^{-7} m/s, with a mean of 1.4 x 10^{-7} m/s.

The hydraulic conductivity of sand deposits tested at OSLO and Suncor ranges from 1.1 x 10^{-8} m/s to 9.2 x 10^{-5} m/s, with a mean of 1.1 x 10^{-5} m/s.

The hydraulic conductivity of sand and gravel deposits, measured in the floodplain at Suncor, ranges from 7.0 x 10^{-6} m/s to 1.0 x 10^{-3} m/s, with a mean of 3.8 x 10^{-4} m/s.

3.3.1.2 Bedrock Materials

The hydraulic conductivity of bedrock units measured in the Oil Sands region is summarized in Table 5. Hackbarth and Nastasa (1979) determined the hydraulic conductivity of the Clearwater Formation ranges from 1 x 10^{-9} m/s to 1 x 10^{-6} m/s, with a mean of approximately 1.5 x 10^{-7} m/s.

Tests conducted in the Oil Sands indicate that the hydraulic conductivity ranges between 3.5 x 10^{-9} m/s and 3.2 x 10^{-7} m/s, with a mean of 1.5 x 10^{-7}.

Extensive pumping tests have been conducted in the Basal Aquifer by Alberta Research Council (Hackbarth 1977) and others at the Alsands site, north of the Steepbank Mine area. The results of these tests are listed in Table 5. The hydraulic conductivity of the Basal Aquifer ranges from 1.5 x 10^{-7} m/s to 2.4 x 10^{-2} m/s, with a mean of 4.2 x 10^{-5} m/s.

The hydraulic conductivity of the Upper Devonian limestone ranges from 4.0 x 10^{-11}m/s to 3.0 x 10^{-5}m/s, with a mean of 5.1 x 10^{-7} m/s. Such a wide range of hydraulic conductivity in a limestone indicates that the rock is probably fractured. Descriptions of the Upper Devonian Strata in Carrigy (1973) and Cotterill and Hamilton (1995) support this interpretation. In some areas of the region, the Upper Devonian limestone may therefore be nearly as permeable an aquifer as the Basal Aquifer.

Below the Upper Devonian strata, the hydraulic conductivity of the underlying formations is generally very low. The hydraulic conductivity of the salt in the Prairie Evaporite Formation is in the order of 3.0 x 10^{-9} m/s. The hydraulic conductivity of the Methy Formation has been found to range from 2.6 x 10^{-10} m/s to 1.6 x 10^{-7} m/s, with a mean of 1.8 x 10^{-8} m/s.

3.3.2 Regional Groundwater Flow Directions

The groundwater flow systems conform to the classic principles of regional groundwater flow. Groundwater is recharged in uplands, and discharges in lowlands. All groundwater flow is directed to the Athabasca and Clearwater Rivers, as well as smaller rivers that have incised into the Upper Devonian strata, such as the Steepbank, Muskeg and MacKay Rivers.

In the surficial deposits in the uplands, the direction of groundwater flow is controlled by the hydraulic conductivity and bedrock topography. A shallow flow system exists in the surficial material, in which groundwater flows more or less horizontally toward the major surface water bodies. The topographic highs in the bedrock act as groundwater divides. Groundwater discharges from the surficial deposits through the colluvium to the river valleys.

In the floodplain of the Athabasca River, the groundwater flow in the surficial deposits is horizontal. The groundwater flows toward the river, with a slight downstream component to its direction.

In the Clearwater Formation and Oil Sands, the direction of groundwater flow is predominantly downward (Hackbarth and Nastasa, 1979). The cause of these gradients is probably due to the fact that these deposits have very low hydraulic conductivity, in comparison to the underlying Basal Aquifer..

The direction of groundwater flow in the Basal Aquifer is toward the Athabasca River, and into any stream valleys and depressions where the aquifer outcrops.

In the upper-most portion of the Upper Devonian rock, the flow is more or less horizontal toward the Athabasca River and deeply incised valleys. This is because the Upper Devonian limestone has a relatively high hydraulic conductivity in comparison to the Oil Sands above it, and the deeper limestone below it.

There is some evidence that the Upper Devonian Limestone and Basal Aquifer may act as a hydraulically connected unit. During pumping tests conducted by Alberta Research Council, the hydraulic head in the Upper Devonian Strata responded to pumping from the Basal Aquifer (Hackbarth and Nastasa, 1979). This implies that there may be some degree of groundwater flow between the two units.

Table 4

Summary of Regional Hydraulic Conductivity Data from Surficial Deposits

Hydrogeologic Unit	Minimum Hydraulic Conductivity (m/s)	Maximum Hydraulic Conductivity (m/s)	Mean Hydraulic Conductivity (m/s)
TILL	5.3×10^{-8}	6.8×10^{-7}	1.4×10^{-7}
SAND	1.1×10^{-8}	9.2×10^{-5}	1.1×10^{-5}
SAND AND GRAVEL	7.0×10^{-6}	1.0×10^{-3}	3.8×10^{-4}

Table 5

Summary of Regional Hydraulic Conductivity Data from Bedrock

Hydrogeologic Unit	Minimum Hydraulic Conductivity (m/s)	Maximum Hydraulic Conductivity (m/s)	Mean Hydraulic Conductivity (m/s)
Clearwater Formation	1×10^{-9}	1×10^{-5}	1×10^{-7}
Oil Sands	3.5×10^{-9}	3.2×10^{-7}	1.5×10^{-7}
Basal Aquifer	1.5×10^{-7}	2.4×10^{-4}	4.2×10^{-5}
Upper Devonian (Waterways Formation)	4.0×10^{-11}	3.0×10^{-5}	5.1×10^{-7}
Prairie Evaporite Formation	-	-	3.0×10^{-9}
Methy Formation	2.6×10^{-10}	1.6×10^{-7}	1.8×10^{-8}

3.3.3 Regional Groundwater Chemistry

Regional groundwater chemistry has been published by Schwartz (1979, 1980) and Hackbarth (1977). In addition, Suncor collects groundwater samples from its network of monitoring piezometers at its active mine. Table 6 shows a summary of groundwater chemistry data from muskeg and surficial deposits. Table7 summarizes groundwater chemistry from bedrock units. The descriptions of the water quality include the terms fresh, brackish and saline. These descriptions are based on the concentration of total dissolved solids (TDS) found in the water. The descriptions are based on the following ranges of TDS:

	TDS (mg/L)
Fresh	0 - 1000
Brackish	1000 - 20 000
Saline	20 000 - 35 000

The chemistry data presented in Table 6 was collected by Schwartz (1979) from the Muskeg River basin, which is several miles north of the Steepbank Mine Study Area. The table shows that the chemistry of water found in muskeg is generally very fresh, with an electric conductivity (EC) ranging from 50 μmhos/cm to over 800 μmhos/cm. The mean EC was found to be 137 μmhos/cm. The major ions in the muskeg water tend to be calcium, magnesium and bicarbonate. Muskeg water that has high levels of EC or sodium concentration probably has been influenced by groundwater discharge from bedrock (Schwartz, 1980).

The groundwater chemistry data has been collected from a variety of surficial deposits, including sand units, and till. The groundwater in the surficial units tends to be fresh. The total dissolved solids (TDS) ranges from 144 mg/L to 754 mg/L, with a mean of 520 mg/L. The major ions are predominantly calcium, magnesium and bicarbonate. Areas in which the groundwater in muskeg and surficial deposits has high levels of sodium and chloride are probably receiving water from bedrock units.

Data from chemical analyses of bedrock groundwater is shown in Table 7. Water in the Clearwater Formation is slightly brackish. The concentration of TDS reported in Schwartz (1979) ranged from 971 mg/L to 2762 mg/L, with a mean of 1794 mg/L. The major cations are sodium and potassium. Bicarbonate is the major anion. The sulphate and chloride concentrations in the Clearwater Formation appear to be higher than in the overlying surficial material.

Table 6

Regional Chemistry of Groundwater in Surficial Deposits

Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/L	SO4 mg/L	Cl mg/L	TDS[1] mg/L	EC µmhos/cm	Total ALK mg/L	Reference
Muskeg	Minimum		0.7	0.5	1.3	0	0	3.2	1.3		50	0	Schwartz 1980
	Maximum		33.6	9.9	212	2.4	566	15.6	9.1		84		
	Mean		17	4.9	4.1	0.6	80.7	5.9	2.4		137.0		
Surficial Deposits													
HC1	Clay, sandy	77/08/09	74.0	25.0	6.1	2.5	358.0	21.0	10.0	496.6	437.0	293.6	Schwartz 1979
HC2	Sand, clayey	77/08/08	35.5	10.0	3.9	1.3	156.0	7.7	0.3	214.7	256.0	127.9	Schwartz 1979
HC4	Clay	77/08/07	110.0	15.0	8.9	2.7	437.0	0.5	4.0	578.1	600.0	358.3	Schwartz 1979
HC6	Clay, silty	77/08/07	130.0	29.0	5.6	2.1	583.0	0.5	4.0	754.2	680.0	478.1	Schwartz 1979
HC7	Clay, silty	77/08/07	98.0	22.0	4.2	1.0	371.0	0.5	2.0	498.7	570.0	304.2	Schwartz 1979
HC8	Sand	77/08/07	38.7	22.0	12.4	2.7	250.0	0.5	4.0	330.3	363.0	205.0	Schwartz 1979
HC9	Sand	77/08/07	20.0	7.6	5.2	0.6	98.0	9.2	4.0	144.6	165.0	80.4	Schwartz 1979
HC10	Clay	77/08/07	117.0	25.0	7.3	2.0	484.0	3.5	4.0	642.8	695.0	396.9	Schwartz 1979
HC12	Clay	77/08/07	110.0	25.0	7.0	1.9	503.0	0.5	4.0	649.4	670.0	412.5	Schwartz 1979
HC13	Clay	77/08/08	110.0	30.0	16.0	2.2	534.0	9.5	4.0	705.7	690.0	437.9	Schwartz 1979
HC15	Clay	77/08/08	90.0	28.0	15.1	3.2	500.0	0.5	4.0	640.8	665.0	410.0	Schwartz 1979
HC16	Clay	77/08/08	73.4	21.3	7.6	2.0	368.0	0.5	4.0	476.8	508.0	301.8	Schwartz 1979
HC18	Clay, silty	77/08/08	82.0	33.0	14.6	8.9	499.0	0.5	4.0	642.0	650.0	409.2	Schwartz 1979
HC21	Silt and clay	77/08/06	66.0	35.0	7.0	2.1	428.0	0.5	10.0	548.6	550.0	351.0	Schwartz 1979
HC23	Silt	77/08/06	73.4	18.0	41.0	1.4	350.0	0.5	76.0	560.3	650.0	287.0	Schwartz 1979
HC25	Sand	77/08/11	27.0	11.01	36.0	5.8	236.0	15.8	4.0	335.7	375.0	193.5	Schwartz 1979
HC26	Sand	77/08/11	63.1	10.8	7.9	3.2	280.0	0.5	4.0	369.5	392.0	229.6	Schwartz 1979
HC27	Clay	77/08/07	110.0	26.0	10.4	1.1	430.0	10.0	4.0	591.5	625.0	352.6	Schwartz 1979
HC29	Clay	77/08/11	98.0	20.0	38.0	5.0	550.0	0.5	4.0	715.5	720.0	451.0	Schwartz 1979
	Minimum		20.0	7.6	3.9	0.6	98.0	0.5	0.3	144.6	165.0	80.4	
	Maximum		130.0	35.0	41.0	8.9	583.0	21.0	76.0	754.2	720.0	478.1	
	Mean		80.3	21.8	13.4	2.7	390.3	4.4	8.0	520.8	539.5	320.0	

Table 7
Regional Bedrock Groundwater Chemistry

Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/l	SO4 mg/L	Cl mg/L	TDS[1] mg/L	EC μmhos/cm	Total ALK mg/L	Reference
Clearwater Formation													
8-114	Clay	75/02/22	19.6	6.6	239.0	13.3	541.8	97.0	54.0	971	1100	444	Schwartz 1979
8-220	Clay	75/03/06	34.0	3.2	700.0	117.0	1898.0	5.7	4.0	2762	1800	1556	Schwartz 1979
8-370	Clay	75/03/23	17.9	7.0	409.0	15.4	1054.0	117.0	27.0	1647	1710	864	Schwartz 1979
	Minimum		17.9	3.2	239.0	13.3	541.8	5.7	4.0	971	1100	444	
	Maximum		34.0	7.0	700.0	117.0	1898.0	117.0	54.0	2762	1800	1556	
	Mean		23.8	5.6	449.3	48.6	1164.6	73.2	28.3	1794	1537	955	
McMurray Formation													
6-21	Oil Sands	75/09/11	31.0	5.2	17.5	1.7	4.6	2.5	12.0	208	280	4	
6-220	Oil Sands	75/09/11	6.9	21.1	1400.0	1017.0	2165.0	14.0	1600.0	37181	6500	1775	
7-135	Oil Sands	75/09/10	9.6	15.0	34520.8	768.9	768.9	6.6	756.7	13922	3390	630	
	Minimum		6.9	5.2	17.5	1.7	4.6	2.5	12.0	208	280	4	
	Maximum		31.0	21.1	34520.8	1017.0	2165.0	14.0	1600.0	37171	6500	1665	
	Mean		15.8	13.8	11979.4	381.2	768.9	6.6	756.7	13922	3389	630	
BP-2WA	Basal Aquifer	80/07/02	74.0	167.0	6281.0	63.0	3304.0	4.0	8550.0	16928	27400	2709	Hackbarth 1977
BP-4WA	Basal Aquifer	80/07/02	3.2	2.2	331.0	19.0	401.0	7.5	176.0	1032	1500	329	Hackbarth 1977
Fina 73-6	Basal Aquifer	80/07/02	8.5	20.0	625.0	15.0	1051.0	10.0	446.0	1652	2850	862	Hackbarth 1977
Fina 73-2	Basal Aquifer	80/07/02	11.0	21.0	203.0	11.3	647.0	6.0	49.0	643	1180	531	Hackbarth 1977
Tenneco	Basal Aquifer	79/07/07	9.0	0.6	118.0	6.7	361.0	6.7	2.0	366	525	296	Hackbarth 1977
Tenneco	Basal Aquifer	74/02/27	128.0	84.0	190.0	-	602.0	528.0	-	1532	-	494	Schwartz 1979
Tenneco	Basal Aquifer	74/02/18	42.0	62.0	161.0	-	431.0	344.0	-	1040	-	353	Schwartz 1979
7-337	Basal Aquifer	75/09/10	14.7	28.0	575.0	22.1	1239.0	2.7	218.0	2100	3200	1016	Schwartz 1979
	Minimum		3.2	0.6	118.0	6.7	361.0	2.7	2.0	366	525	353	
	Maximum		128.0	167.0	6281.0	63.0	304.0	528.0	8550.0	16928	27400	1016	
	Mean		36.3	48.1	1060.5	22.9	1004.5	113.6	1573.5	3162	6109	621	

Table 7
Regional Bedrock Groundwater Chemistry

Well ID	Unit	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/l	SO4 mg/L	Cl mg/L	TDS[1] mg/L	EC µmhos/cm	Total ALK mg/L	Reference
Upper Devonian													
BP-1W	Limestone	80/07/01	106.0	451.0	10281.0	101.0	1515.0	1.0	16750.0	29024	45000	1242	Hackbarth 1977
BP-2W	Limestone	80/07/02	39.0	152.0	7312.0	66.0	1659.0	1700.0	10250.0	19684	31300	1360	Hackbarth 1977
BP-3W	Limestone	80/07/02	13.0	12.0	975.0	9.0	464.0	36.0	1290.0	2576	4550	380	Hackbarth 1977
Env91-2A	Limestone	94/10/27	73.0	58.0	3579.0	19.6	2038.0	1.4	4910.0	9660	16013	1672	KCCL 1995
Env91-5	Limestone	94/11/09	21.9	22.5	2555.0	12.1	2607.0	2.1	2540.0	6458	10752	2138	KCCL 1995
Env92-6	Limestone	94/10/26	110.0	150.0	10626.0	52.4	2731.8	7.0	15480.0	27791	42508	2241	KCCL 1995
Env94-10A	Limestone	94/10/31	190.0	35.5	2086.0	7.8	782.6	48.2	3240.0	5999	10340	642	KCCL 1995
Env94-7	Limestone	94/11/03	336.0	105.0	1180.0	12.1	982.5	918.0	1710.0	4753	7670	806	KCCL 1995
Env94-8A	Limestone	94/10/31	171.0	28.0	207.0	6.3	597.3	58.6	338.0	1108	2011	490	KCCL 1995
Env94-9A	Limestone	94/10/31	113.0	25.2	1460.5	2.7	719.0	61.4	1940.0	3962	7183	590	KCCL 1995
	Minimum		13.0	12.0	207.0	2.7	464.0	1.0	338.0	1108	2011	380	
	Maximum		336.0	451.0	10626.0	101.0	2731.8	1700.0	16750.0	29024	45000	2241	
	Mean		117.3	103.9	4026.0	28.9	1409.6	283.4	5844.8	11807	17733	1156	
Prairie Evaporite													
7-594	gypsum	75/02/19	380	346	1688	67	422	2500	2875	8278	8000+	346	Schwartz 1979
Precambrian													
7-933	Granite	75/03/11	25.4	1.5	251	76	158	134	300	946	1480	130	Schwartz 1979

---

[1] Approximate

Groundwater in the Oil Sands ranges from being quite fresh to saline. The value of TDS, as shown in Table 7, ranges from 208 mg/L to 37 181 mg/L. The mean concentration of TDS was 13 922 mg/L. Sodium, chloride and bicarbonate are the major ions in groundwater from the Oil Sands.

The Basal Aquifer yields water that ranges from fresh to very brackish. The TDS reported by Schwartz (1979) and Hackbarth (1977) ranged from 366 mg/L to 16 928 mg/L. The mean concentration of TDS in the Basal Aquifer was 3162 mg/L. The major ions in the aquifer are sodium, bicarbonate and chloride. The sulphate level was also found to be quite high in two wells in the Alsands area (greater than 300 mg/L). In general, the groundwater in the Oil Sands and the Basal Aquifer appear to be quite similar. The concentration of dissolved compounds in both units varies by two orders of magnitude. They both have the same major ion chemistry. In one important characteristic, however, they are quite different; the Oil Sands contains a higher concentration of hydrocarbons.

The chemistry of groundwater in the Upper Devonian formations shown in Table 8 is from sites at Alsands and Suncor's active mine. The groundwater in the Upper Devonian strata is slightly brackish to saline. The concentration of TDS in the limestone ranged from 1108 mg/L to 29 024 mg/L, with a mean of 11 807 mg/L. Sodium, chloride and bicarbonate are the major ions in water in the Upper Devonian strata. In general, the data in Table 7 indicates that the groundwater in the Upper Devonian strata is more brackish than in the Basal Aquifer. Chloride is also more predominant in the Upper Devonian strata than in the Basal Aquifer.

Table 7 also provides chemistry data for groundwater from the Middle Devonian and Precambrian rock. Water from the Prairie Evaporite and Methy Formations is saline, with major ions being sodium, sulphate and chloride.

4. GEOLOGY OF THE STEEPBANK MINE AREA

4.1 Surficial Geology

An examination of the borehole logs for the 1995 drilling program confirms, in general, the interpretation of the surficial geology by McPherson and Kathol (1977). Table 2 presents a summary of the stratigraphic sequence proposed by McPherson and Kathol. The following discussion describes the surficial deposits found in the uplands, valley slopes and floodplain at the Steepbank Mine area.

4.1.1 Uplands

On the uplands, the simplified stratigraphic column is as follows:

Muskeg
Stratified Sediments
Till
Bedrock

Cross sections through the surficial deposits in the uplands have been prepared. A map showing the locations of the sections is provided in Drawing B-2779-02-06. Two cross sections (A and B) are shown in Drawing B-2779-02-07.

4.1.1.1 Muskeg

From a helicopter flight over the site, it was confirmed that the majority of the uplands area is covered with muskeg. Borehole logs from the 1995 drilling program show the muskeg is generally less than 1 m thick.

4.1.1.2 Stratified Sediments

Below the muskeg, sand was encountered in over half of the boreholes in which surficial materials were logged. From descriptions on the logs, these sediments are interpreted to be either glaciofluvial outwash or mixed glaciolacustrine sediments. Where they are present, the thickness of the sand units ranges from 1 m to 10 m. As shown in the cross sections in Drawing B-2779-02-07, and the isopach map in Drawing B-2779-02-09, the thickest sand deposits were found in Lease 97.

The stratified sediments form a discontinuous layer of sand over the Steepbank Mine area. The presence of the shallow sand in the area suggests that the outwash and glaciolacustrine sediments referred to by McPherson and Kathol (1977) extend farther south than is shown in the surficial geology map in Drawing A-2779-02-03.

4.1.1.3 Till

Till has been deposited over nearly the entire upland area. The descriptions of till in the logs provided by Suncor resemble the Firebag till, as described by McPherson and Kathol (1977). The till is predominantly a sandy loam, increasing in clay content with depth. The composition of the Firebag till bears a resemblance to the bedrock beneath it. In the centre and east portions of the Study Area, the till overlies shale of the Clearwater Formation. In these locations, the lower till horizons are clayey, and appear to contain rafted or re-worked Clearwater shale. On the west side of the Study Area, where the Clearwater Formation has been eroded, the till is in contact with Oil Sands. Correspondingly, the borehole logs describe the till as being more sandy, with bitumen odour. The total thickness of the till ranges from zero to 28 m in the boreholes that have been logged. The till contains some sand layers and lenses of 1 m or 2 m thick.

The presence of the unnamed till at the Study Area was not confirmed with the 1995 drilling results.

Generally, the distribution of the till found in the 1995 boreholes agrees with the surficial geology map prepared by McPherson and Kathol (1977) shown in Drawing A-2779-02-03, with a few exceptions. As shown in cross section B (Drawing B-2779-02-07), the till was absent in borehole L9795005. In this area, stratified sand sediments rest directly on bedrock.

4.1.1.4 Deep Undifferentiated Till and Stratified Sediments

McPherson and Kathol (1977) suggested that unidentified deposits of till and stratified sediments may exist in areas where surficial deposits are very thick. Their investigation indicates that the drift in portions of Lease 19 may be up to 45 m thick. Unfortunately, the 1995 drilling program did not explore these areas. It is possible that coarse grained sediments may exist in these portions of Lease 19.

4.1.2 Valley Slopes

The valley slopes along the Steepbank River and the east side of the Athabasca River are covered with colluvium. The colluvium consists mainly of sandy and silty material, with some bituminous sand. The thickness of these deposits is not known. However, it probably ranges from zero to several 10's of metres, where the slopes are less steep. The bedrock is exposed on slopes that are particularly steep.

4.1.3 Floodplain

The Athabasca River valley has been eroded into the Upper Devonian limestone. Valley sediments consist of discontinuous alluvial gravel, sand silt and clay that contact the Upper Devonian surface. The floodplain on the east bank of the Athabasca River is comprised of organic material and alluvial sand silt and clay, with some sand and gravel deposits. The results from geotechnical drilling in the fall of 1995 indicate that the sand and gravel is very clean, with no silt or clay sized material.

4.1.4 Thickness of Surficial Deposits

A map showing the thickness of surficial deposits is shown in Drawing B-2779-02-08. Data used to produce the map was taken from borehole logs from Leases 97 and 25, Fee Lots 1 and 3, and the GPR survey (AGI, 1995) in the Athabasca River valley. On the uplands, the thickness of surficial material ranges from 1 m to 45 m. The surficial deposits are thinnest along the edge of the scarp of the river valleys. The thickest surficial deposits are located in the southeast part of Lease 25, and in Lease 19. The drift thickness map by McPherson and Kathol (1977), shown in Drawing A-2779-02-04, is more or less consistent with the map prepared for this study.

However, their map extends farther south. It shows that the thickest surficial deposits (50 m) occur east of Leggett Creek in Lease 19.

On the valley slopes, the surficial deposits are generally less than 1 m thick. Along the Steepbank River, in Lease 97 and Fee Lot 1, the valley walls are very steep, and the bedrock outcrops. In the Athabasca floodplain, the GPR survey indicated the alluvial and channel sediments are up to 25 m thick. Beneath the river near Tar Island Dyke, the surficial material has been found to be over 40 m thick.

4.2 Bedrock Geology

From the results of the compilation of borehole data, the simplified bedrock stratigraphy of the Steepbank Mine area is as follows:

- Clearwater Formation
- McMurray Formation Oil Sands
- Basal Aquifer
- Upper Devonian

The bedrock topography in the area is presented in Drawing B-2779-02-10. Six cross sections through the bedrock have been prepared. A map showing the locations of the cross sections is shown in Drawing B-2779-02-11. The cross sections are shown in Drawings B-2779-02-12 to B-2779-02-17. An isopach of the Basal Aquifer is shown in Drawing B-2779-02-18. The structure of the Basal Aquifer is presented in Drawing B-2779-02-19. The structure if the Upper Devonian surface is shown in Drawing B-2779-02-20.

4.2.1 Local Bedrock Topography

The bedrock topography map shown in Drawing B-2779-02-10 illustrates that the bedrock surface generally resembles the ground surface. The topographic contours of the bedrock surface are essentially parallel to the Athabasca River. In the uplands, the bedrock surface generally slopes toward the Athabasca River. The bedrock elevation ranges from 260 masl to greater than 400 masl at the eastern extent of the Study Area. Beneath the Athabasca River, the bedrock elevation is less than 200 masl.

A comparison of the thickness of surficial deposits (Drawing B-2779-02-08) and the bedrock topography (Drawing B-2779-02-10) reveals that depressions in the bedrock surface are filled with thick deposits of surficial material. Therefore, the location of depressions in the bedrock are generally not evident from the ground surface. Depressions in the bedrock surface also tend to correspond with depressions in the Upper Devonian surface (Drawing B-2779-02-20). The presence of these depressions is evidence of collapse features in the Devonian limestone. They also suggest that the collapse processes were active until the late Cretaceous, after the Clearwater Formation was deposited.

Existing borehole data do not indicate the presence of any channel-like features in the bedrock surface, as are present in the OSLO area. Throughout Alberta, Pleistocene deposits of sand and gravel have been deposited in bedrock channels. Such deposits are important aquifers and sources of aggregate around the province. It appears that no such deposits occur in the Steepbank Mine area.

4.2.2 Clearwater Formation

The Clearwater Formation is present over most of the uplands in the Study Area. It extends to the edge of the river valley, where it subcrops beneath the surficial deposits. The edge of the Clearwater Formation is shown on the bedrock topography map in Drawing B-2779-02-10. As shown in cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17), the deposit forms a wedge of material that thickens from west to east. The thickness of the deposit ranges from zero to 30 m.

4.2.3 McMurray Formation Oil Sands

The Oil Sands deposit in the Study Area ranges in thickness from 50 m to 75 m. As illustrated in the cross sections in Drawings B-2779-02-12 to B-2779-02-17, the Oil Sands subcrops in the Athabasca River valley and the lower reach of the Steepbank River. The edge of the Oil Sands deposit is shown in the bedrock topography map in Drawing B-2779-02-10. Borehole data supplied by Suncor indicate that interburden deposits occur sporadically in the Oil Sands. The composition of the interburden was not noted on the data sheets.

The Oil Sands is underlain by the Basal Aquifer in most of the Study Area. In many depressions in the Devonian surface, there is Oil Sands below the Basal Aquifer. This is shown clearly in cross section D, (Drawing B-2779-02-13), in which there is nearly 20 m of Oil Sands in a depression below the Basal Aquifer.

4.2.4 Basal Aquifer

The distribution and thickness of the Basal Aquifer in the Study Area is shown in the isopach map in Drawing B-2779-02-18. There are large portions of Leases 97 and 25 where the aquifer is absent. From field observations in the Steepbank River valley, it has been interpreted that the aquifer is absent from the northeast corner of the Study Area. However there is only limited borehole information to support this interpretation.

The thickness of the Basal Aquifer ranges from zero to 50 m. The aquifer is thickest on the north side of the Steepbank River, in the north end of Fee Lot 1. There is also a 35 m thick occurrence of the aquifer around the east end of Fee Lot 3.

As shown in cross sections C to H, (Drawings B-2779-02-12 to B-2779-02-17), the Basal Aquifer is thickest where it overlies depressions in the Devonian surface. Furthermore, the places where the Basal Aquifer is absent coincide with topographic highs on the Devonian surface. For example, in the isopach map (Drawing B-2779-02-18), there is a meandering feature in Lease 97 and Fee Lot 1 where the aquifer is absent. This feature may be mistaken for a fluvial element. However, from the structure map of the Devonian surface (Drawing B-2779-02-20), it can be seen that the underlying limestone surface is high, and the Basal Aquifer material has been draped around it.

Drawing B-2779-02-19 is a structure map of the top of the Basal Aquifer. Where the aquifer is present, the elevation of its upper surface ranges from 216 masl to 282 masl. Where the aquifer is thin, (less than 15 m), the structure of the aquifer reflects the structure of the underlying Devonian. However, because depressions in the Devonian surface are filled with thick deposits of Basal Aquifer, the thick occurrences of aquifer mask the underlying limestone surface.

4.2.5 Upper Devonian

A structure contour map of the Upper Devonian surface is presented in Drawing B-2779-02-20. The map illustrates the surface of the Devonian is an undulating erosional unconformity, ranging in elevation from 190 masl to 290 masl. Several closed depressions are present on the Devonian surface, which suggest that some subsidence due to karstification and collapse have taken place. Topographic highs are also apparent, at numerous locations on the surface. As shown in the cross sections in Drawings B-2779-02-13 to B-2779-02-17, the surface of the Upper Devonian strata subcrops along the Athabasca River and the lower portion of the Steepbank River. In places, outcrops of limestone stand up to 10 m above river level.

Observations made on core samples and outcrops revealed that the Upper Devonian limestone is highly fractured and weathered. Some of the fractures contain clay. The cause of the fractures is probably related to weathering processes or karstification.

5. HYDROGEOLOGY OF THE STEEPBANK MINE AREA

5.1 Surficial Materials

5.1.1 Uplands

Five piezometers have been constructed in surficial deposits in the uplands of the Steepbank Mine area. The location of the piezometers (L97-P95-OBS#1, -OBS#2, -OBS#3, -OBS#4 and -OBS#5) is shown in Drawing B-2779-02-02. The piezometers are all completed in shallow sand deposits, above the till. Four piezometers were subjected to rising head tests to determine the hydraulic conductivity of the sand. Piezometer L97-P95-OBS#4 was not tested, because the electrical conductivity of its water was too low to activate a depth sounder.

5.1.1.1 Hydraulic Conductivity of Surficial Material in Uplands

The hydraulic conductivity determined from the tests is summarized in Table 8. The hydraulic conductivity of the sand ranges from 4.0×10^{-7} m/s to 2.0×10^{-5} m/s, with a mean of 3.7×10^{-6} m/s. This is within the range calculated from piezometer tests elsewhere in the region (shown in Table 4).

The hydraulic conductivity of the till in the Study Area has not been measured. However, it is reasonable to assume that hydraulic conductivity of the till is similar to what was found elsewhere in the region. As shown in Table 4, the hydraulic conductivity of the till ranges from 5.3×10^{-8} m/s to 6.8×10^{-7} m/s, with a mean of 1.4×10^{-7} m/s. This is the same order of magnitude as the Clearwater Formation, (Table 5).

Table 8
Hydraulic Conductivity of Surficial Deposits in the Study Area

Piezometer	Hydrogeologic Unit	K m/s
L97-P95-OBS#1	Sand	4.0×10^{-5}
L97-P95-0BS#2	Silty Sand	6.0×10^{-7}
L97-P95-OBS#3	Sand	2.0×10^{-5}
L97-P95-0BS#5	Sand	4.0×10^{-7}
	Geometric Mean	3.7×10^{-6}

5.1.1.2 Groundwater Flow in Surficial Material in Uplands

The upland is predominantly covered with permeable sand which overlies less permeable till. The groundwater flow in the surficial materials is controlled by two factors: the hydraulic conductivity of the surficial deposits, and the topography of the ground and underlying geologic units. The groundwater flows horizontally in the more permeable surficial units. Drawing B-2779-02-21 shows an interpretation of the direction of horizontal flow in the surficial materials.

The direction of the horizontal flow is controlled by the site's topography. On the north side of the Steepbank River, the ground surface slopes toward the Steepbank River. Therefore groundwater in the surficial material also flows toward the river.

On the south side the Steepbank River, the majority of the upland area slopes toward the Athabasca River. As shown in Drawing B-2779-02-21, there is a divide in the ground surface very close to the south bank of the Steepbank escarpment. Therefore, the majority of the shallow groundwater flows toward the Athabasca River. A small percentage of the groundwater flows toward the south bank of the Steepbank River. As it reaches the edge of the uplands, the groundwater discharges into the colluvium on the valley slopes, and flows into the river valleys.

In the till, the hydraulic gradient is probably downward except where the till has been incised by stream channels. This is because the hydraulic conductivity of the till is similar to hydraulic conductivity of the underlying Clearwater Formation. The rate of flow through the till is probably much less than the flow through the sandier shallow sediments.

5.1.1.3 Groundwater Chemistry in Surficial Materials in the Uplands

Groundwater samples were collected from five piezometers in the uplands in the Steepbank Mine area in March, July and September 1995. The analytical results from these samples (piezometers L97-P95-OB#1, -OB#2, -OB#3, -OB#4, and -OB#5) are tabulated in Tables 9 and 12. The complete analytical results are included in Appendix 2. A Piper plot, which is a graphical presentation of the major ion chemistry of the water, is shown on Drawing B-2779-02-22 for each sampling event.

The surficial groundwater ranges from extremely fresh (TDS = 24 mg/L) to fresh (TDS = 622 mg/L). The Piper plot in Drawing B-2779-02-22 illustrates that there are two types of water in the surficial sand deposits; low TDS water and high TDS water. The low TDS groundwater is generally a calcium-magnesium bicarbonate type water, while the high TDS groundwater is a sodium-bicarbonate type water. The ratio of sulphate to total dissolved solids is higher in the low TDS water than the high TDS water. There is a higher chloride concentration (although still less than 15 mg/L) in the high TDS water. The pH ranges from 5.9 to 8.1, with an average of 7.1 units.

Trace amounts of organics, including PAH and alkylated PAH's, were found in the surficial groundwater collected from -OB#5 as shown in Table 11. Naphthenic acid values range from <3 to 7 mg/L, and Microtox toxicity testing indicates the water is non-toxic, as shown in Table 12.

Groundwater samples collected in October 1995 were analyzed for the stable isotopes deuterium and oxygen-18. Grab samples were also collected from the Steepbank River, Shipyard Lake, and La Saline Lake, which is north of the Study Area. Stable isotope analyses are used to help understand the source of a water, and the processes that have affected it. A scatter plot of the deuterium and oxygen-18 concentrations in the water samples is shown in Drawing A-2779-02-23. The groundwater from surficial deposits plots along the meteoric water line.

Table 9
Major Ion Chemistry and Field Measured Parameters of Groundwater in the Study Area

Well ID	Date	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO4 mg/L	Total Alk mg/L	Bicarbonate mg/L	TDS mg/L	Specific Cond umhos/cm	pH units
SURFICIAL DEPOSITS												
L97-P95-OB-1	03/17/95	78	22	10.4	1.93	1.2	23.8	305	372	324	580	7.19
L97-P95-OB-1	07/03/95	79.8	19.9	8.8	2.3	0.7	18.3	262	319	290	514	7.68
L97-P95-OB-1	09/12/95	71.9	18.7	9.8	2.6	0.7	16.5	245	299	270	478	7.49
L97-P95-OB-2	03/17/95	25	7.4	186	4.18	9.6	0.7	491	599	532	873	7.56
L97-P95-OB-2	06/29/95	22.8	6.2	189	3.3	14.2	0.8	485	591	532	883	8.1
L97-P95-OB-2	09/13/95	21.4	6.1	195	3.1	10	0.8	481	586	530	885	7.75
L97-P95-OB-3	03/17/95	5.1	0.89	1.66	0.51	<0.5	10.2	9.86	12	24	43	5.56
L97-P95-OB-3	07/04/95	3.3	0.9	4.2	0.7	<0.5	9.9	7.14	9	24	35	5.65
L97-P95-OB-3	09/12/95	3.8	1.1	4.6	1.2	9.7	9	8	10	34	39	5.61
L97-P95-OB-4	03/13/95	4.35	1.29	2.3	1.12	<0.5	9.7	14.72	18	28	48	5.62
L97-P95-OB-4	07/03/95	7.7	1.5	3.2	0.8	3.1	11	12.44	15	35	54	5.87
L97-P95-OB-4	09/12/95	4.6	1.4	5.2	1.1	2.2	10.5	8.01	10	30	50.3	5.76
L97-P95-OB-5	03/13/95	64	17.8	159	2.85	7.8	10.2	566	690	607	1010	7.13
L97-P95-OB-5	07/05/95	53.7	14.4	178	2.1	9.3	5.4	576	702	614	1011	7.45
L97-P95-OB-5	09/14/95	52	14	190	2.4	10.2	5	573	698	623	1048	7.44
FL7-BRDG-4	03/13/95	14.2	3.24	8.9	1.49	4.6	28.8	31.56	38	81	142	6.23
FL7-BRDG-4	07/06/95	17.7	3.4	11.1	1.4	4.2	26.5	51	62	96	174	6.48
FL7-BRDG-4	09/13/95	20.5	3.5	6.2	1.5	4.3	25.5	48	59	92	175	6.6
minimum		3.3	0.89	1.7	0.51	0.7	0.7	7.14	9	24	35	5.56
maximum		79.8	22	195	4.18	14.2	28.8	576	702	623	1048	8.1
mean		30.5	8.0	65.2	1.9	6.1	12.4	231.9	283	265	447	6.73
BASAL AQUIFER												
L97-P95-1-BA	03/13/95	76	105	4880	31.6	6520	1	2125	2590	12909	21860	6.98
L97-P95-1-BA	06/28/95	87.3	92.6	5040	36.7	6220	0.5	2146	2616	12785	21467	7.44
L97-P95-1-BA	09/12/95	85.4	102	5030	34.8	6685	1	2161	2634	13255	21506	7.19
L97-P95-3-BA	03/13/95	45	57	3290	29.9	3880	1.2	1878	2289	8448	14220	7.2
L97-P95-3-BA	07/04/95	52.3	53.8	3320	25.1	4220	<0.5	1886	2299	8821	14025	7.4
L97-P95-3-BA	09/13/95	47.1	43.3	3140	17.8	4090	30.5	1888	2301	8519	14326	7.33
FL3-P95-6-BA	03/13/95	190	158	6720	82.2	10200	5	1451	1769	18240	30840	7.11
FL3-P95-6-BA	07/10/95	193	209	9140	85.3	12800	11.3	2011	2451	23664	39218	7.15
FL3-P95-6-BA	09/15/95	198	223	10700	62	16850	80	2083	2539	29383	43358	7.12
L97-P95-8-BA	06/28/95	16	8.4	1080	28.6	599	6.9	1445	1761	2620	4238	7.76
L97-P95-8-BA	09/13/95	13.7	7.8	1180	20	678	13	1797	2191	3008	4948	7.45
FL3-P95-13-BA	03/13/95	85	103	3230	26.8	3920	1.3	2045	2493	8613	14010	7.13
FL3-P95-13-BA	07/05/95	89.1	80.5	3150	26.2	3920	0.5	2099	2559	8546	13709	7.19
FL3-P95-13-BA	07/05/95	89.1	81.2	3080	26.4	3883	<0.5	2097	2556	8438	13709	7.22
FL3-P95-13-BA	09/14/95	90.6	82.7	3050	24.1	4090	0.6	2073	2527	8601	14499	7.21
minimum		13.7	7.8	1080	17.8	599	0.5	1445	1761	2620	4238	6.98
maximum		198	223	10700	85.3	16850	80	2161	2634	29383	43358	7.76
mean		90.5	93.8	4402	37.2	5904	11.8	1946	2372	11723	19062	7.26
UPPER DEVONIAN												
L97-P95-2-L	03/13/95	25.8	20.5	1560	25.8	1440	2.4	1602	1953	4051	6967	7.39
L97-P95-2-L	06/29/95	27.7	21.6	1860	24.4	1535	0.5	1826	2226	4582	7860	7.74
L97-P95-2-L	09/14/95	26.3	24.7	1870	24.1	1690	16.5	1913	2332	4818	8226	7.65
L97-P95-2-L	09/14/95	24.1	20.5	1850	21	1860	<0.5	1901	2317	4934	8261	7.56
minimum		24.1	20.5	1560	21	1440	0.5	1602	1953	4051	6967	7.39
maximum		27.7	24.7	1870	25.8	1860	16.5	1913	2332	4934	8261	7.74
mean		26.0	21.8	1785	23.8	1631	6.5	1811	2207	4596	7829	7.59

Table 10

Concentrations of Dissolved Metals and Cyanide in Groundwater in the Study Area (mg/L)

Parameter	Surficial Sand				Basal Aquifer				Limestone			
	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples
Aluminum	< 0.01	0.05	0.5	18	< 0.01	0.02	0.07	15	0.02	0.025	0.04	4
Arsenic (µg/L)	< 0.2	0.3	0.5	6	< 0.2	0.2	1.6	5	0.6	0.6	0.6	1
Barium	< 0.01	0.06	0.21	18	0.16	0.75	3	15	0.17	0.205	0.24	4
Beryllium	< 0.001	< 0.001	0.002	18	< 0.001	< 0.001	0.002	15	< 0.001	< 0.001	< 0.001	4
Boron	< 0.01	0.025	0.79	18	2.33	3.87	4.45	15	3.2	3.735	4	4
Cyanide	< 0.001	0.001	0.001	12	< 0.001	0.001	0.002	11	0.001	0.001	0.001	3
Cadmium (µg/L)	< 3	< 3	4	18	< 3	< 3	3	15	< 3	< 3	< 3	4
Chromium	< 0.002	< 0.002	0.013	18	< 0.002	< 0.002	0.018	15	< 0.002	< 0.002	0.002	4
Cobalt	< 0.003	< 0.003	0.004	18	< 0.003	0.005	0.031	15	< 0.003	< 0.003	0.004	4
Copper	< 0.001	0.001	0.003	18	< 0.001	0.002	0.008	15	0.001	0.0015	0.004	4
Iron	< 0.01	0.07	0.42	18	< 0.01	0.7	5.63	15	< 0.01	0.75	0.82	4
Lead	< 0.02	< 0.02	< 0.02	18	< 0.02	< 0.02	0.04	15	< 0.02	< 0.02	< 0.02	4
Lithium	< 0.001	0.005	0.055	18	0.355	0.753	1.79	15	0.291	0.3655	0.387	4
Manganese	0.007	0.068	0.589	18	0.029	0.277	4.02	15	0.034	0.0835	0.099	4
Mercury (µg/L)	< 0.05	< 0.05	0.1	12	< 0.05	< 0.05	1.6	9	< 0.05	0.075	0.23	4
Molybdenum	< 0.003	< 0.003	0.006	18	< 0.003	< 0.003	0.019	15	0.003	0.005	0.009	4
Nickel	< 0.005	0.0065	0.018	18	< 0.005	< 0.005	0.113	15	< 0.005	< 0.005	0.007	4
Phosphorous	< 0.1	< 0.1	0.4	18	< 0.1	< 0.1	0.7	15	< 0.1	< 0.1	< 0.1	4
Selenium (µg/L)	< 0.2	< 0.2	0.4	12	< 0.2	< 0.2	0.8	8	< 0.2	< 0.2	< 0.2	4
Silver (µg/L)	< 2	< 2	3	18	< 2	< 2	5	15	< 2	< 2	3	4
Sulphur	0.5	3.5	10	18	1.4	2.6	25.7	15	2.8	3.45	3.7	4
Strontium	0.027	0.101	0.302	18	0.487	4.14	14.7	15	1.26	1.38	1.49	4
Titanium	< 0.003	< 0.003	0.012	18	< 0.003	< 0.003	0.012	15	< 0.003	< 0.003	< 0.003	4
Uranium	< 0.5	< 0.5	< 0.5	18	< 0.5	< 0.5	< 0.5	15	< 0.5	< 0.5	< 0.5	4
Vanadium	< 0.002	< 0.002	0.003	18	< 0.002	< 0.002	0.009	15	< 0.002	< 0.002	< 0.002	4
Zinc	0.004	0.012	0.04	18	< 0.001	0.004	0.009	15	0.004	0.004	0.014	4

Table 11

Concentrations of Organic Compounds in Groundwater in the Study Area ($\mu g/L$)

	Surficial Sand				Basal Aquifer				Limestone			
	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples
PAH and Alkylated PAH's												
Naphthalene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.05	5	< 0.02	0.035	0.05	2
Acenaphthene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.03	0.04	5	0.04	0.06	0.08	2
Fluorene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.02	0.06	5	0.07	0.075	0.08	2
Dibenzothiophene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	0.02	0.02	2
Phenanthrene	< 0.02	< 0.02	< 0.02	6	0.02	0.03	0.07	5	0.11	0.125	0.14	2
Anthracene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2
Fluoranthene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2
Pyrene	< 0.02	< 0.02	0.02	6	< 0.02	< 0.02	< 0.02	5	< 0.02	0.025	0.03	2
Benzo(a)anthracene/Chrysene	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.02	5	< 0.02	0.03	0.04	2
Methyl naphthalene	< 0.02	< 0.02	< 0.02	6	< 0.02	0.04	0.07	5	< 0.02	0.03	0.04	2
C2 sub'd naphthalene	< 0.04	< 0.04	< 0.04	6	< 0.04	0.09	0.32	5	< 0.04	0.05	0.06	2
C3 sub'd naphthalene	< 0.04	< 0.04	0.17	6	0.04	0.12	0.82	5	0.31	0.42	0.53	2
C4 sub'd naphthalene	< 0.04	< 0.04	0.2	6	< 0.04	0.09	0.5	5	0.19	0.27	0.35	2
Biphenyl	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	< 0.04	5	< 0.04	< 0.04	< 0.04	2
Methyl biphenyl	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	< 0.04	5	< 0.04	0.04	0.04	2
C2 sub'd biphenyl	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	< 0.04	5	< 0.04	0.075	0.11	2
Methyl acenaphthene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.06	5	< 0.04	0.06	0.08	2
Methyl fluorene	< 0.04	< 0.04	0.04	6	< 0.04	0.04	0.14	5	0.08	0.125	0.17	2
C2 sub'd fluorene	< 0.04	< 0.04	0.06	6	< 0.04	0.07	0.13	5	0.09	0.155	0.22	2
Methyl phenanthrene/anthracene	< 0.04	< 0.04	< 0.04	6	0.05	0.1	0.13	5	0.22	0.265	0.31	2
C2 sub'd phenanthrene/anth	< 0.04	< 0.04	0.05	6	< 0.04	0.09	0.23	5	0.15	0.25	0.35	2
C3 sub'd phenanthrene/anth	< 0.04	< 0.04	0.06	6	< 0.04	0.05	0.21	5	0.11	0.2	0.29	2
C4 sub'd phenanthrene/anth	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.16	5	0.04	0.085	0.13	2
Methyl dibenzothiophene	< 0.04	< 0.04	< 0.04	6	< 0.04	0.06	0.16	5	0.12	0.18	0.24	2
C2 sub'd dibenzothiophene	< 0.04	< 0.04	0.04	6	< 0.04	0.08	0.13	5	0.15	0.29	0.43	2
C3 sub'd dibenzothiophene	< 0.04	< 0.04	0.06	6	< 0.04	0.09	0.24	5	0.19	0.32	0.45	2
C4 sub'd dibenzothiophene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.06	5	< 0.04	0.15	0.26	2
Methyl fluoranthene/pyrene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.06	5	< 0.04	0.045	0.05	2
Methyl B(a)A/chrysene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.05	5	< 0.04	0.045	0.05	2
C2 sub'd B(a)A/chrysene	< 0.04	< 0.04	< 0.04	6	< 0.04	< 0.04	0.05	5	< 0.04	0.05	0.06	2
Phenolic Compounds in Water												
o-Cresol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	< 0.1	5	0.1	0.1	0.1	2
p-Cresol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	0.2	5	0.3	0.3	0.3	2
2,4-Dimethylphenol	< 0.2	< 0.1	< 0.1	6	< 2	< 0.2	< 0.1	5	0.1	0.15	0.2	2
PANH and Alkylated PANH's												
7-Methyl quinoline	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	4	5	< 0.02	< 0.02	< 0.02	2
C2 Alkyl subst'd quinolines	< 0.02	< 0.02	< 0.02	6	< 0.02	< 0.02	0.32	5	< 0.02	< 0.02	< 0.02	2
Volatile Organics (MS):Water	nd	nd	nd		nd	nd	nd		nd	nd	nd	
Hydrocarbons, Recoverable (mg/l)	< 1	< 1	< 1	3	< 1	3	5	3	< 1		< 1	1

Table 12 - Naphthenic Acid and Microtox Test Results in Groundwater from the Study Area

WELL	DATE	Field Conductivity	Field pH	Microtox IC50 15 min %	Microtox IC40 15 min %	Microtox IC30 15 min %	Microtox IC20 15 min %	Naphthenic Acid
Surficial Sand								
L97-P95-OB-1	03/17/95							
L97-P95-OB-1	07/03/95	515	7.81	100	100	100	100	<4
L97-P95-OB-1	09/12/95	450	7.71	100	100	100	100	5
L97-P95-OB-2	03/17/95							
L97-P95-OB-2	06/29/95	939	8.07	100	100	100	100	6
L97-P95-OB-2	09/13/95	841	8.05	100	100	100	100	5
L97-P95-OB-3	03/17/95							
L97-P95-OB-3	07/04/95		5.93	100	100	100	100	<3
L97-P95-OB-3	09/12/95	4290	5.95	100	100	100	100	4
L97-P95-OB-4	03/13/95							
L97-P95-OB-4	07/03/95	69	7.16	100	100	100	100	<3
L97-P95-OB-4	09/12/95	47	6.34	100	100	100	100	4
L97-P95-OB-5	03/13/95							
L97-P95-OB-5	07/05/95	955	7.16	100	100	100	100	6
L97-P95-OB-5	09/14/95	968	7.48	100	100	100	100	7
FL7-BRDG-4	03/13/95							
FL7-BRDG-4	07/06/95	487	8.46	100	100	100	100	2
FL7-BRDG-4	09/13/95	181	7.55	100	100	100	100	1
Basal Aquifer								
L97-P95-1-BA	03/13/95							
L97-P95-1-BA	06/28/95	21500	7.18	100	100	100	100	22
L97-P95-1-BA	09/12/95	20700	7.41	100	100	100	100	21
L97-P95-3-BA	03/13/95							
L97-P95-3-BA	07/04/95	14210	6.17	100	100	100	100	31
L97-P95-3-BA	09/13/95	14100	7.28	100	100	100	71	29
FL3-P95-6-BA	03/13/95							
FL3-P95-6-BA	07/10/95	38400	6.51	100	100	100	100	8
FL3-P95-6-BA	09/15/95	43500	6.96	100	100	100	100	9
L97-P95-8-BA	06/28/95	3820	8.03	100	100	100	80	31
L97-P95-8-BA	09/13/95	4710	7.5	100	100	91	34	36
FL3-P95-13-BA	03/13/95							
FL3-P95-13-BA	07/05/95	12280	6.71	100	100	100	100	13
FL3-P95-13-BA	07/05/95	12010	6.66	100	100	100	100	12
FL3-P95-13-BA	09/14/95	14030	7.06	100	100	100	100	12
Limestone								
L97-P95-2-L	03/13/95							
L97-P95-2-L	06/29/95	7770	7.66	100	100	100	59	47
L97-P95-2-L	09/14/95	7620	7.55	100	100	100	75	52
L97-P95-2-L	09/14/95	8150	7.55	100	100	100	49	57

This indicates that the groundwater is meteoric, and has not been affected by any processes such as evaporation.

In general, the chemistry of surficial groundwater from the uplands in the Study Area resembles the regional data presented in Table 6. As a preliminary assessment, it appears that the low TDS groundwater is associated with interaction with water from muskeg. The high TDS groundwater in the surficial sand is probably more closely associated with flow from till and bedrock deposits.

5.1.2 Valley Slopes

Groundwater flow in the slope colluvium is expected to be in the direction of the slope. Localized groundwater discharge occurs along some breaks in slope, and where contrasts in hydraulic conductivity occur.

Evidence of groundwater discharge from the surficial deposits was apparent on both the north and south banks of the Steepbank River. The slopes of the Steepbank and Athabasca Rivers are saturated and unstable in areas.

The groundwater flowing through the colluvium is expected to originate mainly from the surficial deposits on the uplands. The chemistry of the groundwater in the colluvium is therefore probably similar to the chemistry of water in the surficial deposits in the upland. In localized areas, seepage from the Oil Sands beneath the colluvium is likely to be occurring. Where there is seepage, the groundwater in the colluvium may be brackish, with high concentrations of sodium, chloride, and possibly some organic compounds.

5.1.3 Floodplain

5.1.3.1 Hydraulic Conductivity of Surficial Material in Floodplain

One piezometer, FL1-BRDG-#4, was completed in the alluvium in the Athabasca River valley. Unfortunately, the piezometer could not be adequately developed, so it was not tested to determine hydraulic conductivity. The colluvium at the site consisted of 85 per cent sand, with 15 per cent silt and clay (Appendix 1). The hydraulic conductivity of the alluvium is therefore expected to be similar to that measured in sand at Suncor. From Table 4, the range of hydraulic conductivity of sand in the area ranges from 1.1×10^{-8} m/s to 1.0×10^{-3} m/s, with a mean of 1.1×10^{-5} m/s.

The hydraulic conductivity of meltwater sediments in the floodplain has not been measured in the Study Area. The sand and gravel deposits at Suncor are probably a suitable surrogate of what occurs on the east side of the river.

From Table 4, the range of hydraulic conductivity of sand and gravel at Suncor ranges from 7.0 x 10^{-6}m/s to 1.0 x 10^{-3}m/s, with a mean of 3.8 x 10^{-4}m/s.

5.1.3.2 Groundwater Flow in Surficial Material in the Floodplain

The direction of groundwater flow in the floodplain deposits is toward the Athabasca River, with a slight downstream component reflecting the influence of the gradient of the river. The surficial material is believed to be in hydraulic connection with the slope colluvium, the Basal Aquifer and the Upper Devonian.

5.1.3.3 Groundwater Chemistry in Surficial Material in the Floodplain

The groundwater from FL1-BRDG-#4 is representative of one type of water that will be found in the floodplain. Because the predominant direction of groundwater flow in all hydrogeologic units is toward the Athabasca River, the groundwater in the floodplain probably contains mixtures of freshwater from precipitation and surficial deposits, brackish water from bedrock discharge, and possibly river water from bank storage. The chemistry of groundwater in the floodplain is therefore expected to be quite variable, both spatially and temporally.

Groundwater samples from sediments in the floodplain were collected from piezometer FL1-BRDG-#4 in March, July and September. The major ion chemistry of the sample is shown in Table 9. The water is very fresh, with TDS ranging from 81 to 96 mg/L. As shown in the Piper plot in Drawing B-2779-02-22, the water from FL1-BRDG-#4 is very similar to the low TDS groundwater found in the uplands. It is probably groundwater from muskeg and shallow sand deposits that is flowing from the uplands, down through the colluvium toward the river.

Microtox toxicity testing indicates the groundwater is non toxic. Naphthenic acid values range from 1 to 2 mg/L, as shown in Table 15. The surficial groundwater isotopes from this well plot on the meteoric water line (Drawing A-2779-02-23).

5.2 Bedrock Materials

5.2.1 Clearwater Formation

5.2.1.1 Hydraulic Conductivity of Clearwater Formation

The hydraulic conductivity of the Clearwater Formation has not been measured in the Study Area. Hackbarth and Nastasa (1979) found that the hydraulic conductivity ranged from 1.0 x 10^{-9} m/s to 1.0 x 10^{-6} m/s, with a mean of 1.5 x 10^{-7} m/s as shown in Table 5. These values are slightly higher than would be expected for a massive shale deposit. They indicate that fractures and sandstone layers influence the hydraulic conductivity of the formation.

5.2.1.2 Groundwater Flow in Clearwater Formation

The primary direction of groundwater flow in the Clearwater Formation is expected to be downward in the Study Area. The hydraulic head in the overlying surficial deposits is near groundwater level. The head in the Basal Aquifer is 30 m to 70 m below ground, as shown in cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17). Therefore, the hydraulic gradient across the Clearwater is downward. Because the Clearwater Formation has relatively low hydraulic conductivity, the rate of flow through the shale is not great.

5.2.1.3 Chemistry of Groundwater in Clearwater Formation

No groundwater samples have been collected from the Clearwater Formation in the Study Area. The regional data in Table 7 indicates that the groundwater in the Clearwater Formation is slightly brackish, with sodium and bicarbonate being the major ions.

5.2.2 McMurray Oil Sands

5.2.2.1 Hydraulic Conductivity of Oil Sands

The Oil Sands has also not been tested for hydraulic conductivity in the Study Area. As shown in Table 5, the hydraulic conductivity of Oil Sands in the region has been found to range between 3.5 x^{-9} m/s and 3.2 x 10^{-7} m/s. Hydraulic conductivity in the order of 1.5 x 10^{-7} m/s is expected to be representative of Oil Sands in the Study Area.

5.2.2.2 Groundwater Flow in McMurray Oil Sands

The direction and rate of groundwater flow in the Oil Sands is similar to flow in the Clearwater Formation The hydraulic gradient is predominantly downward in the Study Area. The rate of flow in the Oil Sands is low, because of the relatively low hydraulic conductivity of the unit.

Where the Oil Sands is exposed in the river valleys, some groundwater may seep out of the slope face from zones of lower oil saturation. The amount of water flowing through these zones is expected to be small, and not significant in terms of this EIA.

5.2.2.3 Chemistry of Groundwater in McMurray Oil Sands

No groundwater samples have been collected from the Oil Sands in the Study Area. The regional groundwater chemistry data in Table 7 indicates that the groundwater in the Oil Sands varies widely from fresh to saline. Sodium, chloride and bicarbonate are the major ions in groundwater. Organic compounds are also found in groundwater from the Oil Sands.

5.2.3 Basal Aquifer

5.2.3.1 Hydraulic Conductivity of the Basal Aquifer

Four piezometers in the Basal Aquifer in the Study Area were subjected to short term pumping tests. Table 13 shows the transmissivity calculated from the response in the piezometers. The transmissivity ranged from 0.07 m^2/day to 11.2 m^2/day, with a mean of 2.0 m^2/day. The hydraulic conductivity range from 8.6 x 10^{-8} m/s to 0.6 x 10^{-5} m/s, with a mean of 4.1 x 10^{-6} m/s. These values are approximately an order of magnitude less than what was found in the Alsands area (Table 5). This indicates that the Basal Aquifer in the Study Area may not be quite as productive as in the Alsands area.

5.2.3.2 Groundwater Flow in the Basal Aquifer

The predominant direction of groundwater flow in the Basal Aquifer is west, toward the Athabasca River. The hydraulic head measured in the aquifer is plotted on cross sections C to H (Drawings B-2779-02-12 to B-2779-02-17). The head in the aquifer is 306 masl in piezometer FL1-P95-13-BA (Drawing B-2779-02-24). Closer to the Athabasca River, the head approaches the level of the river. Farther to the east, the head in the aquifer is expected to approach ground level, as has been found at Alsands.

A horizontal component of flow in the Basal Aquifer is also expected to be directed toward the Steepbank River. This flow occurs in places where the Steepbank River has incised below the bottom of the Oil Sands. In places where the Upper Devonian surface is high, and the Basal Aquifer is absent, groundwater probably flows from the Basal Aquifer through the Devonian. Therefore, at the west end of the Steepbank River, which has cut into the limestone, groundwater probably flows from the Basal Aquifer, through the limestone, and discharges into the river. This interpretation is supported by the fact that both the Basal Aquifer and Upper Devonian have similar hydraulic conductivities and heads. The groundwater flow map presented in Drawing B-2779-02-24 shows the direction of flow in the Basal Aquifer and Upper Devonian.

5.2.3.3 Chemistry of Groundwater in the Basal Aquifer

Groundwater from four piezometers (L97-P95-1-BA, L97-P95-3-BA, FL3-P95-6-BA and FL3-P95-13-BA) was collected in March, July and September, 1995. The data in Table 9 shows groundwater in the Basal Aquifer is brackish to saline. The major ions are sodium, potassium, chloride and bicarbondate. The TDS of the water ranged from 2620 mg/L to 29 383 mg/L, with a mean of 11 723 mg/L. This is slightly higher than the range of concentrations found in the Basal Aquifer in the Alsands area (Table 7). In general, the water quality in the aquifer in the Study Area is very similar to the regional water in the Basal Aquifer.

Table 13

Summary of Transmissivity and Hydraulic Conductivity Measured in Bedrock in the Study Area

Piezometer/Well Number	Location	Date	Thickness (m)	Flow (Q) (m^3/day)	Transmissivity (T) (m^2/day)	Hydraulic Conductivity (m/s)
L97-P95-1-BA	7-20-92-9W4	1995/03	5.8	6	11.2	2.2×10^{-5}
L97-P95-3-BA	6-20-92-9W4	1995/03	3.6	5	1.8	5.8×10^{-6}
FL3-P95-6-BA	12-9-92-9W4	1995/03	9.8	3	0.07	8.6×10^{-8}
FL1-P95-13-BA	13-28-92-9W4	1995/03	5.0	11	11.2	2.6×10^{-5}
			Geometric Mean		2.0	4.1×10^{-6}
Waterways Fm.						
L97-P-95-2-L	15-17-92-9W4	1995/03	4.5	6	2.2	5.8×10^{-6}

Organic compounds, in particular PAH, alkylated PAH's, PANH and alkylated PANH's, were detected in groundwater from the Basal Aquifer as shown in Table 11. Naphthenic acid values range from 8 to 36 mg/L with a mean of 20 mg/L (Table 12). Microtox toxicity testing indicates the groundwater is non-toxic. Basal Aquifer groundwater isotopes plot on the meteoric water line, (Drawing A-2779-02-23) indicating the water is meteoric.

An additional note about groundwater in the Basal Aquifer concerns natural gas. Gas was observed to effervesce from the groundwater when exposed to atmospheric pressure.

5.2.4 Upper Devonian

5.2.4.1 Hydraulic Conductivity of the Upper Devonian

Piezometer L97-P95-2-L was subjected to a short pumping test. The transmissivity of the Upper Devonian limestone calculated from the test results was 2.2 m^2/day, as shown in Table 13. In terms of hydraulic conductivity, this equates to 5.8×10^{-6} m/s. This is within the range of values found for the Upper Devonian elsewhere in the region (Table 5). It is also the same order of magnitude as the hydraulic conductivity of the Basal Aquifer.

5.2.4.2 Groundwater Flow in the Upper Devonian

As has been discussed in Section 5.3.2 above, it appears likely that groundwater flow in the Basal Aquifer and Upper Devonian is interconnected. As shown in the cross sections in Drawing B-2779-02-12 to B-2779-02-17, the hydraulic head in the two units is similar. Because the two units have similar hydraulic conductivity, there is no hydraulic barrier to impede flow between them. Furthermore, as can be seen in the cross sections, the Upper Devonian surface protrudes above the top of the Basal Aquifer in many locations. Therefore water flowing horizontally through the Basal Aquifer probably flows through the highs in the Upper Devonian surface and back into the Basal Aquifer. This interpretation is consistent with observations made by Hackbarth and Nastasa (1979).

As in the Basal Aquifer, the primary direction of groundwater flow in the Upper Devonian is toward the Athabasca River. There is also a component of groundwater flow toward to lower reach of the Steepbank River, where the river is incised below the bottom of the Oil Sands. The direction of horizontal flow in the Upper Devonian and Basal Aquifer is illustrated in the groundwater flow map in Drawing B-2779-02-24.

Vertical hydraulic gradients, both upward and downward, are also present in the Upper Devonian strata. These gradients were measured in pairs of nested pneumatic piezometers (L97-P95-4A,B-L, L97-P95-5A,B-L, L97-P95-7A,B-L, L97-P95-9A,B-L, and L97-P95-14A,B-L). The locations of the piezometers are shown in Drawing B-2779-02-02. The cross sections in Drawings B-2779-02-12, B-2779-02-14 and B-2779-02-15 show the elevation of head in some of these piezometers. The pattern of vertical gradients in the Upper Devonian strata is not yet understood.

5.2.4.3 Chemistry of Groundwater in the Upper Devonian

Groundwater from the Upper Devonian limestone was collected from piezometer L97-P-2-L in March, June and September 1995. The major ion chemistry of the water is shown in Table 9. The groundwater from the limestone is brackish, with TDS ranging from 4051 to 4934 mg/L. This is within the range of concentrations from in the Upper Devonian at Alsands and Suncor, but lower than the mean level of 11 807 mg/L (Table 7). The major ions in the groundwater are sodium, chloride and bicarbonate, which is also consistent with what has been found elsewhere in the region.

Organic compounds, in particular PAH, alkylated PAH's and phenolic compounds, were detected in groundwater from the Upper Devonian limestone (Table 11). Naphthenic acid values range from 47 to 57 mg/L, with a mean of 52 mg/L (Table 12). Microtox toxicity testing indicates the groundwater is non-toxic. Upper Devonian groundwater isotopes plot on the meteoric water line, indicating the groundwater is meteoric (Drawing A-2779-02-23).

5.3 Potential for Groundwater Use as a Resource

Currently, there are no groundwater users in the Study Area. There are no water wells on the east side of the Athabasca River or south of the Steepbank River within 10 km of the Study Area.

The potential for groundwater to be used in the area as a resource is dependant upon the productivity of the aquifers, and the natural quality of the groundwater. The productivity of the aquifers has been assessed on the basis of their long term yield. In Alberta, this is commonly quantified by calculating the 20-year yield, or Q_{20} (Alberta Environment 1983). The Q_{20} is an estimate of the maximum rate at which water can be withdrawn from a well for 20 years that will not lower the water level in the well below the top of the aquifer. It is calculated using the following equation:

$$Q_{20} = 0.683 \; T \; H \; F$$

where,

T = transmissivity of the aquifer, m2/day

H = available drawdown in the aquifer, m

F = a factor of safety, in this case assumed to be 0.7.

The recommended minimum Q_{20} for a single dwelling in Alberta is 1 m^3/day (Alberta Environment 1983).

The water quality of the aquifers has been assessed on the basis of CCME (1991) criteria and the concentrations of naturally-occuring organic compounds. Table 15 shows a summary of the water quality parameters in the groundwater that exceed the CCME guidelines.

There are two potential sources of groundwater from surficial deposits. These are the sand aquifer in the uplands, and the sand and gravel aquifer in the Athabasca River valley.

Table 14
Groundwater Quality Parameters Which Exceed CCME Guidelines

	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)	Iron (mg/L)	Mercury (mg/L)	Manganese (mg/L)
Median Concentration Found in Groundwater at Steepbank Mine						
Basal Aquifer	3290	4090	8613	0.7	1.6	0.28
Limestone	1855	1613	4700	0.75	0.23	0.08
Surficial Aquifer	9.4	4.3	183	0.07	1	0.07
CCME Guidelines						
Drinking Water	200	250	500	0.3	1	–
Irrigation	–	–	500-3500	5	–	0.01-0.05
Watering Livestock	–	100-700	3000	–	–	0.5

In the upland, the water quality in the sand aquifer is good, as discussed in Section 5.1. However, the productivity of the aquifer is limited by the following factors:

- relatively low hydraulic conductivity;
- the thinness of the aquifer; and
- lack of available drawdown.

The mean hydraulic conductivity of the aquifer is 3.6 x 10^{-6} m/s (Table 8). The aquifer ranges in thickness from 1 m to 10 m, with an average of less than 3 m. Therefore the transmissivity of the aquifer (the product of hydraulic conductivity and thickness) is roughly 0.95 m^2/day or less. The available drawdown, which is the difference between the elevations of the potentiometric surface and the top of the aquifer, is approximately 2 m. From the equation shown above, the Q_{20} for the sand aquifer is estimated to 0.9 m^3/day, which is less than the recommended minimum of 1 m^3/day. The sand aquifer in the upland is therefore not a viable source of water for domestic use.

In the Athabasca River valley, the surficial sand and gravel aquifer is expected to be more productive. As has been discussed in Section 5.1, the hydraulic conductivity of the aquifer is expected to be in the order of 3.8×10^{-4} m/s (Table 4). Although the aquifer is limited areally to the valley, it is hydraulically connected to the river. Therefore, wells can probably be constructed in the aquifer that will induce water from the Athabasca River. The long-term yield from this aquifer is therefore expected to be greater than 780 m^3/day.

In the bedrock aquifers (the Basal Aquifer and Upper Devonian limestone), the transmissivity is 2 m^2/day, and the available drawdown is in the order of 40 m. Therefore, the Q_{20} for the bedrock aquifers is approximately 40 m^3/day, which would be adequate for many water supply purposes. However, the water quality in the bedrock is poor. As shown in Table 15, the water exceeds CCME criteria for sodium, chloride, mercury, iron, manganese and total dissolved solids. Furthermore, as shown in Tables 11 and 12, the bedrock groundwater contains naturally-occurring organic compounds. The groundwater is therefore not suitable for drinking water or agricultural use, without pre-treatment. Hence the bedrock aquifers are not a valuable water supply resource, with the exception perhaps, as industrial water supply.

5.4 Groundwater/Surface Water Interaction

The interaction of groundwater with surface water bodies in the Steepbank Mine area is expected to be the most important issue of the hydrogeologic component of the EIA. As has been discussed in Sections 3 and 5, groundwater from both the surficial material and the bedrock flows toward the river valley. This section discusses the rate of groundwater discharge into the surface water bodies in the Study Area: the Athabasca River, the Steepbank River, Shipyard Lake, and the small creeks that drain the Study Area; Leggett Creek, Wood Creek, and an unnamed creek (shown in Drawing A-2779-02-01).

5.4.1 Methodology

The groundwater discharge has been calculated for flow from surficial deposits and bedrock. The water in muskeg has not been included as groundwater. Flow from muskeg is presented in the hydrology component of the EIA.

The discharge of groundwater has been estimated using the following equations, which are adaptations of Darcy' Law:

from surficial aquifers;

$$Q = K\,b\,i\,L$$

from bedrock aquifers

$$Q = T\,i\,L$$

where;

Q = the rate of discharge into the river
K = the hydraulic conductivity of the aquifer, m/s
b = the thickness of the aquifer, m
T = the transmissivity of the aquifer, m2/day
i= the hydraulic gradient in the aquifer, m/m
L = the length of reach over which the aquifer is exposed to the surface water body, m.

A thin veneer of sandy material is present within the surficial deposits over most of the uplands in the Study Area. Because it is believed that the hydraulic conductivity of the sand is much higher than that of any other surficial deposits, the sand is the only surficial deposit for which groundwater discharge has been calculated. The mean hydraulic conductivity of the sand is 3.7×10^{-6} m/s (Table 8). There is not enough water level information from the surficial aquifer to determine the hydraulic gradient. It has therefore been assumed that the hydraulic gradient in the surficial aquifer in the upland is approximately equal to the gradient of the land surface.

In the bedrock, the two main aquifers are the Basal Aquifer and the limestone in the Upper Devonian strata. The formations that are above these deposits (McMurray Oil Sands and Clearwater shale) are several orders of magnitude less permeable to water than these aquifers. The mean transmissivity of the Basal Aquifer is 2.0 m^2/day (Table 13). The transmissivity of the limestone has been found to be 2.2 m^2/day. The Basal Aquifer is present in only a small portion of the area that will actually be excavated to mine the ore. The limestone is present over the entire site. As the transmissivities of the two units appear to be so similar, and the Basal Aquifer is discontinuous, groundwater discharge from bedrock has been calculated using a transmissivity of 2.0 m^2/day.

The estimated rates of groundwater discharge from the surficial and bedrock aquifers to surface water are shown in Table 15. The discharge to each surface water body is discussed below.

Table 15

Baseline Flow Rates of Groundwater Discharge to Surface WaterBodies in the Study Area

	Discharge Rates (L/s)						
Source	Athabasca River	Steepbank River	Shipyard Lake	Leggett Creek	Wood Creek	unnamed creek	TOTALS
Surficial Deposits	0.44	0.22	0.17	0	0	0	0.83
Bedrock Aquifers	0.93	0.20	0.56	0	0	0	1.69
TOTALS	1.37	0.42	0.73	0	0	0	2.52

5.4.2 Athabasca River

The length of the reach of the Athabasca River in the Study Area that will be adjacent to the mine area is approximately 8 km. Shipyard Lake, which will probably intercept groundwater before it discharges into the Athabasca River, is approximately 3 km long. Therefore, the length over which groundwater will discharge directly to the Athabasca River is roughly 5 km.

The gradient of the ground surface in the upland is about 0.01. Therefore, as explained above, the hydraulic gradient of the surficial aquifer is estimated to be 0.01. The thickness of the surficial aquifer in the upland varies across the site. North of the un-named creek (Drawing B-2779-02-09), the average thickness of the sand unit is roughly 3 m. South of the un-named creek, it is approximately 1.5 m thick. The length of river on the north side of the creek is approximately 3 km. The rate of groundwater discharge on the north side of the creek from the surficial aquifer is therefore approximately 0.33 L/s (29 m^3/day). On the south side of the creek, the length of river (less the length of Shipyard Lake) is roughly 2 km. Therefore, the rate of groundwater discharge on the south side of the creek is approximatley 0.11 L/s (9.5 m^3/day). Hence, the total baseline groundwater discharge from the surficial aquifer to the Athabasca River is 0.44 L/s (38 m^3/day).

The hydraulic gradient in the bedrock aquifers has been estimated from Drawing B-2779-02-24 to be 0.008. Therefore, the rate of groundwater discharge from the bedrock aquifers to the Athabasca River is approximately 0.93 L/s (80 m^3/day).

5.4.3 Steepbank River

The length of the reach of the Steepbank River that will be adjacent to the proposed mine area is approximately 2 km. The slope of the ground surface, and therefore the hydraulic gradient in the surficial aquifer, is roughly

0.01. Therefore, the rate of groundwater discharge from the surficial aquifer to the Steepbank River is 0.22 L/s (19 m^3/day).

The hydraulic gradient toward the Steepbank River from the bedrock aquifers (Drawing B-2779-02-24) is about 0.004. Therefore, the groundwater discharge from the bedrock aquifers to the Steepbank River is 0.20 L/s (16 m^3/day).

5.4.4 Shipyard Lake

The groundwater discharge from the Study Area to Shipyard Lake can be estimated in the same manner as was done for discharge to the Athabasca River. The only change between the two calculations is the length of wetland over which the discharge occurs. Shipyard Lake is approximately 3 km long. Therefore, the rate of groundwater discharge into the wetland from the surficial aquifer is 0.17 L/s (15 m^3/day). The rate of groundwater discharge into the wetlands from the bedrock aquifers is 0.56 L/s (48 m^3/day). It is possible that some of the groundwater flowing in the bedrock aquifers may pass under Shipyard Lake, and discharge into the Athabasca River. Therefore, this estimate of groundwater discharge to Shipyard Lake may represent a slight overestimate.

5.4.5 Leggett Creek, Wood Creek and Unnamed Creek

The baseflows (i.e. winter flows) in Leggett Creek, Wood Creek and the unnamed creek are zero, (Klohn-Crippen 1996). This indicates that the rate of groundwater discharge into the creeks in winter is zero. Based on observations made during field visits, it is expected that the rate groundwater discharge to these creeks is essentially zero.

5.4.6 Summary of Groundwater/Surface Water Interaction

The rates of groundwater discharge from the surficial and bedrock aquifers in the Study Area to surface waters are very low. As shown in Table 15, the total rate of groundwater discharge to all surface water bodies in the Study Area is estimated to be 2.52 L/s. The rates of groundwater discharge to the Athabasca River, the Steepbank River, and Shipyard Lake are 1.37 L/s, 0.42 L/s and 0.73 L/s, respectively. In comparison, the minimum monthly flows recorded in the Athabasca and Steepbank Rivers (Klohn-Crippen 1996) are:

Athabasca River	101,000 L/s
Steepbank River	168 L/s.

The average inflow to Shipyard Lake has been estimated to be (Klohn-Crippen 1996):

Shipyard Lake	111 L/s.

Therefore, the rates of groundwater discharge in the Study Area are less than 1 % of the minimum average surface water flows in the Athabasca and Steepbank Rivers, and less than 1 % of the average flow into Shipyard Lake.

6. CONCLUSIONS

6.1 Geology

The geology of the surficial deposits is characterized in three physiographic settings; uplands, valley slopes and floodplain. The stratigraphy of surficial deposits in the uplands is, from top to bottom:

muskeg
stratified sediments
till
bedrock

Most of the upland is covered with muskeg, which is generally less than 1 m thick. The underlying stratified sediments form a discontinuous layer of sand over the Study Area. The sand appears to be glaciolacustrine or glaciofluvial in origin. The stratified sediments range in thickness from 1 m to 10 m. Beneath the stratified sediments, till rests on bedrock over nearly the entire upland. The till ranges from being sandy, where it rests on sandstone, to very clayey, where it is in contact with shale. From its lithology, the till appears to be the Firebag till described by McPherson and Kathol (1977). The thickness of the till ranges from zero at the edge of the uplands to 28 m. The total thickness of the surficial deposits in the uplands ranges from 1 m to 45 m. The thickest deposits appear to be in Lease 19. There is no evidence of buried channel deposits in the uplands.

The valley slopes along the Steepbank River and the Athabasca River are covered with colluvium, which consists mainly of sandy and silty material, with some bituminous sand.

The floodplain on the east bank of the Athabasca River is comprised of organic material and alluvial sand silt and clay, with some sand and gravel meltwater deposits. The thickness of sediments in the floodplain is as great as 25 m.

The simplified bedrock stratigraphy in the area is:

Clearwater Formation
McMurray Oil Sands
Basal Aquifer
Upper Devonian

Shale of the Clearwater Formation is the uppermost bedrock unit over most of the upland. The shale is approximately 10 m thick in the east portion of the Study Area, and thins toward the west. The Oil Sands deposit in the Study Area is between 50 m and 75 m thick. It subcrops in the Athabasca River valley and outcrops along the lower reaches of the Steepbank River.

The Basal Aquifer is an extensive discontinuous unit within the McMurray Formation. The aquifer is generally positioned at the bottom of the Oil Sands, and is commonly absent above topographic highs in the surface of the underlying Devonian. The aquifer is up to 50 m thick in Fee Lot 1, and ranges from zero to 30 m thick throughout the rest of the Study Area. The Basal Aquifer is absent in the south half of Lease 97, and the northwest of Fee Lot 1.

The Upper Devonian deposit is limestone of the Waterways Formation. The Upper Devonian surface has 100 m of relief, with numerous depressions and topographic highs. The highly irregular surface is the result of karstification, and collapse of karst features. The rock observed in outcrops and core samples is weathered and highly fractured. The Upper Devonian is exposed along the Athabasca River, and the lower reaches of the Steepbank River.

6.2 Hydrogeology

Groundwater flow in the stratified surficial sediments is toward the Steepbank and Athabasca Rivers. On the north side of the Steepbank, most of the flow is to the Steepbank River. South of the Steepbank, the vast majority of the groundwater in the surficial sand flows toward the Athabasca River. The mean hydraulic conductivity of the sand is 3.7 x 10^{-6} m/s.

The direction of hydraulic gradients in the till, the Clearwater Formation and the McMurray Oil Sands is predominantly vertically downward. These units have relatively low hydraulic conductivity, in the order of 10^{-7} m/s.

The groundwater in the Basal Aquifer and the Upper Devonian is flowing predominantly toward the Athabasca River. In the vicinity of the lower reach of the Steepbank River, where the river has cut below the bottom of the Oil Sands, a component of the flow in the aquifer is toward the Steepbank River.

Under most of the upland area, the hydraulic head in both the Basal Aquifer and the Upper Devonian is above the bottom of the McMurray Oil Sands. The Basal Aquifer and Upper Devonian appear to have similar hydraulic conductivities. The mean hydraulic conductivity of the Basal Aquifer is 4.1 x 10^{-6} m/s. The hydraulic conductivity measured in one piezometer completed in the Upper Devonian is 5.8 x 10^{-6} m/s.

The groundwater in surficial deposits is quite fresh. The concentration of total dissolved solids ranges from 24 mg/L to 623 mg/L. The freshest water is similar to water found in the muskeg. The water with higher TDS is associated with till and bedrock. The major ions in the surficial groundwater are calcium, magnesium and bicarbonate. The water with higher TDS levels also tends to have higher concentrations of sodium.

In the Oil Sands, Basal Aquifer and Upper Devonian, the groundwater chemistry ranges from brackish to saline. The units contain similar water, with the major ions being sodium, chloride and bicarbonate. The water in the Oil Sands also contains organic compounds, including naphthenic acid. In the Basal Aquifer, the concentration of TDS ranges from 2,620 mg/L to 29,383 mg/L. The concentration of naphthenic acid in the Basal Aquifer ranges from 6 mg/L to 36 mg/L. Mercury was found at a concentration of 1.6 μg/L in one sample of groundwater from the Basal Aquifer. In the Upper Devonian, the concentration of TDS has been found to range from 1,108 mg/L to 29,024 mg/L. In the Study Area, the median TDS in groundwater from the one piezometer completed in the Upper Devonian was 4,700 mg/L. The median concentration of naphthenic acid in the limestone was 52 mg/L.

In terms of groundwater resources, the surficial aquifer in the uplands and the bedrock aquifers were found to be unsuitable sources of water supply. The long-term yield (Q_{20}) from the surficial aquifer is inadequate (less than 1 m^3/day). The bedrock aquifers are capable of yielding higher volumes of water. However, the water quality in the bedrock aquifers is poor, and could not be utilized for drinking water or agricultural purposes without pre-treatment.

The surficial aquifer in the Athabasca River valley is expected to be a viable source of groundwater.

The contribution of groundwater discharge to surface water has been found to be very minor. The total rate of groundwater discharge from surficial and bedrock aquifers to all water bodies in the Study Area is estimated to be 2.52 L/s. The rates of groundwater discharge are less than 1 % of the minimum average surface water flows in the Athabasca and Steepbank Rivers, and less than 1 % of the average flow into Shipyard Lake.

PART III - IMPACT ASSESSMENT - MINING AND POST-RECLAMATION

1. INTRODUCTION

The purpose of the hydrogeologic component of the Environmental Impact Assessment is to identify changes to surface water or groundwater that may result from the development of the proposed Steepbank Mine. In particular, this assessment evaluates the impact of the mine on two groundwater-related issues of special concern, which have been identified in a process of consultation with stakeholders, regulators and environmental professionals. These issues are encapsulated in the following key Hypothesis Statements:

1. Flows in the Athabasca and Steepbank Rivers would be significantly changed by mine development, withdrawals for extraction and upgrading, or reclamation.
2. Groundwater quality could be affected by contaminant migration from processing and extraction activities.

In addition, some of the information in this report has been used to identify the effect of mine development on other environmental resources; in particular the aquatic resources (Suncor 1996). The impacts on specific disciplines, such as human health, soils, vegetation and terrain, aquatic resources and wildlife, are evaluated and discussed in other reports that support the Environmental Impact Assessment.

2. KEY FACTORS USED TO ASSESS IMPACT

The impacts to groundwater of the development and reclamation of the mine have been evaluated on the basis of changes to:

Direction of groundwater flow;
Rate of groundwater discharge to surface water bodies; and
Groundwater quality.

The term "water quality" refers to the concentration of dissolved and suspended compounds found, either naturally or otherwise, in the water.

The degree of significance of various impacts was assessed by a qualitative evaluation of the severity, duration and anticipated areal extent of each impact. The severity of each impact was assessed as either high, medium or low, based on the impacts to either flow or water quality. The duration of the impact was categorized as being short term if the impact occurred through the life of the mine or long-term if beyond the life of the mine. The areal extent of the impact was considered local if the effect was in the immediate mine area, or regional if beyond the immediate mine area. A final assessment of the degree of concern was made based on the expected impact on the receiving water body (either the Athabasca or Steepbank Rivers, or Shipyard Lake).

3. MINE DEVELOPMENT

3.1 Design Philosophy

During the construction and operation of the mine, both surface run-off and groundwater will be diverted to facilitate mining. The Steepbank Mine will be designed with systems to handle this water, to ensure that only water of acceptible quality flows into receiving waters. To achieve this, there will be one drainage system to collect all water that has contacted Oil Sands or mine processing, or that has been produced from the bedrock aquifers. The water in this system will be piped across the river, and used as process water. All water from up-gradient of the mine, including surface run-off and groundwater diverted from surficial deposits by de-watering, will be released into existing surface water bodies. These drainage systems are described more fully in the surface water impact analysis document, (Klohn-Crippen 1996).

3.2 Chronology of Mine Development

Following is a brief description and chronology of the components of mine development pertinent to the assessment of impacts on water resources in the Study Area. Plans showing the overall mine development and drainage plans in 2001, 2009 and 2020, and post reclamation are attached (Drawings A-2770-01-003 to A-2770-01-006).

1995 Baseline Conditions

- Background or pre-mine conditions.

1997 - 2001 (Facility Construction)

- Bridge construction will start in 1997 and is expected to be completed in 1999. Until this time, the Athabasca River will be crossed by barge or using an ice bridge.

- Permanent access roads will be constructed in 1998.

- The gravel pit will be developed in 1997 and 1998.

- Initial site drainage for Pit 1, stormwater retention ponds A, B, C and D will be completed by 2000.

- Surficial deposits at Pit 1 are dewatered, and groundwater is diverted around the pit.

- The excavation of Pit 1 will start in 2000. Overburden will be placed in the active mine area.

- Plant facilities, water supply systems and sewage disposal system will be constructed between 1997 and 2000.

- Two water wells for supplying plant and shop facilities have been completed in the surficial deposits on the Athabasca River floodplain. Total well production is estimated to be approximately 7.6 L/s (650 m^3/day).

- The bridge is constructed, and plant and shop facilities are in place.

- The North Dump is being used for overburden.
- Ditch 0-3 has been constructed to intercept natural runoff flowing west towards Pit 1 and convey it to Shipyard Lake.

2001 - 2009 (Pit 1 Development)

- Excavation of Pit 1 continues until 2009.
- Construction of Dyke 10 starts in 2002. Until 2005, there will be limited opportunity for storing excess mine drainage in Pit 1. It is assumed that Dyke 10 will be revegetated as construction progresses.
- Dyke 10A is built in 2007 and 2008. This dyke, together with Dyke 10 will permit the use of Pond 7A for tailings disposal while the south portion of Pit 1 is being excavated.
- Part of Shipyard Lake is drained in 2004 in preparation for placing the West Dump and 600 000 m^3 of muskeg has been removed.
- Overburden material is being placed on the North, West and East Dumps. It is planned to construct the West Dump over part of Shipyard Lake, reducing the total area of this wetlands from 144 to 92 hectares and the area of open water from 23 to 5 hectares.
- Ditches 3-A and 3-B are constructed east of Pit 1 in 2003 to collect natural runoff flowing west towards the pit and convey it to the Shipyard Lake.
- Ditches 9-A and 9-B are constructed in 2008 to intercept natural runoff. The north portion of the runoff is conveyed to Shipyard Lake in Ditch 9A and the southern portion of the drainage is conveyed to Leggett Creek in Ditch 9-B.
- Mine stormwater retention pond D' is constructed.
- It is assumed that de-pressurizing the Basal Aquifer under the southern portion of Pit 1 commences in this period.
- The mining of Pit 1 is completed in 2009 and the excavated area is used for disposal of consolidated tailings (CT) (Ponds 7A and 7B). The water surface elevation in the ponds will be 297 m (above Geodetic Datum).
- The excavation of Pit 2 starts in 2009.
- The construction of Dyke 11 at the west edge of Pit 2 is started.

2009 - 2020 (Pit 2 Development)

- The mining of Pit 2 continues until 2020.
- Surficial deposits at Pit 2 are dewatered and shallow groundwater is diverted around the pit.
- Overburden is being placed on the South Dump.
- It is expected that the Basal Aquifer and Upper Devonian limestone under Pit 2 have been de-pressurized.
- In 2015, tailings disposal begins in Pond 8A.

- Perimeter drainage ditches 15-A and 15-B are constructed in 2012 and Ditch 15-C in 2015. These ditches divert natural runoff from the area to the east of the mine to Wood Creek. Construction of the perimeter ditch will increase the area draining to Wood Creek by 240% and will reduce the area draining to Shipyard Lake by 83%.

- Construction of Dyke 11 is completed in 2016. Dyke 11A and 11B are built between 2013 and 2016, and 2015 and 2019, respectively. The construction of Dyke 12 at the east side of Pit 2 is started in 2017.

- Consolidated tailings (CT) start to be placed in Pond 8A in 2016.

- As of 2020, the mining in Pit 2 is finished. The static level in the deep bedrock aquifers (Basal Aquifer and Upper Devonian) is expected to have returned to pre-mine levels.

- The water surface elevation in Pond 7 and Pond 8 is 326 m and 304 m, respectively.

Post Closure Equilibrium

- It is expected that the same closure philosophy proposed for the existing Lease 86 mine will be adopted for the Steepbank Mine. This will include reclaiming and seeding disturbed areas, seeding overburden dumps and exposed dyke slopes, providing drainage systems to remove excess water from the tailings areas and vegetating the dry tailings surfaces.

- As the tailings consolidate, water is released. Initially, the water release rate is estimated to be approximately 90 L/s from Pond 7 and 100 L/s from Pond 8. It is expected that this discharge will be channelled to Shipyard Lake with pre-treatment if the water quality is not considered acceptable. This discharge is expected to reduce to nearly zero over a period of 60 to 80 years.

- Both Ponds 7 and 8 have been filled with consolidated tailings (CT) to 327 m elevation.

4. METHODOLOGY

4.1 Spatial and Temporal Boundaries

The Study Area of the hydrogeologic impact assessment is the same as the baseline Study Area, which is shown in Drawing A-2779-02-01. The temporal boundaries of the Impact Analysis have been selected to compare the three main stages of the mine development with the baseline conditions:

Construction Phase (1997 to 2001);
Operational Phase (2001 to 2020); and
Post Reclamation.

The construction and operation phases have been assessed by evaluating the conditions that are expected to exist in 2001, 2009 and 2020. The post reclamation conditions in the Study Area have been assessed as the long-term, steady state conditions that will exist several years after the closure and reclamation of the mine. These are the same 'snap shots' in time that have been evaluated in the aquatics impact analysis (Suncor 1996), in which the results of the hydrogeologic impact analysis have been incorporated. Drawings A-2779-

02-25 to B-2779-02-28 show the mine development and drainage plans for 2001, 2009, 2020 and post reclamation.

4.2 Changes in Groundwater Flow Rates

All changes in flows caused by activities at the mine have been treated as being instantaneous. That is to say, aquifer storage, and travel time have not been included in any calculations. This has the effect of accelerating any impacts, and results in a slightly conservative impact assessment. This approach has also provided two benefits. It allows the evalautions of the impacts to be performed with relatively simple calculations. It also makes it easier to discuss the potential impacts of each aspect of mine development - i.e. both cause and effect can be discussed in the same time frame.

5 IMPACTS OF MINE DEVELOPMENT ON GROUNDWATER

5.1 Construction Phase (1997 - 2000? [2001?])

In the period from 1997 to 2000, during the construction phase of the mine development, three things may impact the groundwater system. These are:

The commencement of de-watering of the surficial deposits;
The commencement of mining from Pit 1; and
The construction of water supply wells.

At this early stage in the mine development, the initial de-watering of the surficial deposits and excavation of Pit 1 are expected to have only a very minor impact on the groundwater. This is because the mining activity will start at the north end of Pit 1, in a relatively small area, where surficial deposits are very thin. The effects of de-watering and mining will be more pronounced after 2001. Those impacts are discussed in the sections to follow.

The primary effect that the construction phase is expected to have on the groundwater system is associated with the water supply wells for the new facility. It is planned that two or three water wells will be constructed in the sand and gravel between the Athabasca River and the outflow from Shipyard Lake. The combined withdrawal rate of these wells will be approximately 7.5 L/s (650 m^3/day). Because of the proximity of the wells to the river, the majority of the well production will be induced infiltration from the Athabsca River. The effect of the wells on the groundwater will therefore be localized to a small area in the river valley. Hence, in terms of groundwater discharge to surface water, there will be no real change in the rate of discharge to any of the water bodies, although the new wells will reduce the flow in the Athabasca River by an amount roughly equal to their pumping rate.

None of the activities planned in the construction phase are expected to affect the quality of the groundwater.

5.2 Mine Operations (2000 -2009)

During the first ten years of the operation of the mine, the effects imposed on the groundwater system will be associated with the excavation of Pit 1. The activities that will affect the groundwater are:

The surficial deposits will be de-watered;
The bedrock aquifers may be de-pressurized;
Pit 1 will be mined; and
Consolidated tailings (CT) will be placed in the pit once the ore has been mined.

As is discussed below, the result of these acitivities will be slight changes to the direction of flow, rates of discharge and quality of some components of the groundwater system. Table 16 shows the rates of groundwater discharge to surface water that are expected to occur in 2009, at the end of this phase of mine development.

Surficial Deposits

The surficial deposits up-gradient of Pit 1 will be de-watered, to facilitate the stripping of overburden prior to the mining of Pit 1. The groundwater flow in the surficial aquifer will be intercepted with a diversion system on the east side of the mine which is connected to the surface water pre-mine drainage system. By 2009, groundwater in the surficial aquifer up-gradient of both Pits 1 and 2 will be diverted to Shipyard Lake and Leggett Creek. From there, it will ultimately discharge into the Athabasca River. The diversion of groundwater from the surficial aquifer is expected to continue after the closure of the mine.

The total volume of groundwater discharging from the surficial aquifer to the surface water environment will not change. However, the nature of groundwater discharge to surface water will change. Currently, the discharge occurs as seepage to the Athabasca River, Steepbank River and Shipyard Lake, along the reach of these water bodies adjacent to the Study Area. This broad discharge will be replaced by discharge from point sources into Shipyard Lake and Leggett Creek.

As shown in Table 16, the discharge of groundwater from the surficial aquifer to the Athabasca River will decrease from 0.44 L/s in 1995 to 0.2 L/s by 2009. The discharge into Shipyard Lake will increase from 0.17 L/s to 0.4 L/s, due to point source discharge. The discharge into Leggett Creek in 2009 will be approximately 0.23 L/s. The groundwater discharge to the Steepbank River will reduce to near zero as the surficial aquifer will have been mined out. As has been discussed in Part I of this report, the groundwater discharge to the Athabasca and Steepbank Rivers and Shipyard Lake is extremely minor in comparison to the flow in these streams. Therefore, the severity of the impact of these changes in groundwater discharge is very low.

Table 16
Estimated Groundwater Discharge Rates to Surface Water Bodies in the Study During Mining and Post Reclamation

Destination	1995	2001	2009	2020	Post-2020
Surficial Groundwater					
Athabasca River	0.44	0.44	0.2	0	0
Steepbank River	0.22	0.22	0	0	0
Shipyard Lake	0.17	0.17	0.40	0.20	0.20
Leggett Creek	0	0	0.23	0	0
Wood Creek	0	0	0	0.63	0.63
Bedrock Groundwater					
Athabasca River	0.93	0.93	0.93	0.93	0.93
Steepbank River	0.20	0.20	0.20	0.20	0.20
Shipyard Lake	0.56	0.56	0.56	0.56	0.56
Leggett Creek	0	0	0	0	0
Wood Creek	0	0	0	0	0
CT Water from Tailings Pond					
Athabasca River	0	0	2.20	5.80	5.83
Steepbank River	0	0	1.10	1.40	1.30
Shipyard Lake	0	0	0.30	0.40	0.43
Leggett Creek	0	0	0	0	0
Wood Creek	0	0	0	0	0

An effect of the de-watering of the surficial deposits will be that the water table in the vicinity of the de-watering system will be lowered. The distance that this impact will extend from the de-watering system is difficult to determine precisely, due to the variability of the surficial deposits. A distance of 300 m has been calculated, using simple trench de-watering equations. This appears to be somewhat of an over-estimate of the areal extent of the impact of de-watering. In comparison, the Athabasca River valley is essentially a large trench, that de-waters both the surficial deposits and the shallow bedrock. The water table in the upland remains quite close to the ground surface, right up to the edge of the escarpment. This indicates that the areal extent of the effect of the valley on the water table is limited to within a few hundred metres of the escarpment. Hence, it is reasonable to conclude that the areal extent of the impact of the Steepbank Mine de-watering system will be limited to the mine area.

Bedrock Aquifers

As has been discussed in Part 1, the hydraulic head in the bedrock aquifers is higher than the elevation of the base of the McMurray Oil Sands. It is likely that the head in the bedrock aquifers in the vicinity of Pit 1 will be lowered during mining from the pit. This would happen in one of two ways. The pressure (or hydraulic head) in the aquifers may be released as groundwater seeps into the mine. Or, it is possible that the bedrock aquifers may have to be de-pressurized before all the ore in the proposed Pit 1 mine can be excavated. This will be required if it is determined that the walls and floor of the mine will be unstable due to the uplift pressures exerted by the water pressure in the aquifers. Such an analysis will be conducted as part of the final design of the mine. Should de-pressurization be required, water wells will be installed in the bedrock aquifers, and water will be pumped out to reduce the pressure (or hydraulic head) in the aquifers. This water will be discharged to the mine drainage system, and piped across the river to the processing plant.

The result of the depressed hydraulic head around the mine would be a change in the direction of groundwater flow in the bedrock aquifers, and the rate of discharge to surface waters would be reduced. Groundwater in the bedrock would flow toward Pit 1. The areal extent of this impact would be limited to within 2 km of the pit. The groundwater discharge from bedrock in the vicinity of Pit 1 would be more or less eliminated, while water is being pumped out of the aquifers. Therefore groundwater discharge to the Athabasca River and Shipyard Lake will be decreased by approximately half, from 0.93 L/s to roughly 0.46 L/s, and from 0.56 L/s to roughly 0.28 L/s, respectively. The discharge from bedrock to the Steepbank River will be reduced to essentially zero.

Because the groundwater discharge to surface water is such a minor component of the flow in the Athabasca and Steepbank Rivers, and Shipyard Lake, the severity of these changes in flow direction and discharge rate is very low. The changes will be limited to the Study Area. The duration of the impact will also be quite short. By 2009, Pit 1 will be filled with consolidated tailings (CT), as shown in Drawing B-2779-02-26. Once the CT is placed in the pit, the head in the bedrock aquifers will return to pre-mining levels. The rate of groundwater discharge from the bedrock will return to pre-mining conditions as shown in Table 16. The direction of groundwater flow in the bedrock aquifers will also return to pre-mine conditions by 2009.

There is the potential, while the hydraulic head in the bedrock around Pit 1 is depressed, that water will recharge the bedrock aquifers from the Steepbank River and flow toward the pit. Based on the hydraulic conductivity of the bedrock aquifers, and the difference in elevation between the river and the pit, the maximum amount of water that may be diverted under steady state conditions is approximately 1.1 L/s. This is less than 1% of the recorded minimum monthly flow in the Steepbank River. Therefore, it does not represent a severe impact on the flow in the river. The areal extent of this effect will be limited to within 2 km of Pit 1. The duration of impact will be relatively short term. In 2009, once Pit 1 is filled with consolidated tailings (CT), groundwater from the aquifer will once again discharge to the Steepbank River.

The impacts of placing CT in Pit 1 discussed in the following section.

5.3 Mine Operations (2009 -2020)

During the period 2009 to 2020, Pit 2 will be mined. Consolidated tailings will be placed in Pond 7 (formerly Pit 1) at the beginning if this period. Pond 8 (formerly Pit 2) will be filled with CT at the end of this period.. The factors that will affect the groundwater are:

The continued de-watering of the surficial deposits;
The bedrock aquifers may be de-pressurized;
The mining of Pit 2; and
The seepage of pore water from CT.

As is discussed below, the results of these factors will be slight changes to the direction of flow, the rates of discharge and the quality of some components of the groundwater system. Table 16 shows the rates of groundwater discharge to surface water that are expected to occur in 2020, at the end of this phase of mine development.

Surficial Deposits

As Pit 2 is mined, it will advance across Leggett Creek (Drawing B-2779-02-27). The diversion system used to de-water the surficial deposits up-gradient of Pits 1 and 2 will be extended to discharge into Wood Creek. As shown in Table 16, the total rate of groundwater discharge from surficial deposits to surface water will remain constant. However, the groundwater will be diverted such that the discharge rate to Shipyard Lake decreases from 0.4 L/s to roughly 0.2 L/s. The discharge to Leggett Creek will be stopped, as the area around the creek is mined. All remaining discharge, approximately 0.63 L/s will therefore be directed to Wood Creek, from which it will flow to the Athabasca River.

As has been explained above, the areal extent of the impact of de-watering the surficial deposits will be limited to the Study Area. The duration of the impact will be long-term. As has been discussed in Part 1 of this report, the groundwater discharge to the Athabasca and Steepbank Rivers and Shipyard Lake is extremely minor in comparison to the flow in these streams. Therefore, the severity of the impact of these changes in groundwater discharge is very low.

Bedrock Aquifers

The effects of mining Pit 2 on the bedrock aquifers will be very similar to the effects described for Pit 1. The direction of groundwater flow in the bedrock will become directed toward Pit 2, either as the result of natural groundwater flow toward to active mine, or de-pressurization of the aquifers prior to mining. The groundwater discharge from bedrock in the vicinity of Pit 2 would be more or less reduced to zero. Therefore, the total groundwater discharge from bedrock in the Study Area to the Athabasca River and Shipyard Lake would decrease by approximately half, from 0.93 L/s to roughly 0.46 L/s and from 0.56 L/s to roughly 0.28 L/s, respectively.

Because the groundwater discharge to surface water is such a minor component of the flow in the Athabasca and Shipyard Lake, the severity of these changes in flow direction and discharge rate is very low. The areal extent of the impact will be limited to the mine area, as discussed in Section 5.2. The duration of the impact will also be quite short. By 2020, Pit 2 will be filled with CT, as shown in Drawing B-2779-02-27. Once the CT is placed in the pit, the head in the bedrock aquifers will return to pre-mining levels. The rate of groundwater discharge from the bedrock will return to pre-mining conditions, as shown in Table 16. The direction of groundwater flow in the bedrock aquifers will also return to pre-mine conditions by 2009.

Consolidated Tailings

Consolidated tailings will be placed in the mine pits, as a component of the mine reclamation. The process of producing CT is relatively new, and the long-term behaviour and composition of the material has not been well documented yet. The expected benefit of placing CT in the mined pits is that the tailings will provide a stable, weight-bearing, dry surface, that will be re-vegetated with trees.

The CT is expected to interact with the groundwater in the bedrock once it is placed in the tailings ponds. Pore water within the CT will seep downward into the bedrock, and eventually discharge with the groundwater to surface water. The impact that the seepage will have on the groundwater will be the result of the combined effects of the rate of flow, and the chemical composition of the pore water. These are both discussed in the following paragraphs.

The rate of seepage from the ponds will be a function of the hydraulic conductivity of the CT, the vertical hydraulic gradient between the CT and the underlying bedrock aquifers, and the area of the ponds. The equation used to calculate the seepage rate is:

$$Q = K\,i\,A$$

where;

Q = seepage rate,
K = the hydraulic conductivity of the aquifer, m/s
i = the hydraulic gradient in the aquifer, m/m
A = area of the pond, m^2.

The hydraulic conductivity of the CT has been estimated to be 1×10^{-9} m/s (AGRA 1996). Pond 7 will be approximately 5.9×10^{6} m^2 in area. Pond 8 will be approximately 4.5×10^{-6} m^2. The vertical hydraulic gradient in the ponds is difficult to predict, because it is not known what the elevation of the phreatic surface within the CT will be. However, as the hyraulic conductivity of the CT is quite low (10^{-9} m/s is similar to what is measured in clayey deposits), it is aniticipated that the phreatic surface within the CT will be very close to ground level. Therefore, the vertical hydraulic gradient in the CT has been calculated using the estimated elevation of the top surface of the CT. For instance, as shown in Drawing B-2779-02-28, the elevation of the CT in Pond 7 will be 297 m in 2009. The elevation of the bottom of the pond is roughly 260 m. The average elevation of the potentiometirc surface in the bedrock aquifers, in the area of the ponds, is 275 m. Therefore, the vertical hydraulic gradient in the CT in Pond 7 in 2009 is estimated to be:

$$i = (297\text{ m} - 275\text{ m})/(297\text{ m} - 260\text{ m}) = 0.6$$

The total rate of seepage from Pond 7 into the bedrock aquifers is therefore calculated to be 3.6 L/s. This seepage will ultimately discharge with the groundwater into the Athabasca River, the Steepbank River, and Shipyard Lake. The exact proportions of the CT contribution to each of these water bodies will depend on a number of factors, including preferential pathways in the bedrock, the final elevation of the bottom of the pond, and variability in the composition of the CT. It is therefore not possible to predict precisely how the CT water will be divided among the three water bodies. As a rough approximation, it is assumed that 60 % of the CT seepage will flow through bedrock to the Athabasca River, 30 % will flow to the Steepbank River, and 10 % will discharge into Shipyard Lake. In accordance with these assumptions, the approximate discharge rates of CT the Athabasca and Steepbank Rivers and Shipyard Lake will be 2.2 L/s, 1.1 L/s and 0.3 L/s respectively.

These estimates of seepage of CT pore water to surface water are also shown in Table 16.

In 2020, the elevation of CT in Pond 7 will have been raised to 326 m. CT will be placed in Pond 8 to an elevation of 304 m, as shown in Drawing B-2779-02-28. The vertical hydraulic gradients in the ponds will be approximately 0.77 and 0.66, respectively. The resulting rates of discharge of CT pore water to the Athabasca and Steepbank Rivers and Shipyard Lake (assuming all seepage from Pond 8 discharges into the Athabasca River) are 5.8 L/s, 1.4 L/s and 0.4 L/s, respectively. The rate of seepage represents less than 1 % of the flow in any of these water bodies.

Chemical analyses have been conducted on pore water samples collected from test batches of consolidated tailings. Tables 17 and 18 show the results of inorganic analyses of CT pore water. Table 19 shows the results of organic anayses, including naphthenic acids, of the CT porewater.

The results of the evaluations of the chemistry of CT pore water are quite preliminary. Ongoing research into the composition of the pore water is being conducted by Suncor. The results shown in Tables 17 and 18 indicate the inorganic chemistry of the CT pore water is relatively benign with respect to the potential impacts to surface water. The pore water does contain dissolved organic compounds, including phenols, PAHs and naphthenic acids. However, as shown in Table 20, the types and concentrations of organic compounds found in the CT pore water are similar to the naturally-occurring organic composition of the groundwater in the bedrock aquifers. Of the 33 organic compounds detected in the CT pore water, all but three were also found to be naturally present in the groundwater from the limestone. These three compounds were acenaphthylene, phenol and m-cresol. The range of concentrations of naphthenic acids measured in the CT pore water (62 mg/L to 94 mg/L) is slightly higher than in the bedrock aquifers (8 mg/L to 57 mg/L).

The severity of the impacts associated with the seepage of CT pore water from the ponds is expected to be low. The rate of seepage is less than 1 % of the flows in the receiving water in the Athabasca and Steepbank Rivers, and Shipyard Lake. The chemistry of the CT pore water is similar to the chemistry of the groundwater in the bedrock aquifers that currently discharges to surface water in the in the Study Area. Therefore, the chemistry of the receiving waters is not expected to be altered by the seepage of the CT from the ponds. The areal extent of the impact of the seepage will be limited to the area between the ponds and the Athabsca River. The impacts of the seepage will however be long-term. It is expected that the seepage will continue more or less in perpetuity after the closure of the mine. Considering the rates and quality of the seepage, the severity of the impact from the CT pore water will be low.

5.4 Post Reclamation

Following the closure and reclamation of the mine, the factors that will continue to impact the groundwater are:

The continued de-watering of the surficial deposits;
The long-term seepage of pore water from CT.

Table 17
Consolidated Tailings (CT) - Major Ions in Pore Water

Parameter	Detection Limits	Units	Min	Max	Median	No. of Samples
Calcium	0.003	mg/L	<0.003	0.0066	<0.003	9
Magnesium	0.01	mg/L	7.2	28	12	18
Sodium	0.01	mg/L	347	1170	445	18
Potassium	0.02	mg/L	11.5	29	16.6	18
Chloride	0.5	mg/L	45.4	510	55	18
Sulphate	0.5	mg/L	555	1290	659	18
Total Alkalinity	0.5	mg/L	277	688	353.5	18
Bicarbonate	0.5	mg/L	331	800	409	18
Silicon	0.02	mg/L	<2.3	5.6	2.9	8
Total Dissolved Solids	1	mg/L	1400	1805	1600	7
Specific Conductance	0.1	µS/c	1891	4900	2337	9
pH	0.01	m	7.9	8.5	8.3	18
Phenols	0.001	Units	<0.002	0.016	0.004	5
Dissolved Organic Carbon	0.2	mg/L	52	65.3	60.6	8
Nitrite + Nitrate	0.003	mg/L	<0.003	0.05	0.016	18
Total Phosphorus (ICP)	0.1	mg/L	<0.1	0.1	<0.1	6
		mg/L				

Data obtained from Chemex Labs (Suncor ID: RW 162, 163, 164)
Samples collected in July, August and September 1995
Other CT samples from Suncor: CT 1219

Table 18

Consolidated Tailings (CT) - Metals and Cyanide in Pore Water

Parameter	Detection Limits	Units	Min	Max	Median	No. of Samples
Aluminum	0.01	mg/L	<0.01	1.92	0.05	9
Arsenic	0.0002	mg/L	0.0007	0.0058	0.0029	8
Barium	0.01	mg/L	0.05	0.18	0.1	9
Beryllium	0.001	mg/L	<0.001	0.004	<0.001	9
Boron	0.01	mg/L	2.26	4.26	3.19	9
Cyanide	0.001	mg/L	<0.001	0.055	<0.001	8
Cadmium	0.003	mg/L	<0.003	0.0066	<0.003	9
Chromium	0.002	mg/L	<0.002	0.003	<0.002	9
Cobalt	0.003	mg/L	<0.003	0.007	<0.003	9
Copper	0.001	mg/L	<0.001	0.004	0.002	9
Iron	0.01	mg/L	<0.01	1.01	0.04	9
Lead	0.02	mg/L	<0.0003	0.02	0.02	9
Lithium	0.001	mg/L	0.16	0.27	0.19	9
Manganese	0.001	mg/L	<0.001	0.058	0.024	9
Mercury	0.05	μg/L	<0.05	0.05	<0.05	7
Molybdenum	0.003	mg/L	0.15	1.42	1.15	9
Nickel	0.005	mg/L	<0.005	0.030	0.018	9
Selenium	0.0002	mg/L	<0.0002	0.04	0.0015	8
Silver	0.002	mg/L	<0.0002	0.002	<0.002	9
Strontium	0.002	mg/L	0.75	2.12	1.02	9
Titanium	0.003	mg/L	<0.003	0.016	<0.003	9
Uranium	0.5	mg/L	0.0068	0.5	0.5	9
Vanadium	0.002	mg/L	<0.002	0.17	0.006	9
Total Ammonia	0.01	mg/L	0.098	3.98	0.7	17
Total Sulphur	0.2	mg/L	186	266	229	7
Total Kjeldhal Nitrogen	0.05	mg/L	0.95	6.8	1.82	16
Total Dissolved Solids	1	mg/L	1400	1805	1600	7
Titanium	0.003	mg/L	<0.003	0.016	<0.003	9
Total Organic Carbon	0.2	mg/L	56.1	68	64.5	6
Total Alkalinity	0.5	mg/L	277	688	354	18
Total Phosphorus	0.003	mg/L	0.006	0.096	0.037	16
Total Suspended Solids	0.4	mg/L	<0.4	187	6	6
Uranium	0.5	mg/L	0.0068	0.5	0.5	9
Vanadium	0.002	mg/L	<0.002	0.17	0.006	9
Zinc	0.001	mg/L	0.003	0.056	0.043	9

Data obtained from Chemex Labs (Suncor ID: RW 162, 163, 164)
Samples collected in July, August and September 1995
Other CT samples from Suncor: CT1219

Table 19
Consolidated Tailings (CT) - Organic Compounds (including Naphthenic Acids) in Pore Water (μg/L)

Parameter	Suncor Consolidated Tailings			
	Min	Median	Max	No. of Samples
PAH&Alkylated PAH's				
Naphthalene	<0.02	<0.02	0.05	16
Acenaphthene	0.02	<0.02	0.08	16
Acenaphthylene	<0.02	0.03	0.16	16
Fluorene	<0.02	<0.02	0.03	16
Dibenzothiophene	<0.02	<0.02	0.07	14
Phenanthrene	<0.02	<0.02	0.09	16
Pyrene	<0.02	<0.02	0.04	16
Benzo(a)anthracene/Chrysene	<0.02	<0.02	0.27	16
Methyl naphthalene	0.02	<0.04	0.08	14
C2 sub'd naphthalene	<0.04	<0.04	0.25	16
C3 sub'd naphthalene	<0.04	<0.04	0.3	16
C4 sub'd naphthalene	<0.04	<0.04	2	16
Methyl biphenyl	0.04	<0.04	0.08	16
C2 sub'd biphenyl	<0.04	<0.04	0.25	16
Methyl acenaphthene	<0.04	<0.04	0.19	16
Methyl fluorene	<0.04	<0.04	0.3	16
C2 sub'd fluorene	<0.04	<0.04	1.1	16
Methyl phenanthrene/anthracene	<0.04	<0.04	0.79	16
C2 sub'd phenanthrene/anth.	<0.04	<0.04	4.5	16
C3 sub'd phenanthrene/anth.	<0.04	<0.04	3.6	16
C4 sub'd phenanthrene/anth.	<0.04	<0.04	1.7	15
Methyl dibenzothiophene	<0.04	<0.04	0.65	16
C2 sub'd dibenzothiophene	<0.04	<0.04	2.2	16
C3 sub'd dibenzothiophene	<0.04	<0.04	4.1	16
C4 sub'd dibenzothiophene	<0.04	<0.04	4.4	16
Methyl fluoranthene/pyrene	<0.04	<0.04	0.65	16
Methyl B(a)/chrysene	<0.04	<0.04	0.5	16
C2 sub'd B(a)A/chrysene	<0.04	<0.04	0.83	16
Phenolic Compounds in Water				
Phenol	<0.1	0.2	0.2	6
m-Cresol	<0.1	0.3	0.5	5
m-Cresol	1	1	1	3
p-Cresol	0.1	<0.1	0.2	5
2,4-Dimethylphenol	<0.2	0.35	1	4
PANH & Alkylated PANH's	nd	nd	nd	
Volatile Organics (MS):H20	nd	nd	nd	
Naphthenic Acids (mg/L)	62	76	94	
Hydrocarbons, Recoverable (mg/L)	<1	<1	22	18

Data obtained from Envirotest Laboratories (Suncor ID: RW 162, 163, 164) & PD5, CT1219
Samples Collected in July, August, September 1995
Additional CT900 & CT1400 obtained from Syncrude Research Center.
nd = not detected

Table 20
Comparison of Organic Compounds Detected in Consolidated Tailings (CT) and Groundwater Samples (μg/L)

	Suncor Consolidated Tailings				Basal Aquifer				Limestone				Surficial Sand			
Parameter	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples	Min	Median	Max	No of Samples
PAH & Alkylated PAH's																
Naphthalene	< 0.02	<0.02	**0.05**	16	< 0.02	< 0.02	**0.05**	5	< 0.02	**0.035**	**0.05**	2	< 0.02	< 0.02	< 0.02	6
Acenaphthene	**0.02**	<0.02	**0.08**	16	< 0.02	**0.03**	**0.04**	5	**0.04**	**0.06**	**0.08**	2	< 0.02	< 0.02	< 0.02	6
Acenaphthylene	< 0.02	**0.03**	**0.16**	16	< 0.02	< 0.02	< 0.02	5	< 0.02	< 0.02	< 0.02	2	< 0.02	< 0.02	< 0.02	6
Fluorene	< 0.02	<0.02	**0.03**	16	< 0.02	**0.02**	**0.06**	5	**0.07**	**0.075**	**0.08**	2	< 0.02	< 0.02	< 0.02	6
Dibenzothiophene	< 0.02	<0.02	**0.07**	14	< 0.02	< 0.02	< 0.02	5	< 0.02	**0.02**	**0.02**	2	< 0.02	< 0.02	< 0.02	6
Phenanthrene	< 0.02	<0.02	**0.09**	16	**0.02**	**0.03**	**0.07**	5	**0.11**	**0.125**	**0.14**	2	< 0.02	< 0.02	< 0.02	6
Pyrene	< 0.02	<0.02	**0.04**	16	< 0.02	< 0.02	< 0.02	5	< 0.02	**0.025**	**0.03**	2	< 0.02	< 0.02	**0.02**	6
Benzo(a)anthracene/Chrysene	< 0.02	<0.02	**0.27**	16	< 0.02	< 0.02	**0.02**	5	< 0.02	**0.03**	**0.04**	2	< 0.02	< 0.02	< 0.02	6
Methyl naphthalene	**0.02**	<0.04	**0.08**	14	< 0.02	**0.04**	**0.07**	5	< 0.02	**0.03**	**0.04**	2	< 0.02	< 0.02	< 0.02	6
C2 sub'd naphthalene	< 0.04	<0.04	**0.25**	16	< 0.04	**0.09**	**0.32**	5	< 0.04	**0.05**	**0.06**	2	< 0.04	< 0.04	< 0.04	6
C3 sub'd naphthalene	< 0.04	<0.04	**0.3**	16	**0.04**	**0.12**	**0.82**	5	**0.31**	**0.42**	**0.53**	2	< 0.04	< 0.04	**0.17**	6
C4 sub'd naphthalene	< 0.04	<0.04	**2**	16	< 0.04	**0.09**	**0.5**	5	**0.19**	**0.27**	**0.35**	2	< 0.04	< 0.04	**0.2**	6
Methyl biphenyl	**0.04**	<0.04	**0.08**	16	< 0.04	< 0.04	< 0.04	5	< 0.04	**0.04**	**0.04**	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd biphenyl	< 0.04	<0.04	**0.25**	16	< 0.04	< 0.04	< 0.04	5	< 0.04	**0.075**	**0.11**	2	< 0.04	< 0.04	< 0.04	6
Methyl acenaphthene	< 0.04	<0.04	**0.19**	16	< 0.04	< 0.04	**0.06**	5	< 0.04	**0.06**	**0.08**	2	< 0.04	< 0.04	< 0.04	6
Methyl fluorene	< 0.04	<0.04	**0.3**	16	< 0.04	**0.04**	**0.14**	5	**0.08**	**0.125**	**0.17**	2	< 0.04	< 0.04	**0.04**	6
C2 sub'd fluorene	< 0.04	<0.04	**1.1**	16	< 0.04	**0.07**	**0.13**	5	**0.09**	**0.155**	**0.22**	2	< 0.04	< 0.04	**0.06**	6
Methyl phenanthrene/anthracene	< 0.04	<0.04	**0.79**	16	**0.05**	**0.1**	**0.13**	5	**0.22**	**0.265**	**0.31**	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd phenanthrene/anth.	< 0.04	<0.04	**4.5**	16	< 0.04	0.09	**0.23**	5	**0.15**	**0.25**	**0.35**	2	< 0.04	< 0.04	**0.05**	6
C3 sub'd phenanthrene/anth.	< 0.04	<0.04	**3.6**	16	< 0.04	**0.05**	**0.21**	5	**0.11**	**0.2**	**0.29**	2	< 0.04	< 0.04	**0.06**	6
C4 sub'd phenanthrene/anth.	< 0.04	<0.04	**1.7**	15	< 0.04	< 0.04	**0.16**	5	**0.04**	**0.085**	**0.13**	2	< 0.04	< 0.04	< 0.04	6
Methyl dibenzothiophene	< 0.04	<0.04	**0.65**	16	< 0.04	**0.06**	**0.16**	5	**0.12**	**0.18**	**0.24**	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd dibenzothiophene	< 0.04	<0.04	**2.2**	16	< 0.04	**0.08**	**0.13**	5	**0.15**	**0.29**	**0.43**	2	< 0.04	< 0.04	**0.04**	6
C3 sub'd dibenzothiophene	< 0.04	<0.04	**4.1**	16	< 0.04	**0.09**	**0.24**	5	**0.19**	**0.32**	**0.45**	2	< 0.04	< 0.04	**0.06**	6
C4 sub'd dibenzothiophene	< 0.04	<0.04	**4.4**	16	< 0.04	< 0.04	**0.06**	5	< 0.04	**0.15**	**0.26**	2	< 0.04	< 0.04	< 0.04	6
Methyl fluoranthene/pyrene	< 0.04	<0.04	**0.65**	16	< 0.04	< 0.04	**0.06**	5	< 0.04	**0.045**	**0.05**	2	< 0.04	< 0.04	< 0.04	6
Methyl B(a)A/chrysene	< 0.04	<0.04	**0.5**	16	< 0.04	< 0.04	**0.05**	5	< 0.04	**0.045**	**0.05**	2	< 0.04	< 0.04	< 0.04	6
C2 sub'd B(a)A/chrysene	< 0.04	<0.04	**0.83**	16	< 0.04	< 0.04	**0.05**	5	< 0.04	**0.05**	**0.06**	2	< 0.04	< 0.04	< 0.04	6
Phenolic Compounds in Water																
Phenol	< 0.1	**0.2**	**0.2**	6	< 2	< 0.2	< 0.1	5	< 0.1	< 0.1	< 0.1	2	< 0.2	< 0.1	< 0.1	6
m-Cresol	< 0.1	**0.3**	**0.5**	5	< 2	< 0.2	< 0.1	5	< 0.1	< 0.1	< 0.1	2	< 0.2	< 0.1	< 0.1	6
m-Cresol	**1**	**1**	**1**	3												
p-Cresol	**0.1**	<0.1	**0.2**	5	< 2	< 0.2	**0.2**	5	**0.3**	**0.3**	**0.3**	2	< 0.2	< 0.1	< 0.1	6
2,4-Dimethylphenol	< 0.2	**0.35**	**1**	4	< 2	< 0.2	< 0.1	5	**0.1**	**0.15**	**0.2**	2	< 0.2	< 0.1	< 0.1	6
PANH & Alkylated PANH's	nd	nd	nd		nd	nd	nd		nd	nd	nd		nd	nd	nd	
Volatile Organics (MS):H2O	nd	nd	nd		nd	nd	nd		nd	nd	nd		nd	nd	nd	
Naphthenic Acids (mg/l)	**62**	**76**	**94**		**8**	**21**	**36**	11	**47**	**52**	**57**	3	< 4	**4**	**7**	12
Hydrocarbons,Recoverable (mg/l)	< 1	<1	**22**	18	< 1	**3**	**5**	3	< 1	< 1	< 1	1	< 1	< 1	< 1	3

Data obtained from Envirotest Laboratories (Suncor ID: RW 162, 163, 164) & PD5, CT1219
Samples Collected in July, August, September 1995

Additional CT900 & CT1400 obtained from Syncrude Research Center.
nd = not detected

The effects of the re- direction of groundwater flow in the surficial deposits have been discussed above in detail. As shown in Table 16, there is expected to be no change in the flows after 2020.

Also as described above, the seepage of CT pore water from the tailings ponds is expected to carry on for a very long time after the mine area has been reclaimed. The chemistry of the seepage water is not expected to change. The total long-term rate of seepage will decrease very slightly to 10.08 L/s in comparison to the seepage rate in 2020 of 10.12 L/s. This slight decrease is due to the final elevation of the CT surface. After being allowed to settle, the CT is expected to have an equilibrium level of 314.5 m in both Ponds 7 and 8.

As has been discussed above, the level of concern of these impacts is low.

6. Requirement for Environmental Monitoring

The impacts to groundwater of the mine, as it has been designed, are expected to be negligible. There is, however, always the possibility that groundwater can be contaminated as a result of accidental spills or releases of substances. Therefore, a comprehensive sampling and analysis program, similar to that conducted as part of the existing operation, will be conducted up-gradient and down gradient of the mine area. The objective of the monitoring program will be to confirm that mining impacts are as expected, and to provide notice of any water quality and flow concerns that may arise.

7. CONCLUSIONS

With respect to the hypothesis statements in Section 1, the residual impacts of the development and reclamation of the mine are of low concern. Specifically:

1) There will be no significant changes to flows in the Athabasca or Steepbank Rivers from groundwater.

2) The groundwater quality will not be affected by contaminant migration from processing and extraction activities at the mine.

There is no groundwater use in the area. In addition, there is little potential for groundwater to be used as a resource, except in the Athabasca River valley.

Groundwater discharge to surface water is a very minor component of the surface water flow. The rate of groundwater discharge is less than 1 % of the minimum monthly flow in the Athabasca and Steepbank Rivers, and less than 1 % of the average monthly flow in Shipyard Lake.

The following things have been evaluated, with regard to their impacts on the direction of groundwater flow, the rate of groundwater discharge, and the quality of groundwater:

Construction of water wells in the Athabasca River valley;
De-watering of the surficial deposits up-gradient of the mine;
The lowering of the hydraulic head in the bedrock aquifers during mining; and
The placement of consolidated tailings (CT) in the pits to reclaim the mine.

In all instances, the areal extent of the impacts will be limited to the Study Area. Because the groundwater flow rates are so low in comparison to the flow rates in the Athabasca River, Steepbank River and Shipyard Lake, the severity of changes in groundwater flow direction and discharge rate are low.

The duration of most impacts to the groundwater will be short term, with the exception of the diversion of groundwater in the surficial deposits, and the seepage of pore water from CT.

The groundwater from the surficial deposits is expected to be diverted to Shipyard Lake and the Athabasca River, via Wood Creek. Once again, because the rate of groundwater flow in the aquifer is so low in comparison to the surface water flows, the level of concern over this impact is low.

The pore water from CT is expected to seep through the bedrock aquifers, and discharge to the Athabasca River, Steepbank River and Shipyard Lake. The quality of the CT pore water is very similar to the natural quality of groundwater in the bedrock aquifers. It contains essentially the same organic compounds as the groundwater, although at slightly higher concentrations. Therefore, the level of concern associated with the long-term seepage of pore water from CT is considered to be low.

Aside from the impact of CT in the tailings ponds, the quality of groundwater is not expected to be impacted by the mine. A program of groundwater monitoring will be used to ensure that any accidental spills or releases are detected and can be mitigated quickly.

PART IV - REFERENCES

Alberta Environment. 1983. Soil Testing and Groundwater Supply Evaluation Guidelines for Residential Subdivisions. Prepared by: Soils Branch, Earth Sciences Division, Environmental Protection Services, and Regional Land Use Branch, Land Reclamation Division, Environmental Coordination Services, Alberta Environment, February, 1983.

Alsands Project Group. 1978a. Application to the Alberta Energy Resources Conservation Board for an Oil Sands Mining Project, December 1978.

Alsands Project Group. 1978b. Environmental Impact Assessment, presented to the Alberta Energy Resources Conservation Board for an Oil Sands Mining Project.
Applied Groundwater Imaging (AGI) Ltd., 1995. Ground Penetrating Radar Survey for Suncor OSG Inc. February 1995. Vol. 1.

Applied Ground Imaging Ltd. (AGI), 1995. Athabasca River Ground Penetrating Radar Survey, Feb. 1995. Report prepared for Suncor OSG and Klohn-Crippen Consultants Ltd.

Associated Mining Consultants Ltd., 1995. Fixed Frequency Electromagnetic Survey Suncor Inc. - Lease 19, 25, 39 and 97 for Suncor OSG Inc., March, 1995.

Atmospheric Environment Service, 1993. Canadian Climate Normals, 1961-1990, Prairie Provinces, Environment Canada.

Bayrock, L.A., Surficial Geology of the Bitumount area, Alberta. NTS 74E. Alberta Research Council Map.

Bayrock, L.A., and T.H.F. Reimchen, 1973. Surficial Geology, Waterways, Alberta, NTS 74D. Alberta Research Council Map.

Carrigy, M.A., 1959. Geology of the McMurray Formation Part 111 General Geology of the McMurray Area, Memoir 1, Research Council of Alberta, Edmonton.

Carrigy, M.A., 1973. Guide to the Athabasca Oil Sands Area. Alberta Research Council, Information Series No. 65, prepared for the Canadian Society of Petroleum Geologists Oils Sands Symposium. Editor: M.A. Carrigy, Assoc. Editor: J.W. Kramers.

CCME. 1991. Interim Canadian Environmental Quality Criteria for Contaminated Sites. Report CCME EPC-CS34, Prepared by: Canadian Council of Ministers of the Environment, CCME Subcommittee on Environmental Quality Criteria for Contaminated Sites. Available from: Environmental Quality Guidelines Division, Water Quality Branch, Environment Canada, Ottawa K1A 0H3.

Cotterill, D.K. and W.N. Hamilton. 1995. Geology of Devonian Limestones in Northeast Alberta, Alberta Geological Survey/Alberta Research Council Open File Report 1995-07, prepared for Canada-Alberta MDA Project M92-04-14, March, 1995.

Crickmay, C.H., 1957. Elucidation of some Western Canada Devonian Formations;published by author, Imperial Oil Ltd., Calgary, Alberta, 14 pp.

Hackbarth, D.A, 1977. Groundwater Observation Well Network: Athabasca Oil SandssAreas, Alberta Research Council, Information Series No. 69.

Hackbarth, D.A. and N. Nastasa. 1979. the Hydrogeology of the Athabasca Oil Sands Area, Alberta. Alberta Research Council Bulletin 38.

Klohn-Crippen Consultants Ltd. (KCCL) 1995. 1994 Groundwater Monitoring Program. Report prepared for Suncor Inc., April 1995.

Klohn-Crippen Consultants Ltd. 1996. Hydrology Baseline, Steepbank Oilsands Mine for Suncor OSG, May 1996.

McPherson, R.A. and C.P,. Kathol. 1977. Surficial Geology of Potential Mining Areas in the Athabasca Oil Sands Region. Alberta Research Council Open File Report No. 1977-4.

Norris, A.W., 1963. Devonian Stratigraphy of Northeastern Alberta and Northwestern Saskatchewan. Geol. Surv. Canada, Mem. 313, 168 pp.

Schwartz, F.W. 1979. Interim Report on a Hydrogeological Investigation of the Muskeg River Basin, Project HG-1-1. Prepared for Alberta Oil Sands Environmental Research Program, Water Systems.

Schwartz, F.W. 1980. Hydrogeological Investigation of the Muskeg River Basin, alberta, Project WS-2-2. Prepared for Alberta Oil Sands Environmental Research Program, Water Systems.

Suncor Inc., 1996. Aquatics Impacts Analysis; Steepbank Mine Environmental Impacts Document.

PART V - GLOSSARY OF TERMS

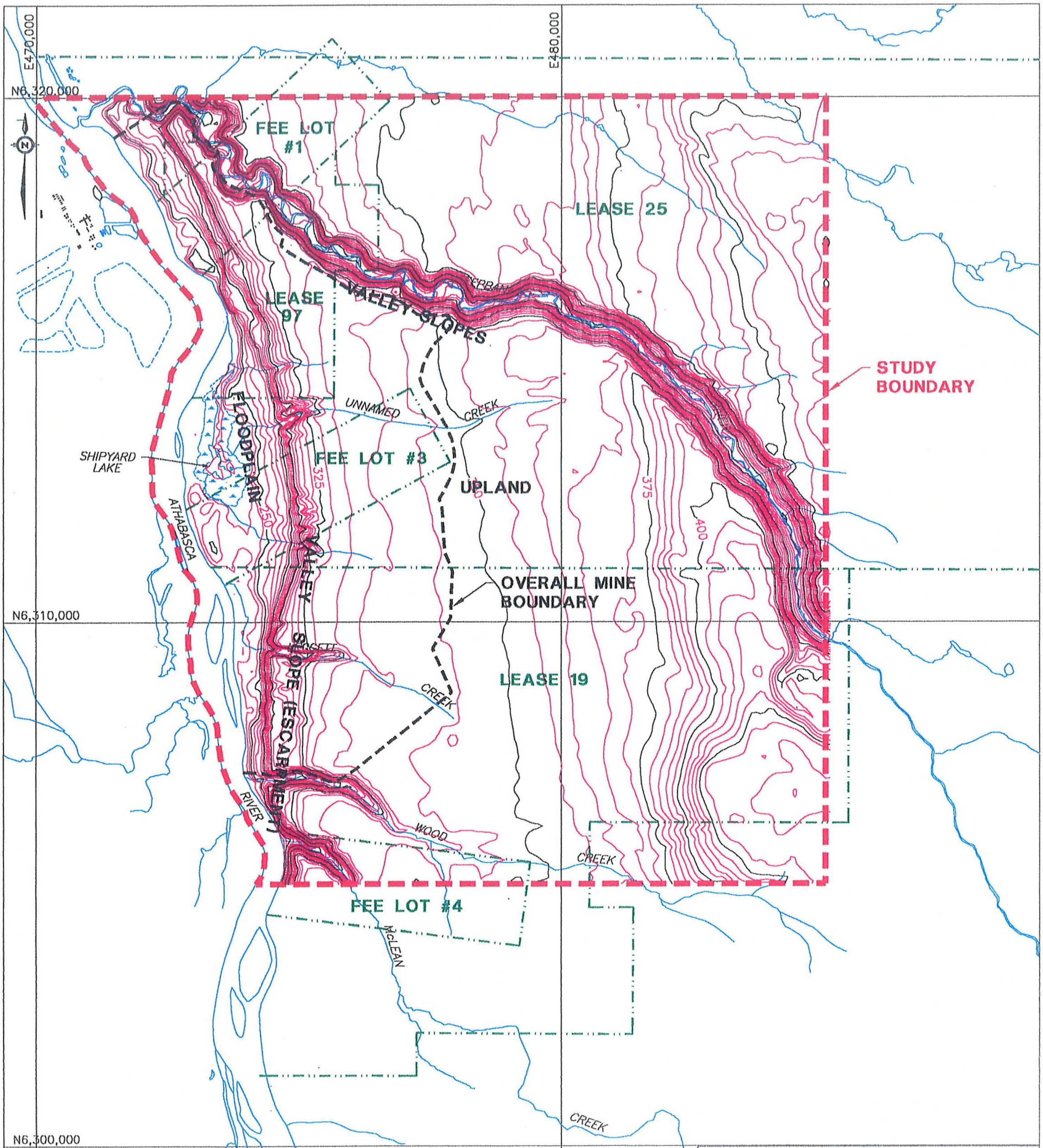
Aquifer	A body of rock or soil which contains sufficient amounts of saturated permeable material to yield economic quantities of water to wells or springs.
Aquitard	A lithologic unit that impedes ground water movement and does not yield water freely to wells or springs but that may transmit appreciable water to or from adjacent aquifers. Where sufficiently thick, may act as a ground water storage zone. Synonymous with confining unit.
Available Drawdown	The vertical distance that the equipotential surface of an aquifer can be lowered; in confined aquifers, this is to the top of the aquifer; in unconfined aquifers, this is to the bottom of the aquifer.
Baseline	A surveyed condition which serves as a reference point to which later surveys are coordinated or correlated.
Bedrock	The body of rock which underlies the gravel, soil or other superficial material.
Borehole Log	The record of geologic units penetrated, drilling progress, depth, water level, sample recovery, volumes and types of materials used, and other significant details regarding the drilling of an exploratory borehole or well.
Confined Aquifer	An aquifer in which the potentiometric surface is above the top of the aquifer.
Consolidated Tailings	The portion of ore that is deposited after washing and milling and which has undergone a reduction in volume and increase in density. (See also "Consolidation")
Consolidation	The gradual reduction in volume of a soil mass resulting from an increase in applied load. a) Initial consolidation (initial compression): A comparatively sudden reduction in volume of a soil mass under an applied load due principally to release or the squeezing out and compression of gas in the soil voids preceding primary consolidation b) Primary consolidation (primary compression) (primary time effect): The reduction in volume of a soil mass caused by the application of a sustained load to the mass and due principally to a squeezing out of water from the void spaces of the mass and accompanied by a transfer of the load from the soil water to the soil solids. c) Secondary consolidation (secondary compression) (secondary time effect): The reduction in volume of a soil mass caused by the application of a sustained load to the mass and due principally to the adjustment of the internal structure of the soil mass after most of the load has been transferred from the soil water to the soil solids.
Darcy's Law	A law describing the rate of flow of water through porous media. (Named for Henry Darcy of Paris who formulated it in 1856 from extensive work on the flow of water through sand filter beds.)
Deposit	Material left in a new position by a natural transporting agent such as water, wind, ice or gravity, or by the activity of man.
De-pressurize	The process of reducing the pressure in an aquifer, by withdrawing water from it.
Deuterium	A stable isotope of hydrogen, which has two neutrons.
Energy Dissipation	A structure designed to dissipate the excessive structure energy of a high velocity fluid (i.e. water), to establish a safe flow condition and prevent scour or minimize erosion. (See also "Hydraulic structure")

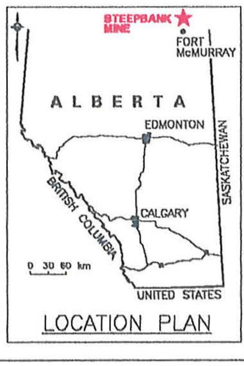
Ephemeral	A phenomena, feature, marriage which only lasts for a short time (ie., an ephemeral stream is only present for short periods during the year.
Equipotential Level	The level on which the potential everywhere is constant; the level at surface which the pressure head of a body of groundwater is the same.
Floodplain	Land near rivers and lakes that may be flooded during seasonally high water levels.
Fluvial	Relating to a stream or river.
Glacial Till	Unsorted and unstratified glacial drift, generally unconsolidated, deposited directly by a glacier without subsequent reworking by water from the glacier, and consisting of a heterogeneous mixture of clay, silt, sand, gravel and boulders varying widely in size and shape.
Glacio-Lacustrine	Relating to the lakes that formed of the edge of glaciers as the glaciers receded. Glacio-lacustrine sediments are commonly laminar deposits of fine sand, silt and clay.
Ground Penetrating	Method of mapping subsurface layer geometry using radar.
Groundwater	Water that is found below the ground surface, in soil and rock.
Groundwater Level	The level below which the rock and subsoil, to unknown depths, are saturated.
Groundwater Regime	Water below the land surface in a zone of saturation.
Groundwater Velocity	The speed at which groundwater advances through the ground. The way that the term is used in this document, it technically refers to the average linear velocity of the groundwater.
Head	The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. It is used in various compound terms such as pressure head, velocity head, and loss of head.
Hydraulic Conductivity	The permeability of soil or rock to water.
Hydraulic Gradient	A measure of the force moving groundwater through soil or rock. It is measured as the rate of change in total head per unit distance of flow in a given direction. Hydraulic gradient is commonly shown as being dimensionless, since its units are m/m, ft/ft.
Hydraulic Head	The elevation with respect to a specified reference level at which water stands in a piezometer connected to the point in question in the soil. Its definition can be extended to soil above the water table if the piezometer is replaced by a tensiometer. The hydraulic head in systems under atmospheric pressure may be identified with a potential expressed in terms of the height of a water column. More specifically, it can be identified with the sum of gravitational and capillary potentials, and may be termed the hydraulic potential.
Hydraulic Structure	Any structure which is designed to handle water in any way. This includes the retention, conveyance, control, regulation, and dissipation of the energy of water.
Hydrogeology	The study of the factors that deal with subsurface water, and the related geologic aspects of surface water.
Inorganics	Pertaining or relating to a compound that contains no carbon. (See also "Organic compounds")

Landform	Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape, and produced by natural causes.
Lean Oil Sands	Oil bearing sands, which do not have a high enough saturation of oil to make mining of them economically feasible.
Microtox	A measure of toxicity in a sample. (See also "Toxicity")
Organic Compounds	Chemicals (naturally occurring or otherwise) which contain carbon, with the exception of carbon dioxide (CO^2) and carbonates (e.g., CACO3)
Overburden	The soil, sand, silt, or clay that overlies bedrock. In mining terms, this includes all material which has to be removed to expose the ore.
Oxygen-18	A stable isotope of oxygen which has two more neutrons than the more common oxygen-16.
Piezometer	An instrument for measuring pressure. In groundwater and geotechnical investigations, piezometers are commonly Poly Vinyl Chloride pipe that has been sealed in a drill hole. The height to which groundwater rises in the pipe is a measure of the water pressure at the bottom of the piezometer.
Piezometric Surface	If water level elevations in wells completed in an aquifer are plotted on a map and contoured, the resulting surface described by the contours is known as a potentiometric or piezometric surface.
Pneumatic Piezometer	A type of piezometer in which the hydraulic head is measured using a compressed gas.
Pore Water	Water that is present between the grains of a soil or rock.
Potentiometric Surface	An imaginary surface representing the static head of groundwater. The water table is a particular potentiometric surface.
Sediment Sampling	A field procedure relating to a methodology for determining the configuration of sediment deposits.
Sedimentation	The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material.
Stable Isotopes	Isotopes of a particular element have the same number of protons; but different numbers of neutrons. Isotopes are stable if they do not naturally undergo radioactive decay.
Static Water Level	The elevation of the top of a column of water in a monitoring well or piezometer that is not influenced by pumping.
Stratigraphy	The succession and age of strata of rock and unconsolidated material. Also concerns the form, distribution, lithologic composition, fossil content and other properties of the strata.
Surficial Aquifer	A surficial deposit containing water to be considered an aquifer.
Surficial Deposit	A geologic deposit (like clay, silt or sand) that has been placed above bedrock. (See also "Overburden")
Tailings	The portion of ore, after washing and milling, which is too low grade to warrant further processing.

Total Dissolved Solids (TDS)	The total concentration of all dissolved compounds solids found in a water sample.
Toxicity	The tendency of a chemical or condition to cause harm to the life process.
Twenty Year Safe Yield (Q_{20})	An estimation of the long term rate at which a water well will produce water. The Q20 is the rate at which a well can be pumped continuously for 20 years, without the water level dropping below the top of the aquifer. (See also "Available drawdown")
Unconfined Aquifer	An aquifer in the which the water level is below the top of the aquifer.
Water Equivalent	As relating to snow; the depth of water that would result from melting.
Water Table	The shallowest saturated ground below ground level - technically, that surface of a body of unconfined groundwater in which the pressure is equal to atmospheric pressure.
Wetlands	Area of surface water ponding which forms the habitat for a variety of wildlife including water fowl.

DRAWINGS





LOCATION PLAN

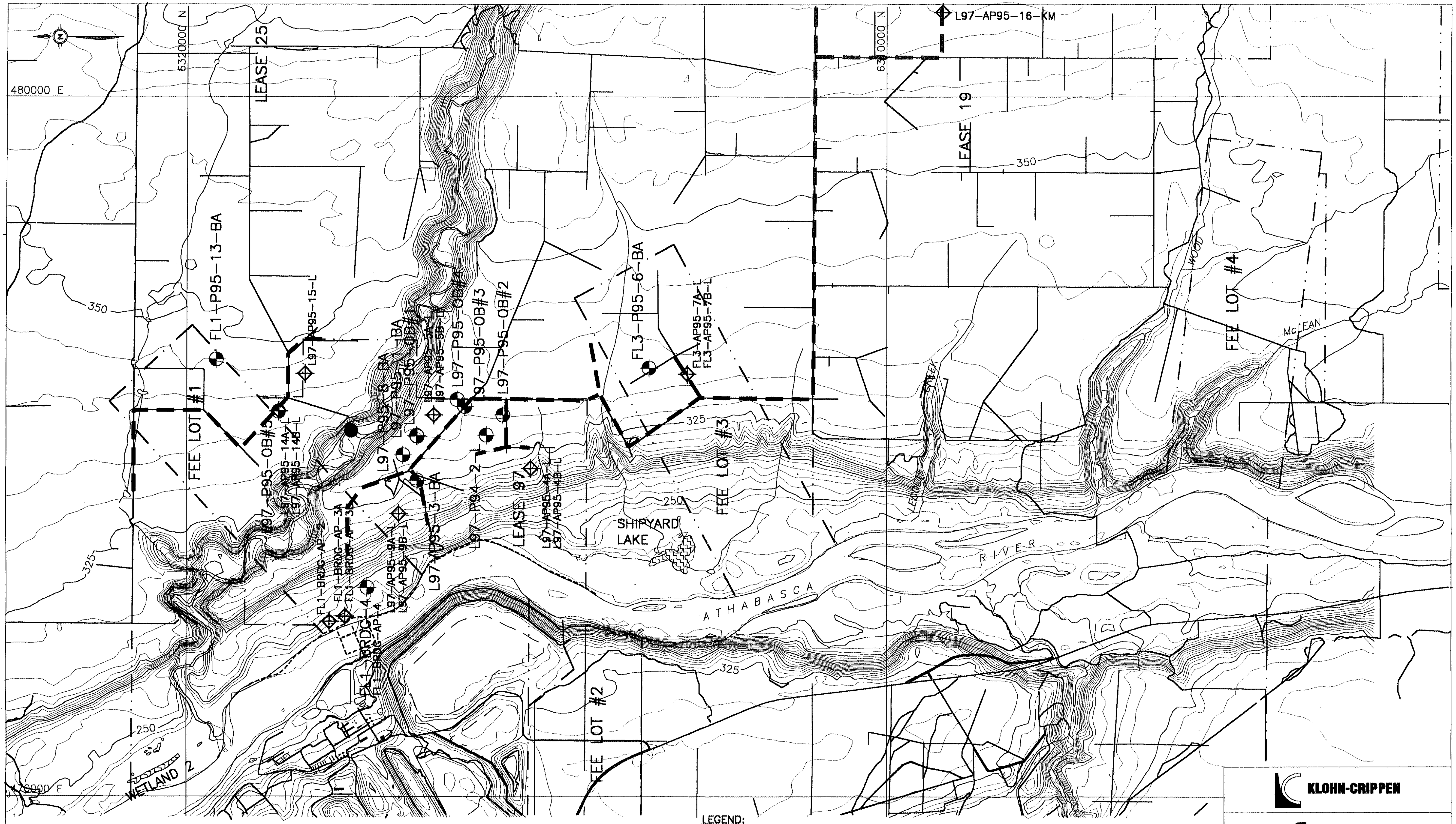
02-01.dwg

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

BASELINE CONDITIONS
SITE MAP

SCALE: 1:100,000	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: 25 03 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-001



LEGEND:

▬ ▬ ▬ GROUND CONDUCTIVITY SURVEY

-------- GPR SURVEY

⊕ STANDPIPE PIEZOMETERS

◇ PNEUMATIC PIEZOMETERS

● ENVIRONMENT CANADA STATION

(1:100,000) 0 500 1000m

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

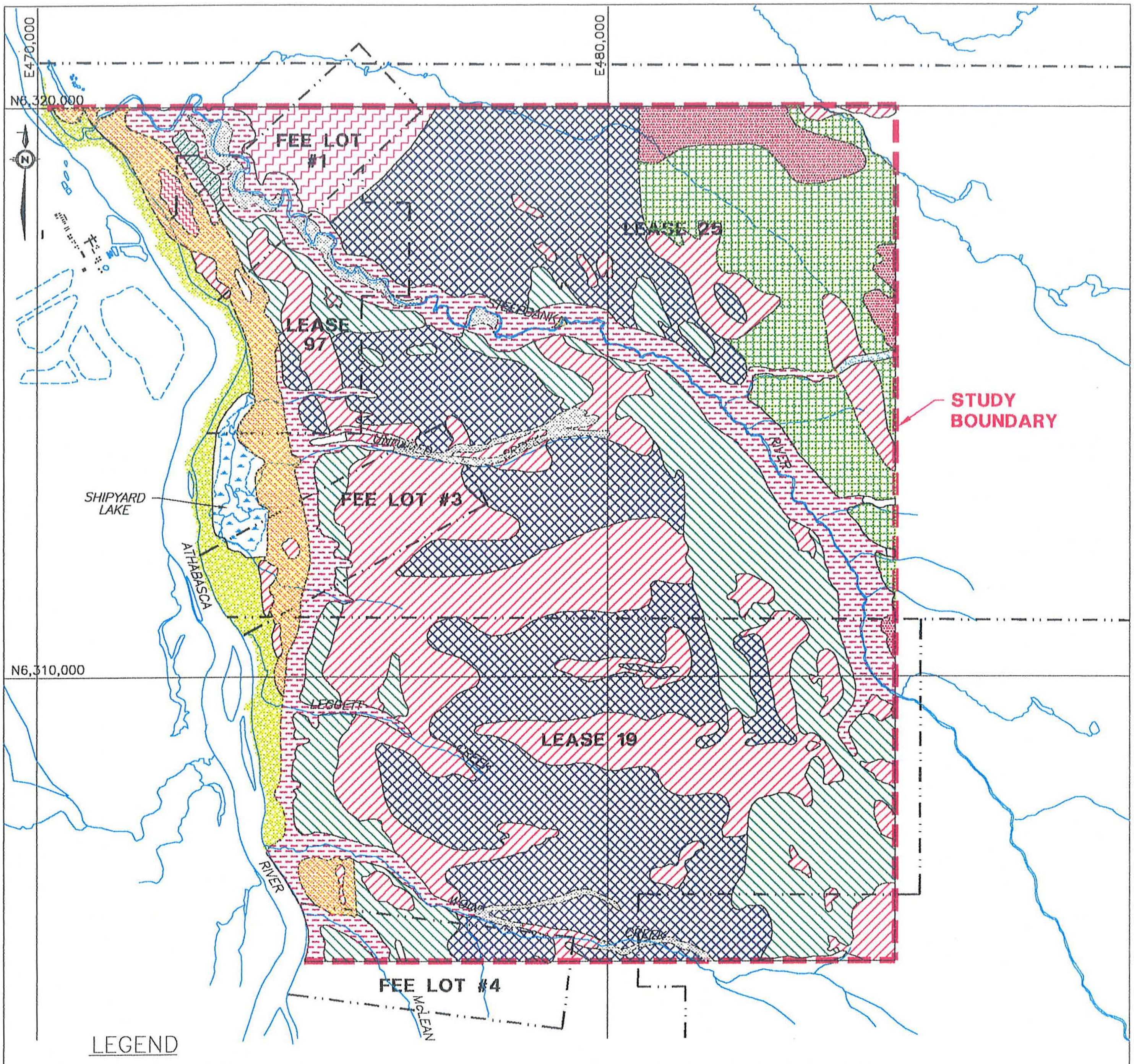
LOCATIONS, PIEZOMETERS, GEOPHYSICAL LINES, AND WETLANDS IN STUDY AREA

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

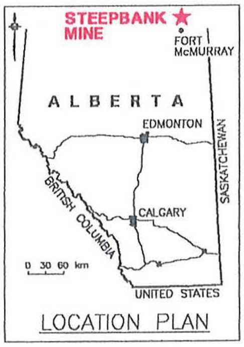
REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-002

02-02.dwg



LEGEND

- ▨ ▦ LOW RELIEF TILL, a) OVERLAIN BY DISCONTINUOUS MUSKEG
- ▨ ▨ OUTWASH SAND, a) OVERLAIN BY DISCONTINUOUS MUSKEG
- ▨ ▨ MELTWATER CHANNEL SEDIMENT, a) OVERLAIN BY DISCONTINUOUS MUSKEG
- ▩ ▦ MIXED GLACIOLACUSTRINE DEPOSITS, a) OVERLAIN BY DISCONTINUOUS MUSKEG
- ▩ ALLUVIAL SILT AND CLAY, OVERLAIN BY ALLUVIAL SAND AND GRAVEL
- ▩ ALLUVIAL SAND
- ▨ MUSKEG
- ▤ ERODED SLOPE, GULLEY AND STREAM VALLEY



LOCATION PLAN

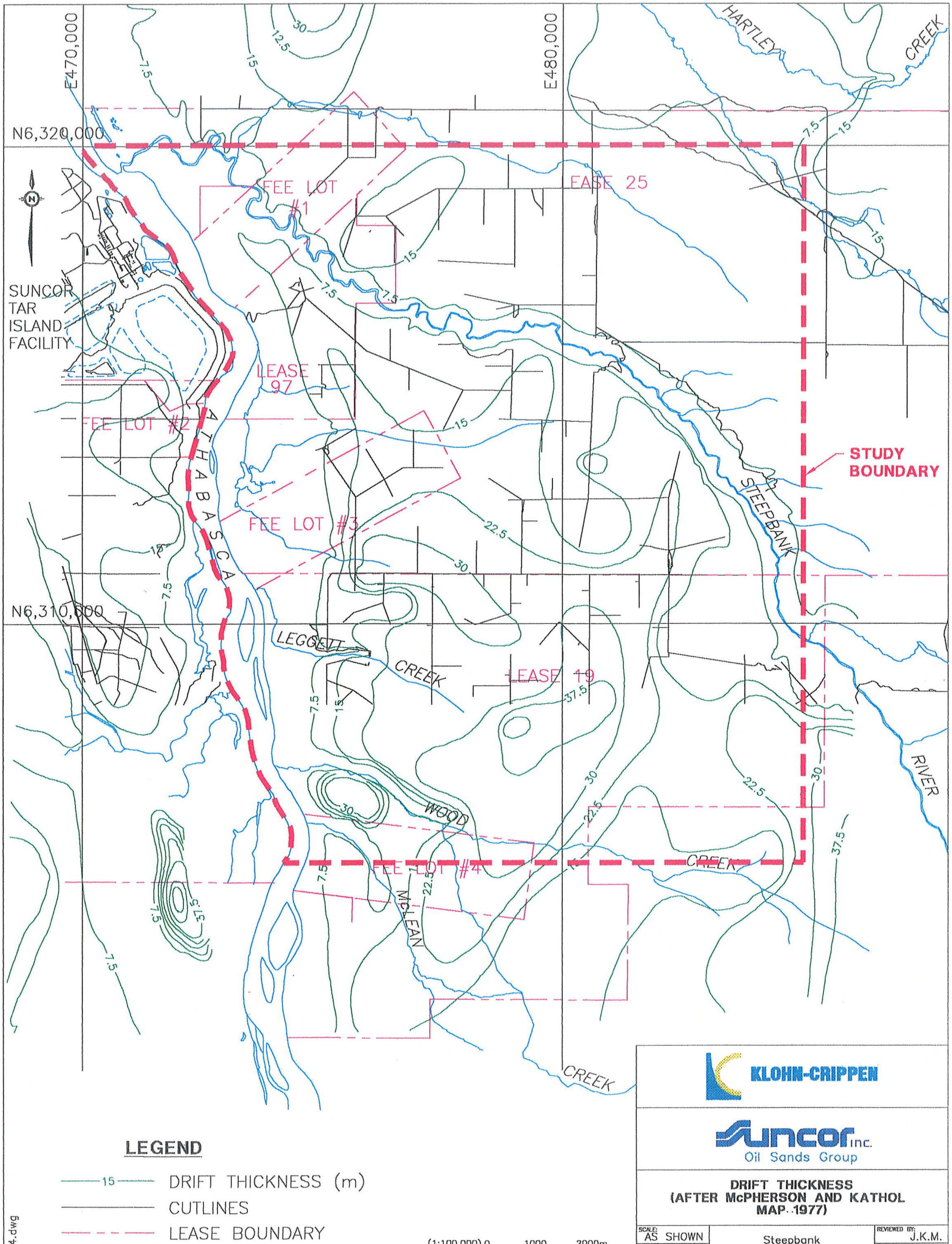
02-03.dwg

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

SURFICIAL GEOLOGY MAP (AFTER McPHERSON AND KATHOL 1977)

SCALE: 1:100,000	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-003

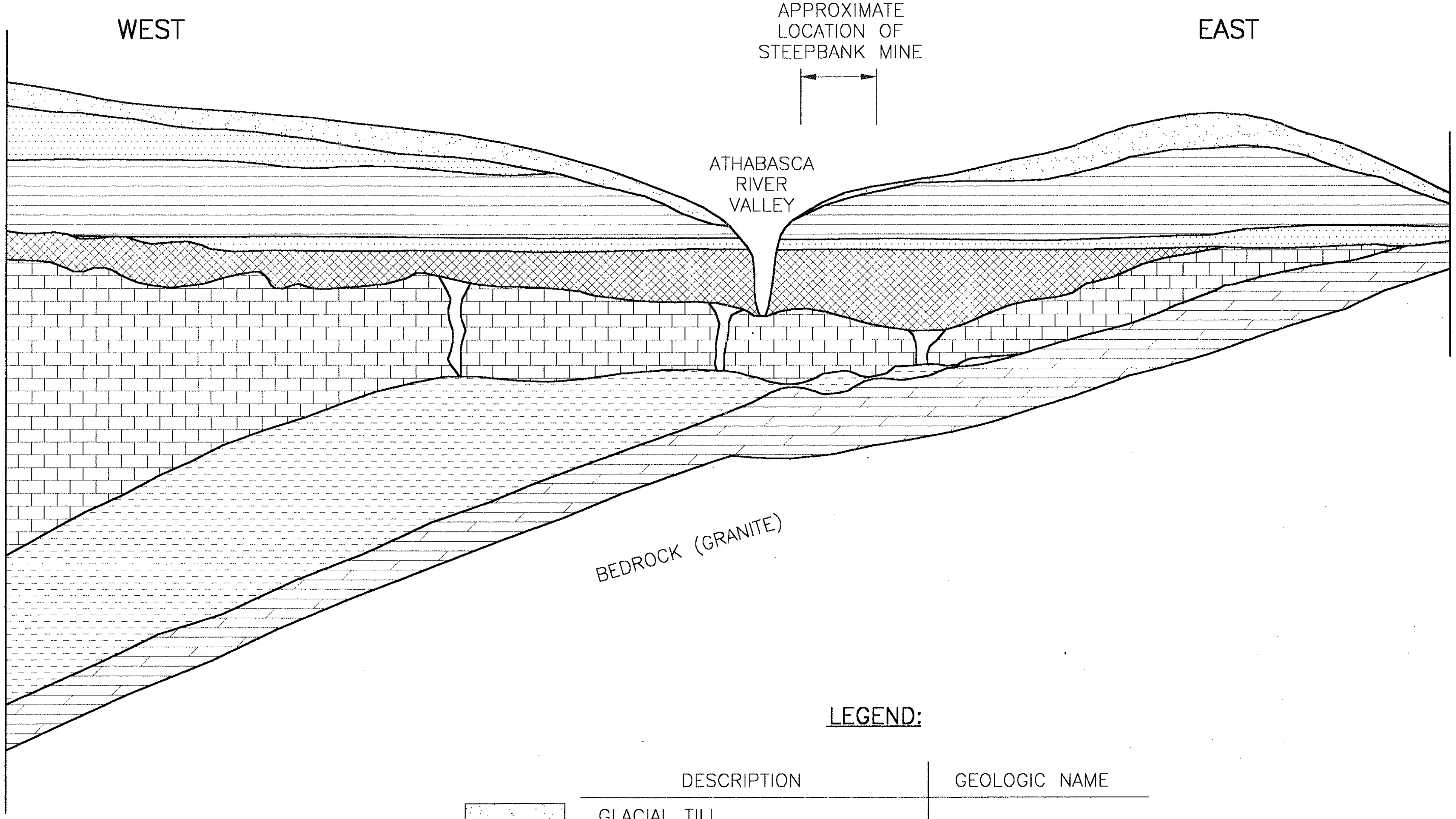


KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

DRIFT THICKNESS
(AFTER McPHERSON AND KATHOL MAP 1977)

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-004



LEGEND:

DESCRIPTION	GEOLOGIC NAME
GLACIAL TILL	GRAND RAPIDS FM. CLEARWATER FM. -WABISKAW MBR.
SHALE	
SAND	
BITUMINOUS SANDS	McMURRAY FM.
LIMESTONE	UPPER DEVONIAN
SALT (IMPERMEABLE LAYER)	
DOLOMITE	MIDDLE DEVONIAN
PRE-CRETACEOUS SINK HOLES	

0 5 20Km

VERTICAL EXAGGERATION x85

KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

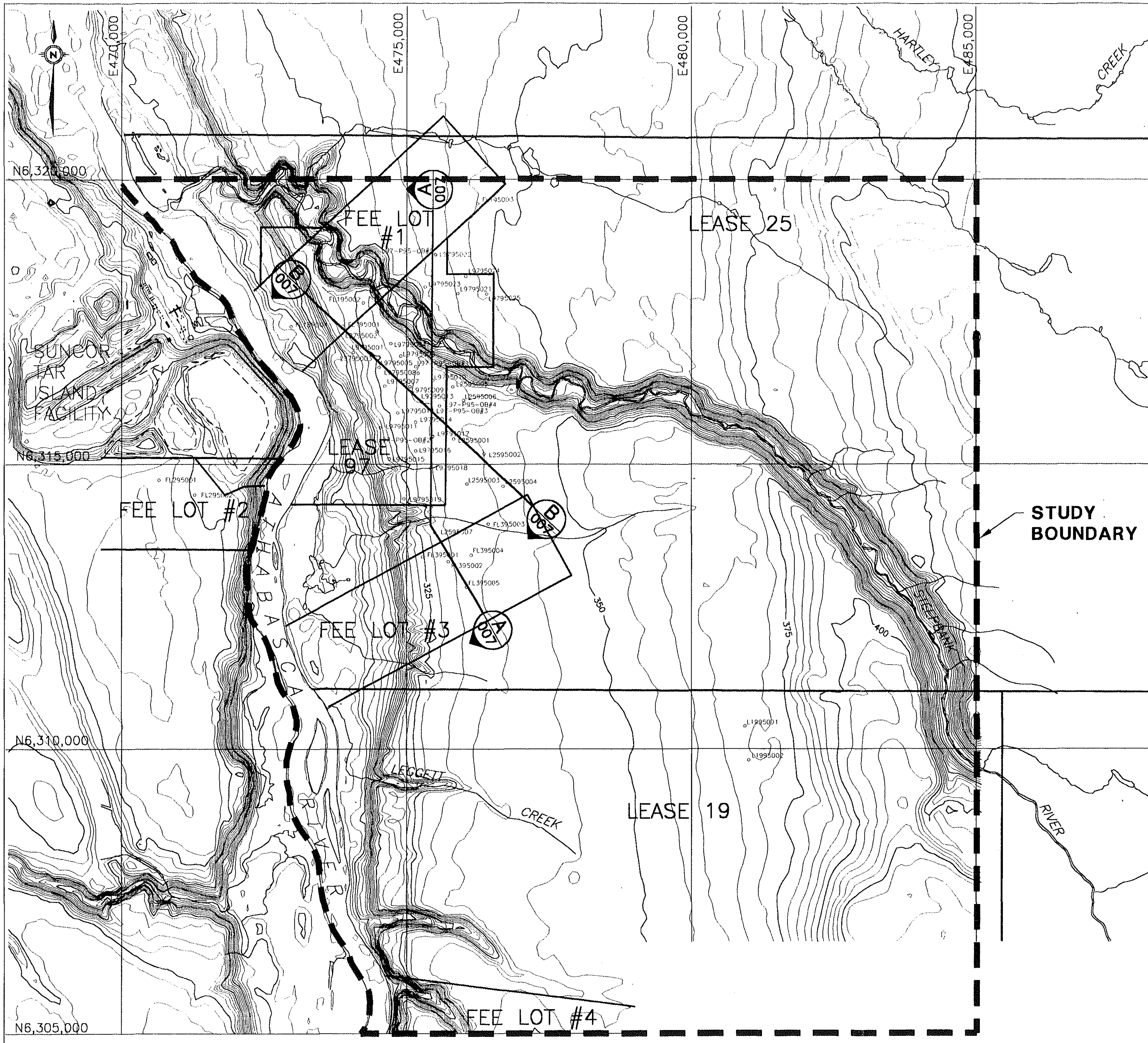
CONCEPTUALIZED REGIONAL GEOLOGY
CROSS SECTION
(MODIFIED FROM CARRIGY, 1973)

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-005

02-05.dwg



LEGEND

∘FL395004	BOREHOLE LOCATION
350	TOPOGRAPHIC CONTOURS CONTOUR INTERVAL = 5m

(1:75,000) 0 750 1500m

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

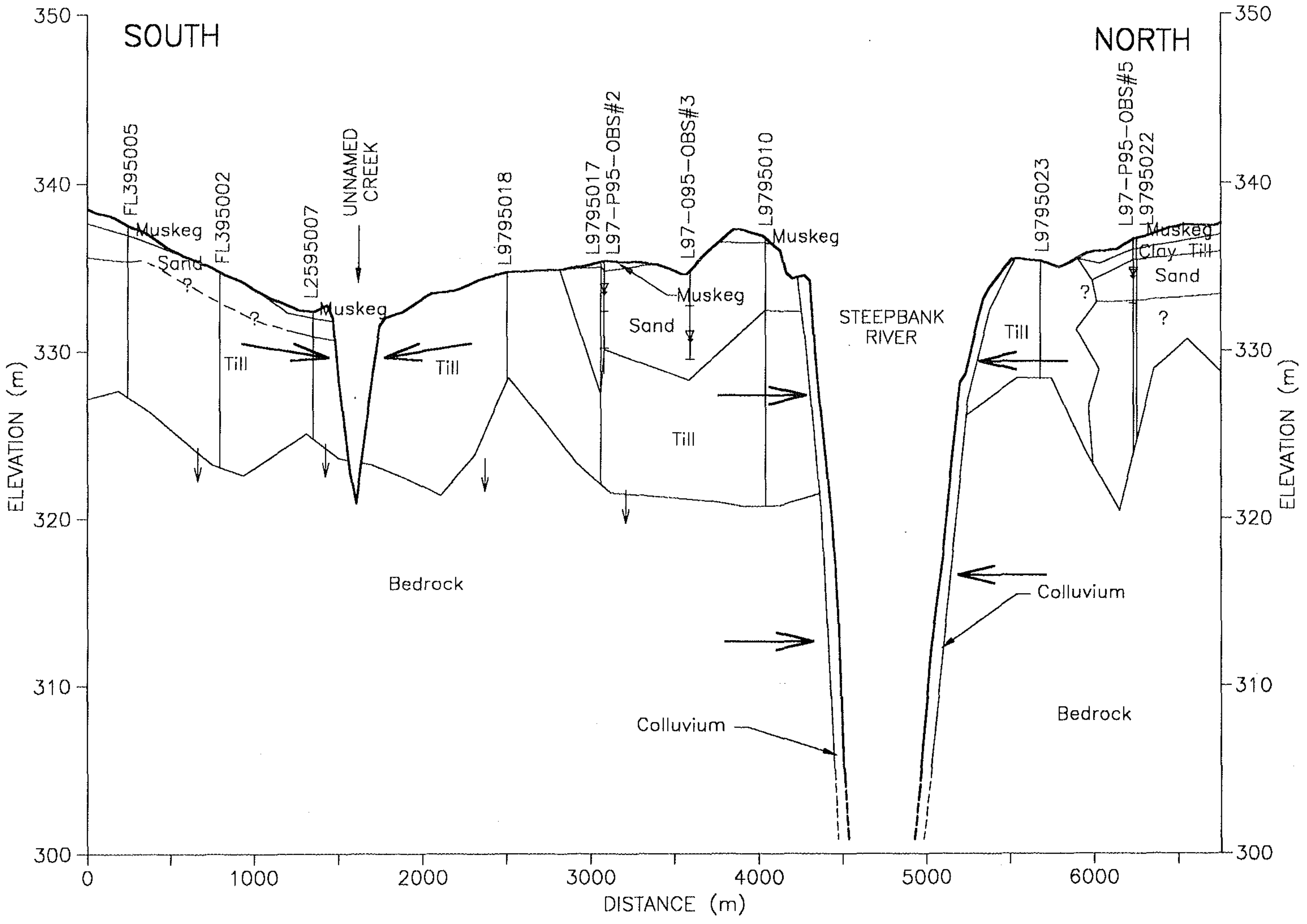
CROSS SECTIONS IN SURFICIAL SOILS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

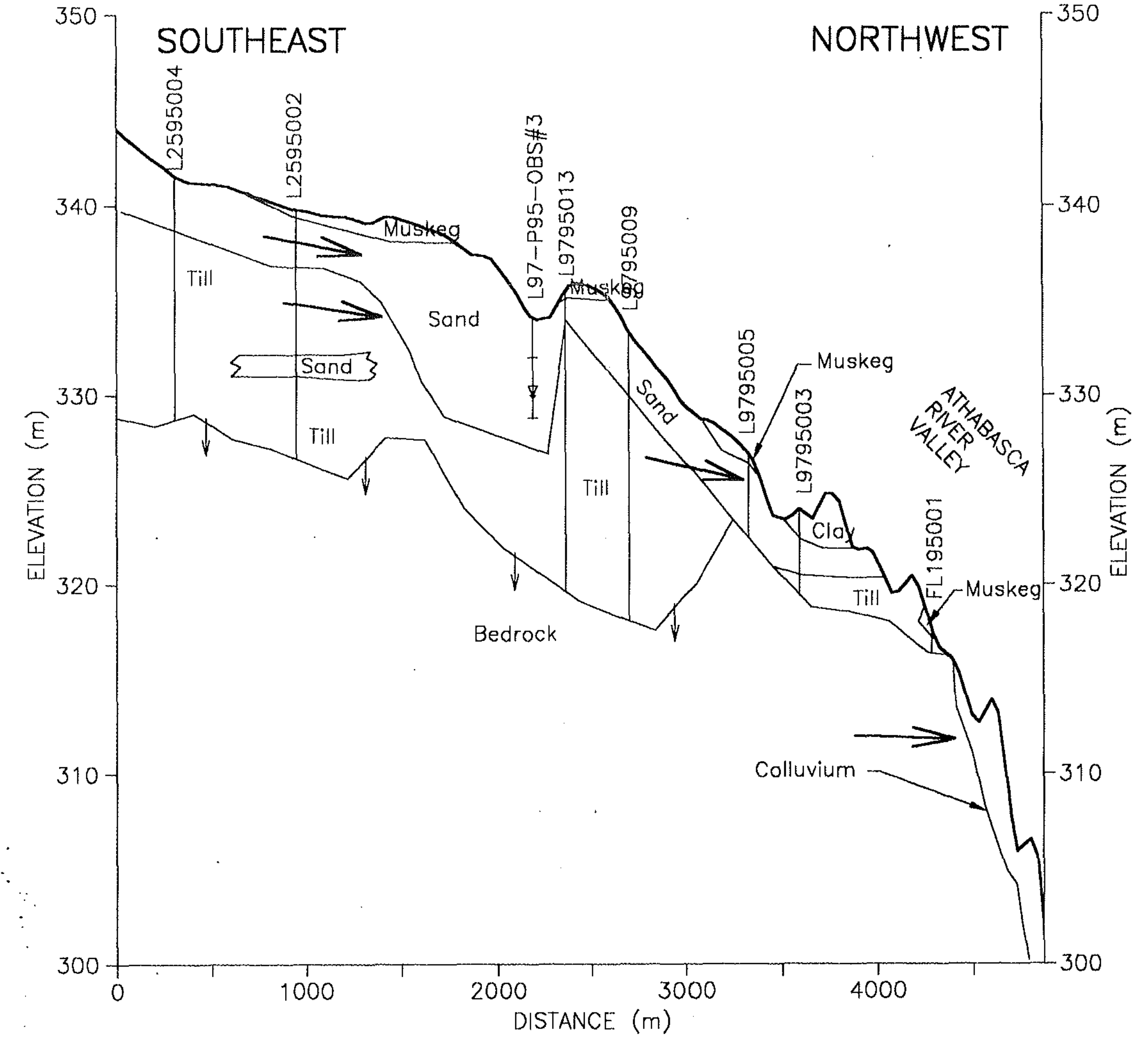
Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: 8-2779-02-006

02-06.dwg



SECTION (A/006)



SECTION (B/006)

LEGEND

⫲ STANDPIPE PIEZOMETER

▼ WATER LEVEL IN PIEZOMETER

← DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:40000) 0 400 800m (SCALE B)
(1:2000) 0 20 40m (SCALE A)

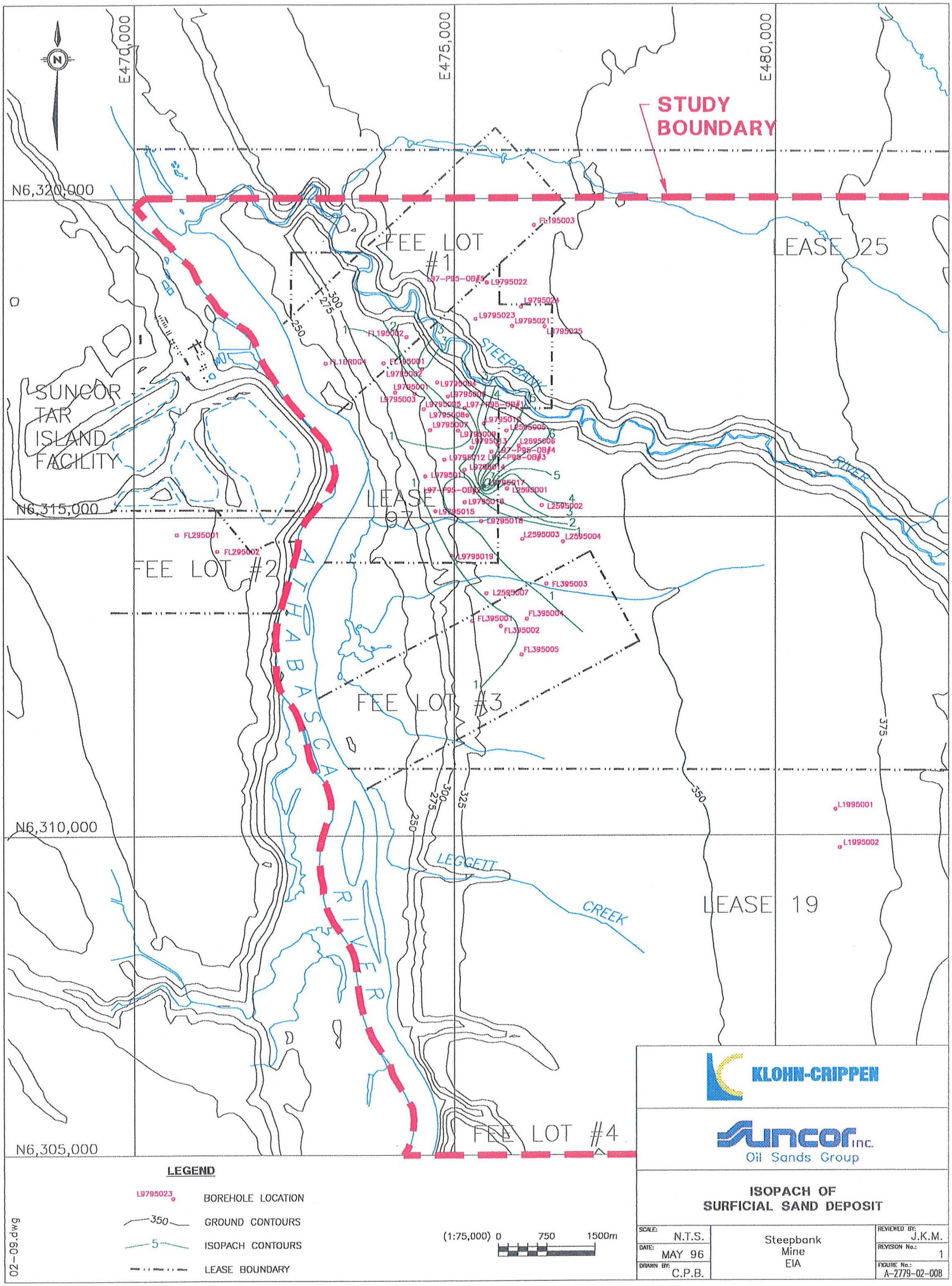
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

SURFICIAL GEOLOGY
CROSS SECTIONS A & B
BASELINE CONDITIONS

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: 8-2779-02-007

02-07.dwg

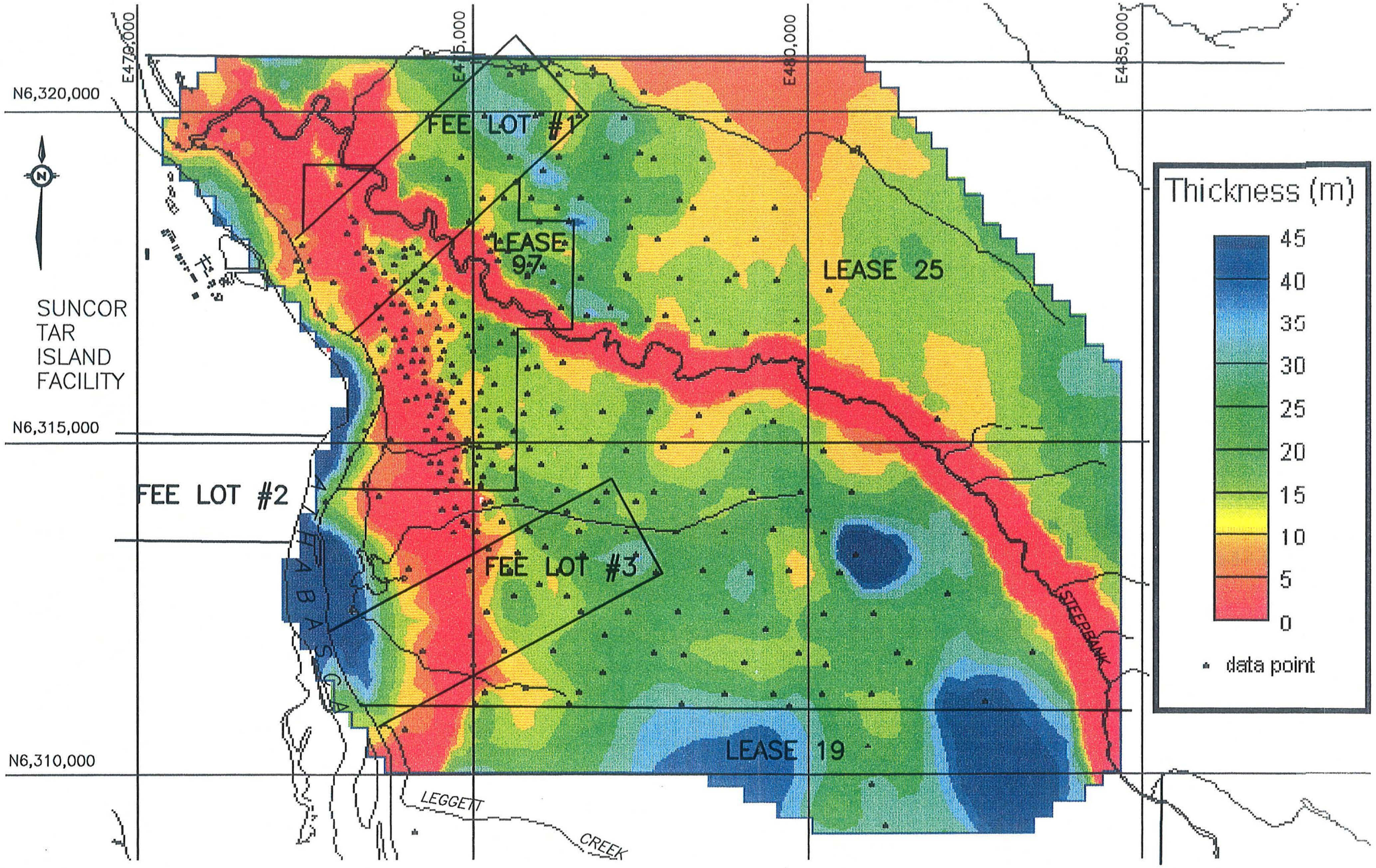


KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

ISOPACH OF SURFICIAL SAND DEPOSIT

SCALE: N.T.S.	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-008



(1:75,000) 0 750 1500m

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

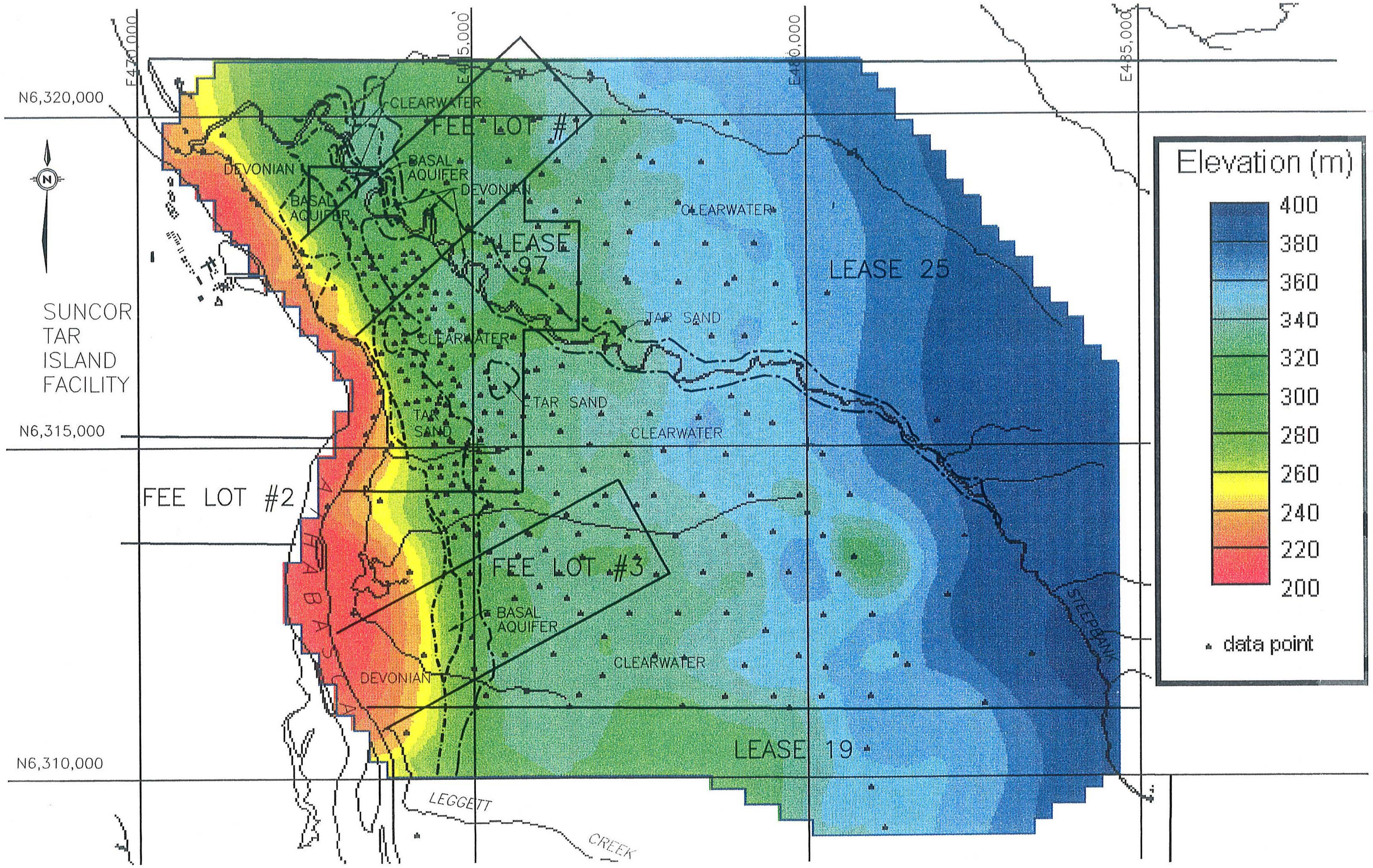
ISOPACH MAP OF SURFICIAL DEPOSITS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-008

02-08.dwg



(1:75,000) 0 750 1500m

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

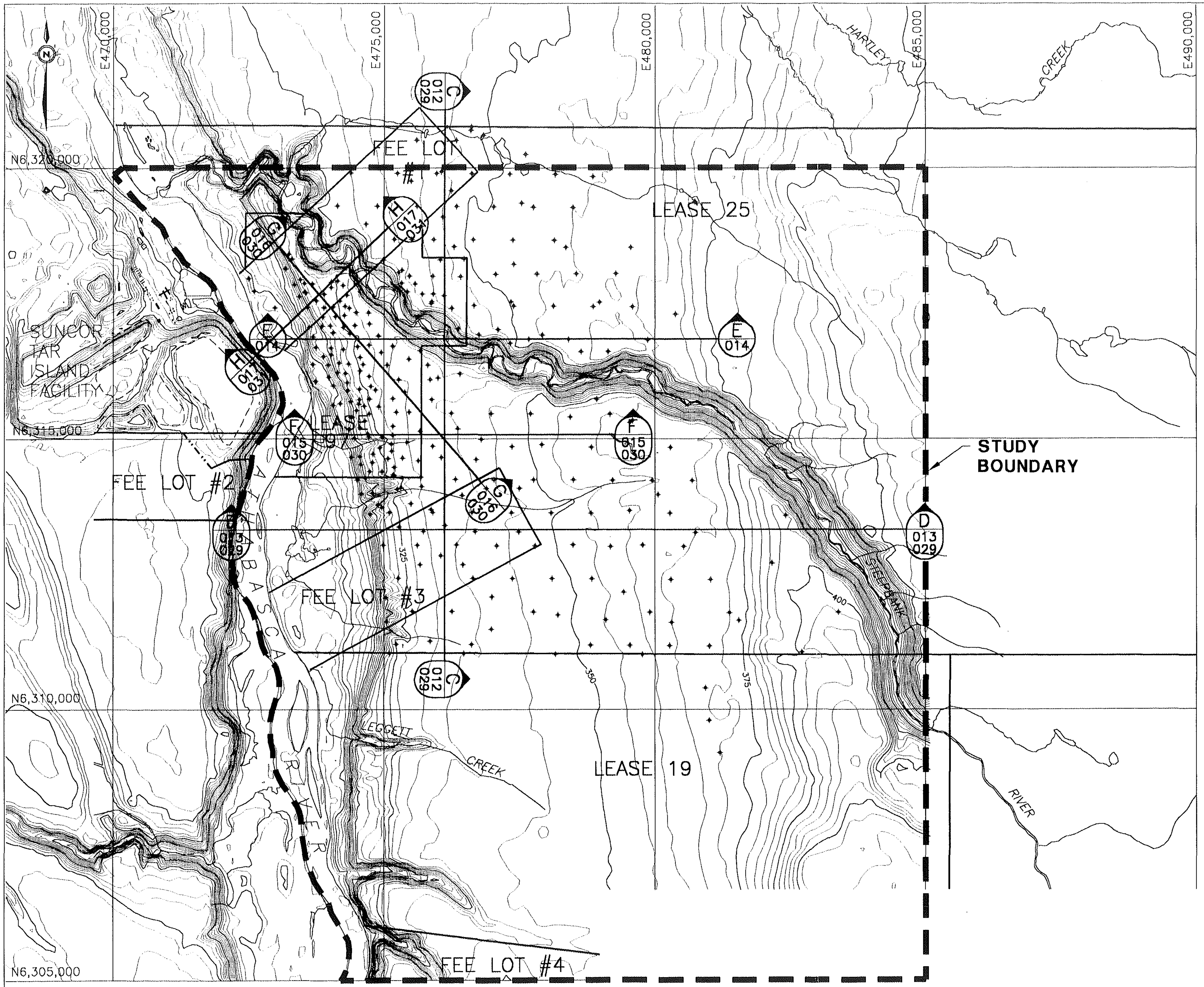
BEDROCK TOPOGRAPHY MAP

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-010

02–10.dwg



LEGEND

✦ BOREHOLE LOCATION

350 TOPOGRAPHIC CONTOURS
CONTOUR INTERVAL = 5m

(1:75,000) 0 1500 3000m

KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

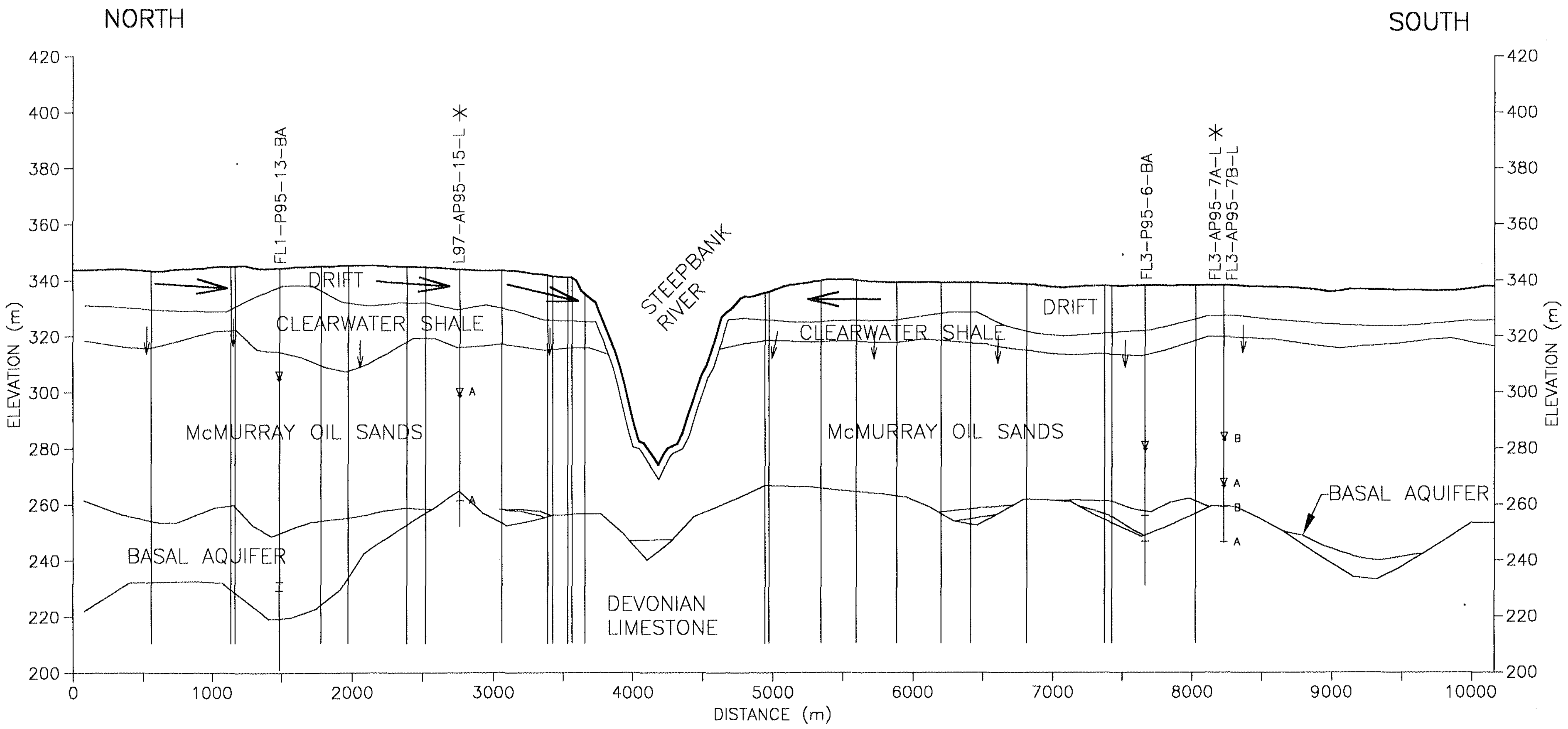
CROSS SECTIONS
IN
BEDROCK

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-011

02-11.dwg



SECTION C 011

LEGEND

⟂	STANDPIPE PIEZOMETER
⟂ B A	PNEUMATIC PIEZOMETER
▽	WATER LEVEL IN PIEZOMETER
▽ B	HYDRAULIC HEAD AT PNEUMATIC PIEZOMETER
L97-P95-x-BA	PIEZOMETER COMPLETED IN BASAL AQUIFER
L97-AP95-x-L	PIEZOMETER COMPLETED IN LIMESTONE
←	DIRECTION OF GROUNDWATER FLOW
*	THE COMPLETION ZONES OF PIEZOMETERS OFFSET FROM THE SECTION MAY NOT LINE UP WITH THE SECTION'S STRATIGRAPHY.

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:40,000) 0 400 800m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

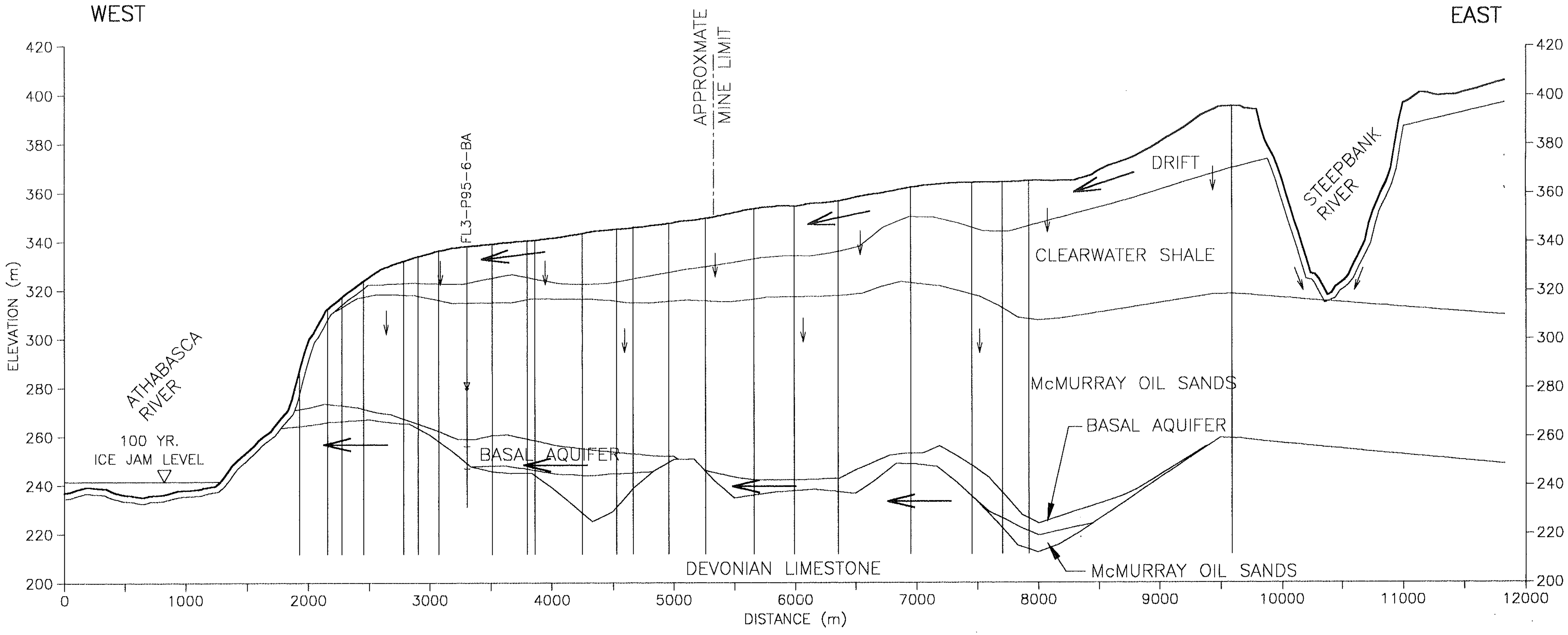
BEDROCK CROSS SECTION C
BASELINE CONDITIONS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-012

02-12.dwg



SECTION D 011

LEGEND

STANDPIPE PIEZOMETER

WATER LEVEL IN PIEZOMETER

L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER

← DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:40,000) 0 400 800m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

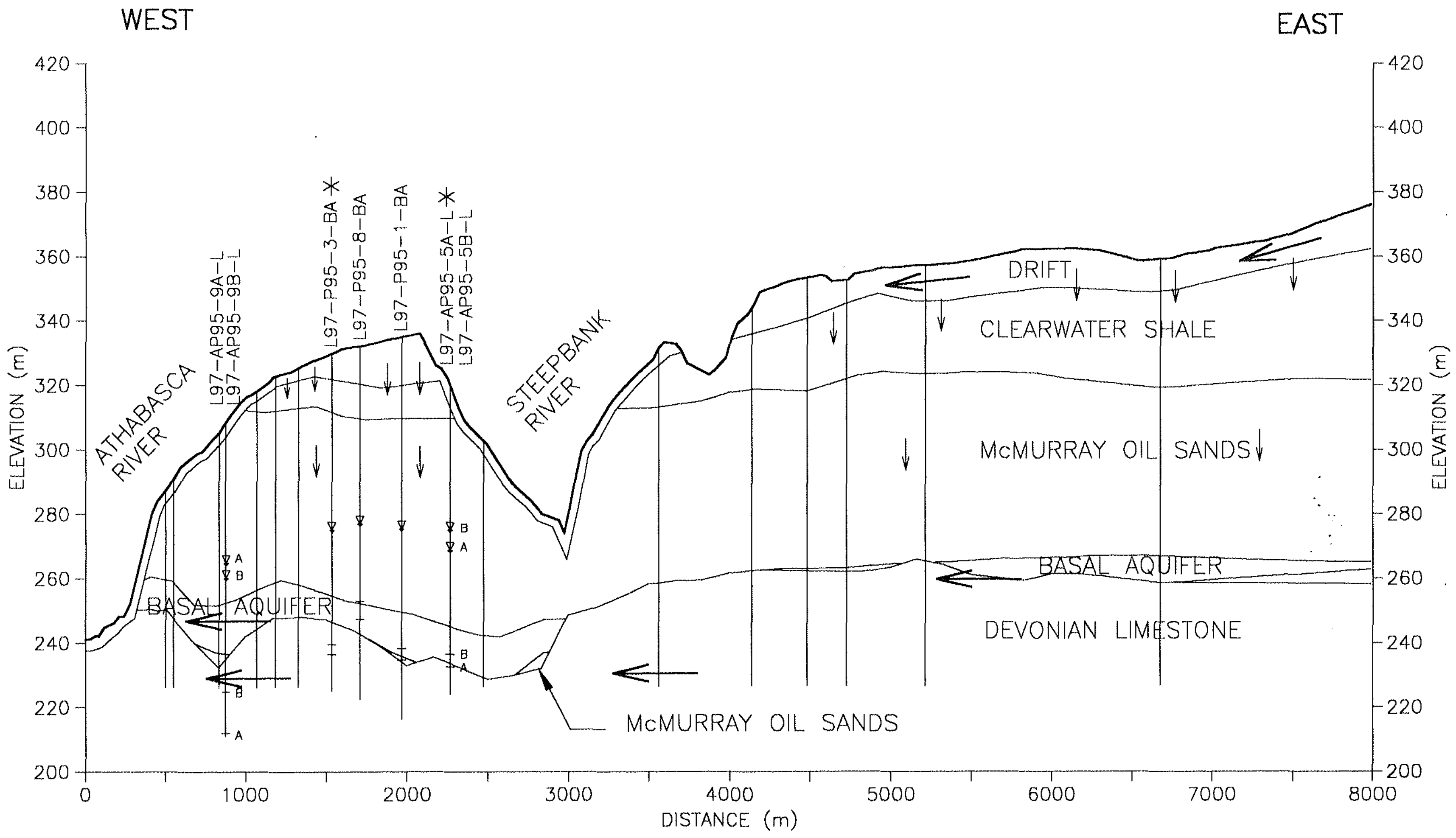
BEDROCK CROSS SECTION D, BASELINE CONDITIONS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-013

02-13.dwg



SECTION E 011

LEGEND

STANDPIPE PIEZOMETER

PNEUMATIC PIEZOMETER

WATER LEVEL IN PIEZOMETER

HYDRAULIC HEAD AT PNEUMATIC PIEZOMETER

L97-P95-x-BA PIEZOMETER COMPLETED IN BASAL AQUIFER

L97-AP95-x-L PIEZOMETER COMPLETED IN LIMESTONE

← DIRECTION OF GROUNDWATER FLOW

* NOTE: THE COMPLETION ZONES OF PIEZOMETERS OFFSET FROM THE SECTION MAY NOT LINE UP WITH THE SECTION'S STRATIGRAPHY.

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:40,000) 0 400 800m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

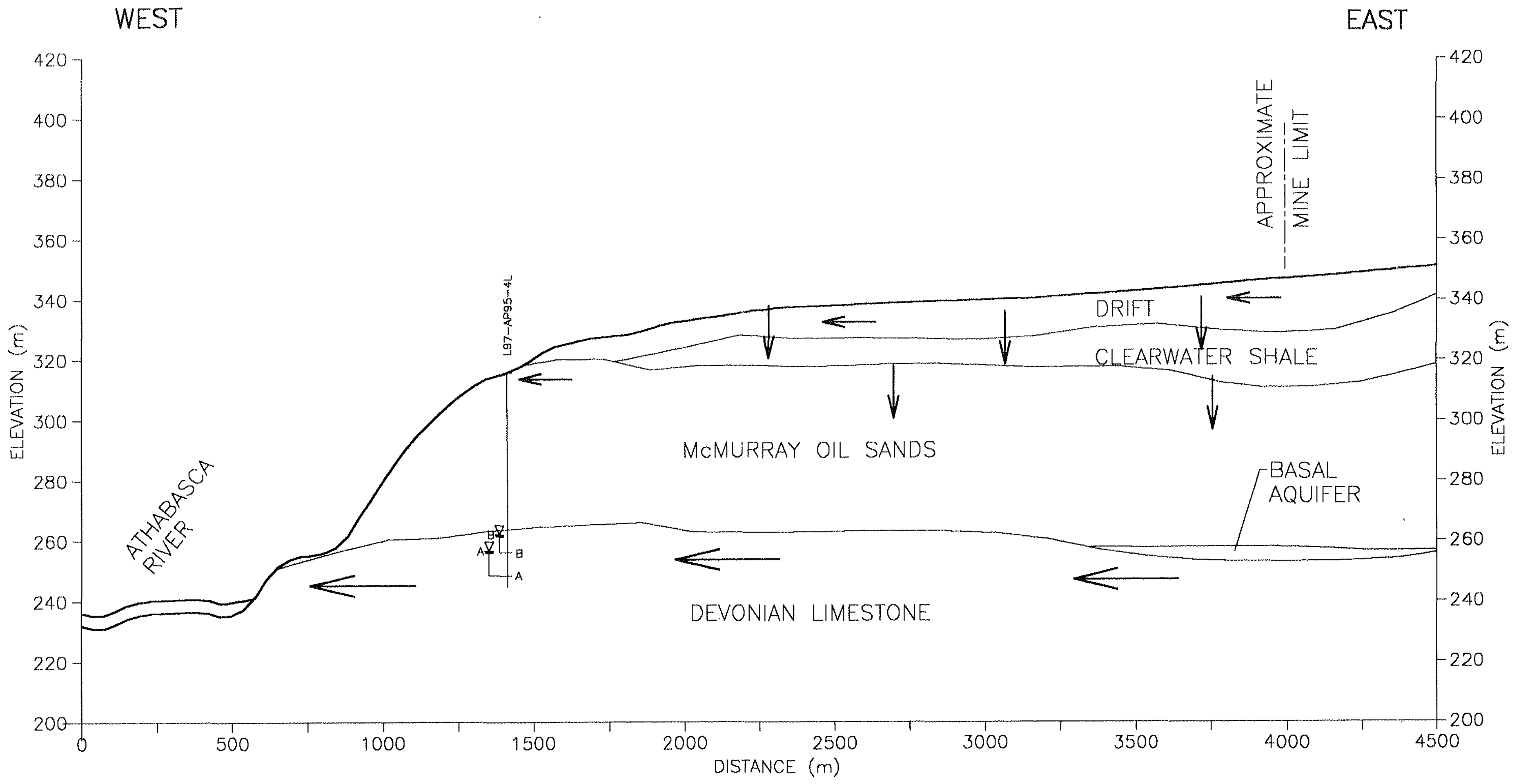
KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

BEDROCK CROSS SECTION E
BASELINE CONDITIONS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.
Steepbank Mine EIA
REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-014

02-14.dwg



SECTION F/011

LEGEND

⊥	STANDPIPE PIEZOMETER
▽	WATER LEVEL IN PIEZOMETER
L97–P95–x–BA	PIEZOMETER COMPLETED IN BASAL AQUIFER
←	DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:20,000) 0 200 400m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

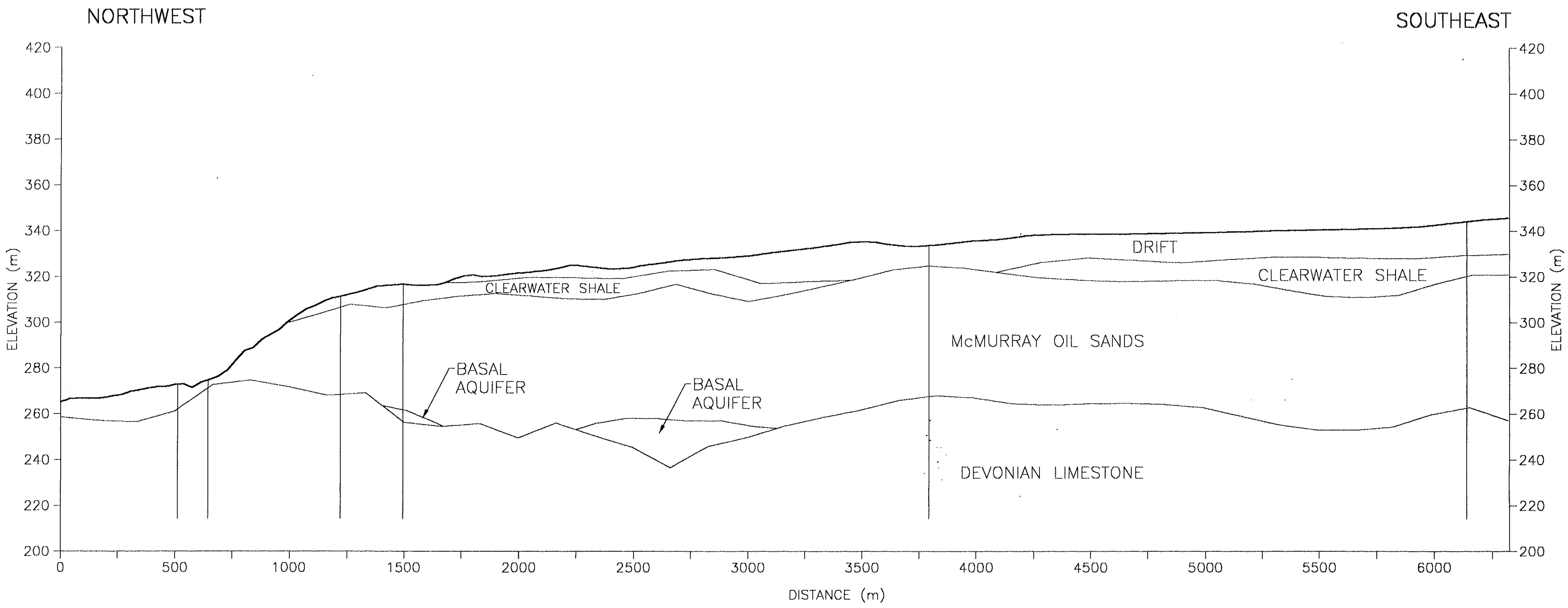
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

BEDROCK CROSS SECTION F
BASELINE CONDITIONS

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-015

02-15.dwg



SECTION G 011

LEGEND

| TESTHOLE LOCATION

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:20,000) 0 200 400m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

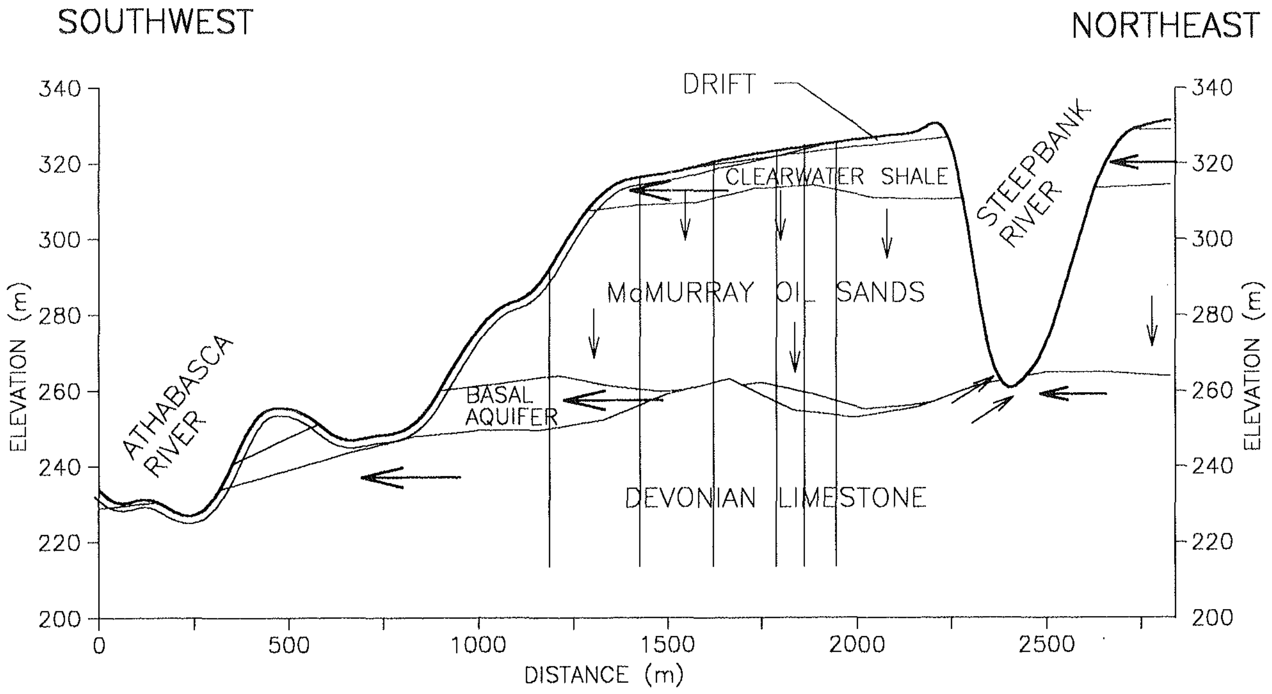
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

BEDROCK CROSS SECTION G
BASELINE CONDITION

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-016

02-16.dwg
]



SECTION H 011

LEGEND

│ TESTHOLE LOCATION

← DIRECTION OF GROUNDWATER FLOW

NOTE:

STRATIGRAPHY IS INTERPRETED FROM AVAILABLE INFORMATION AND GEOLOGIC MODELLING AND MAY VARY FROM THAT SHOWN

(1:20,000) 0 200 400m (SCALE B)
(1:2,000) 0 20 40m (SCALE A)

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

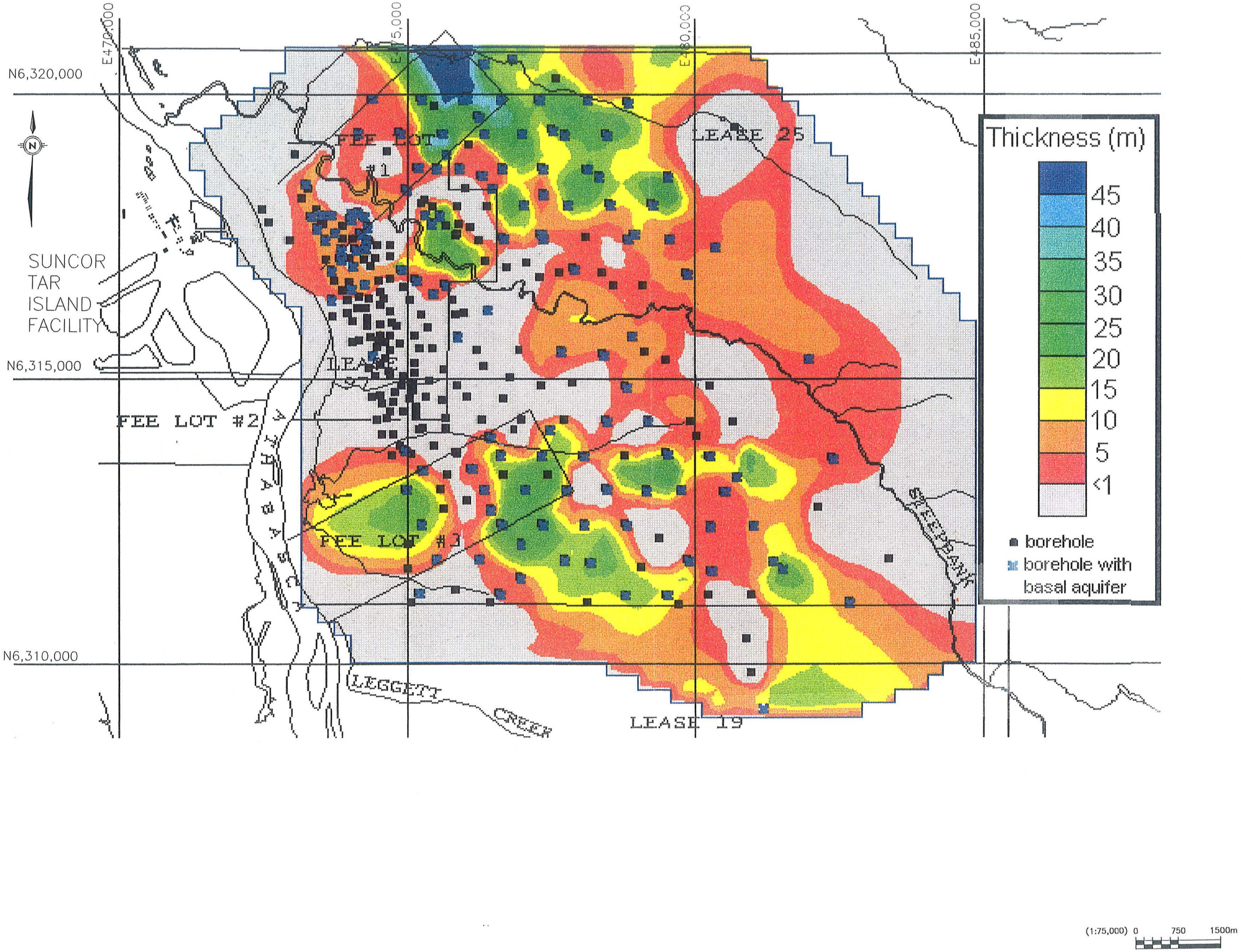
BEDROCK CROSS SECTION H
BASELINE CONDITIONS

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: 8-2779-02-017

02-17.dwg



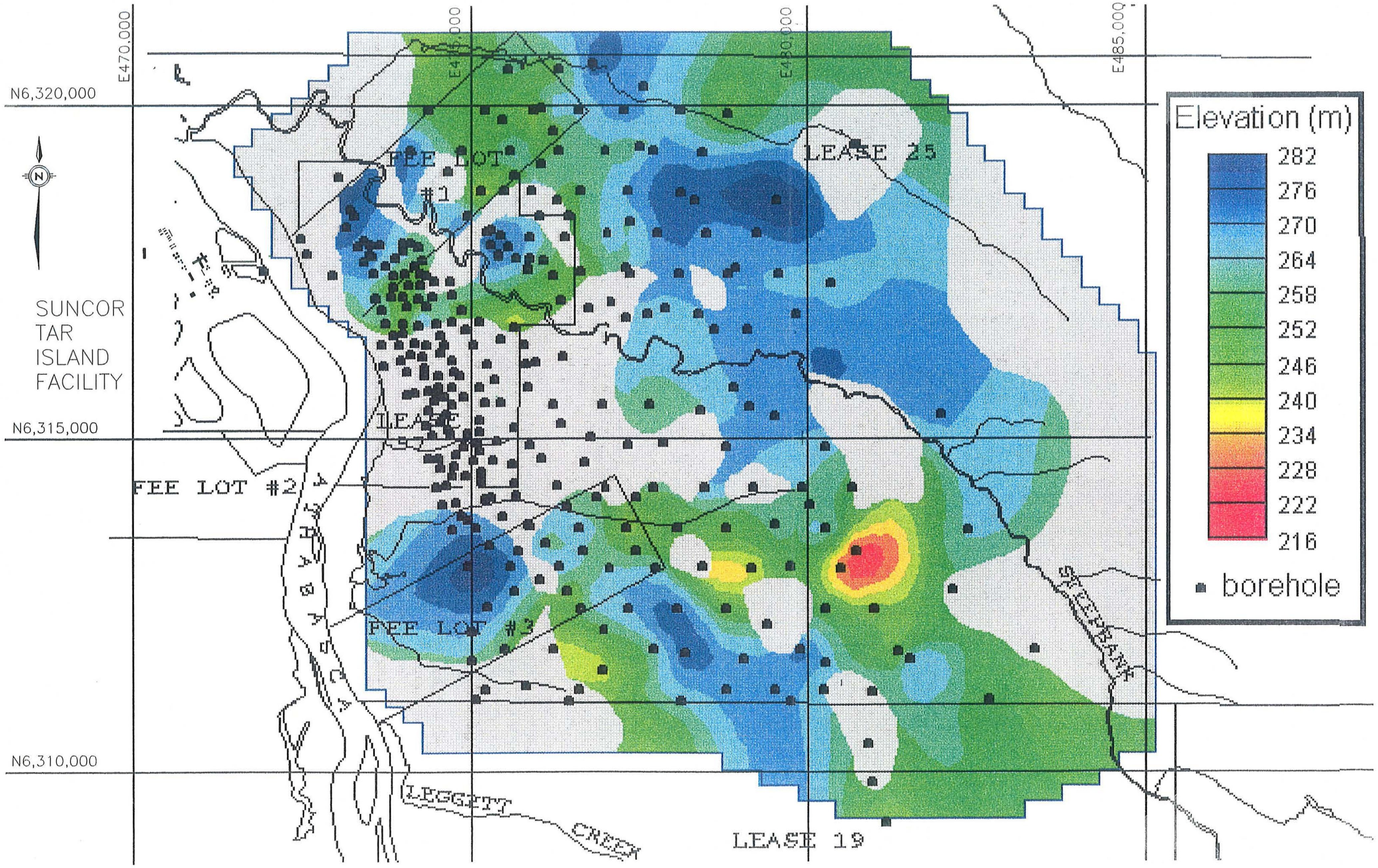
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

ISOPACH MAP OF BASAL AQUIFER

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-018

02-18.dwg



(1:75,000) 0 750 1500m

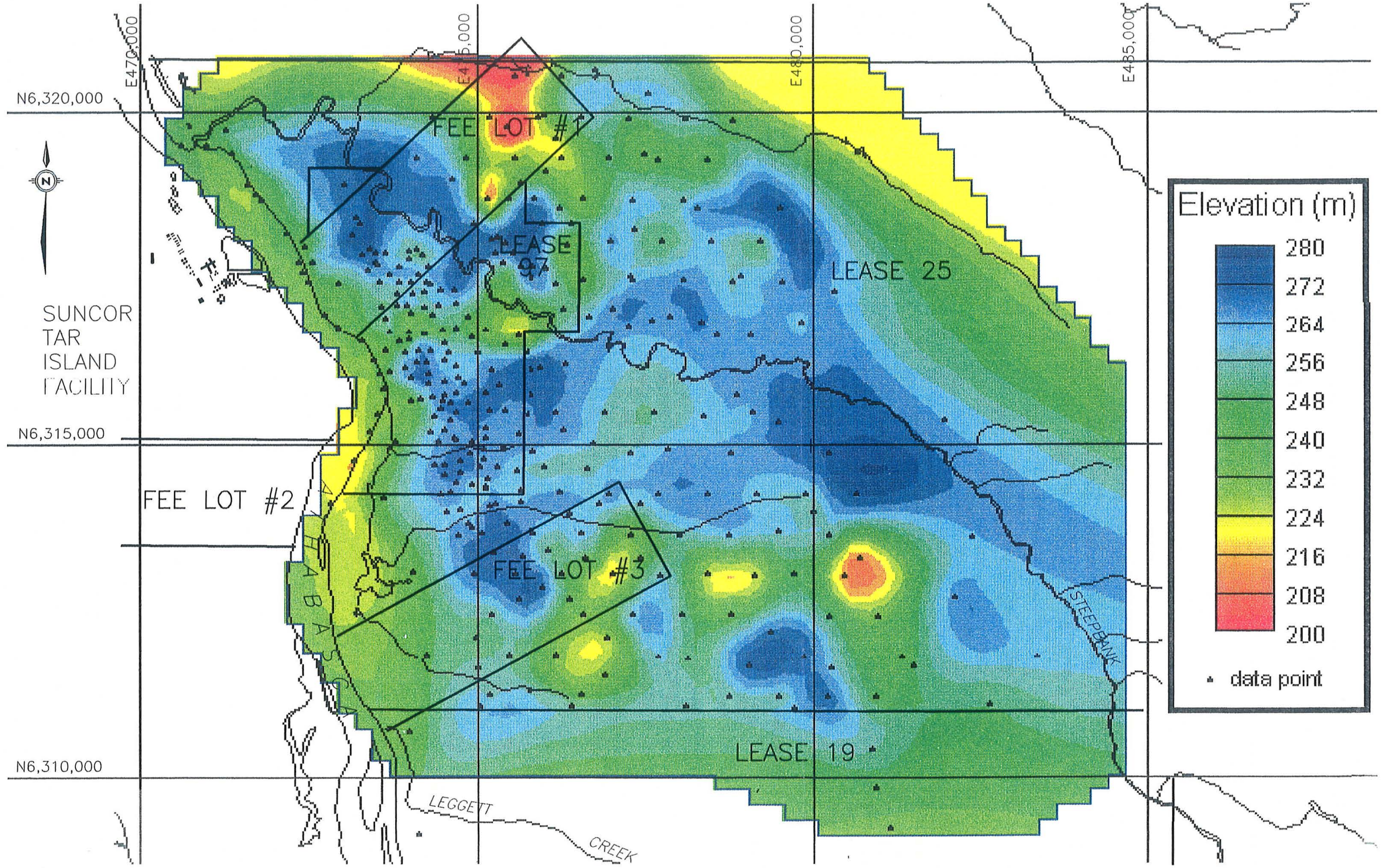
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

STRUCTURE MAP OF BASAL AQUIFER

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-019

02-19.dwg



(1:75,000) 0 750 1500m

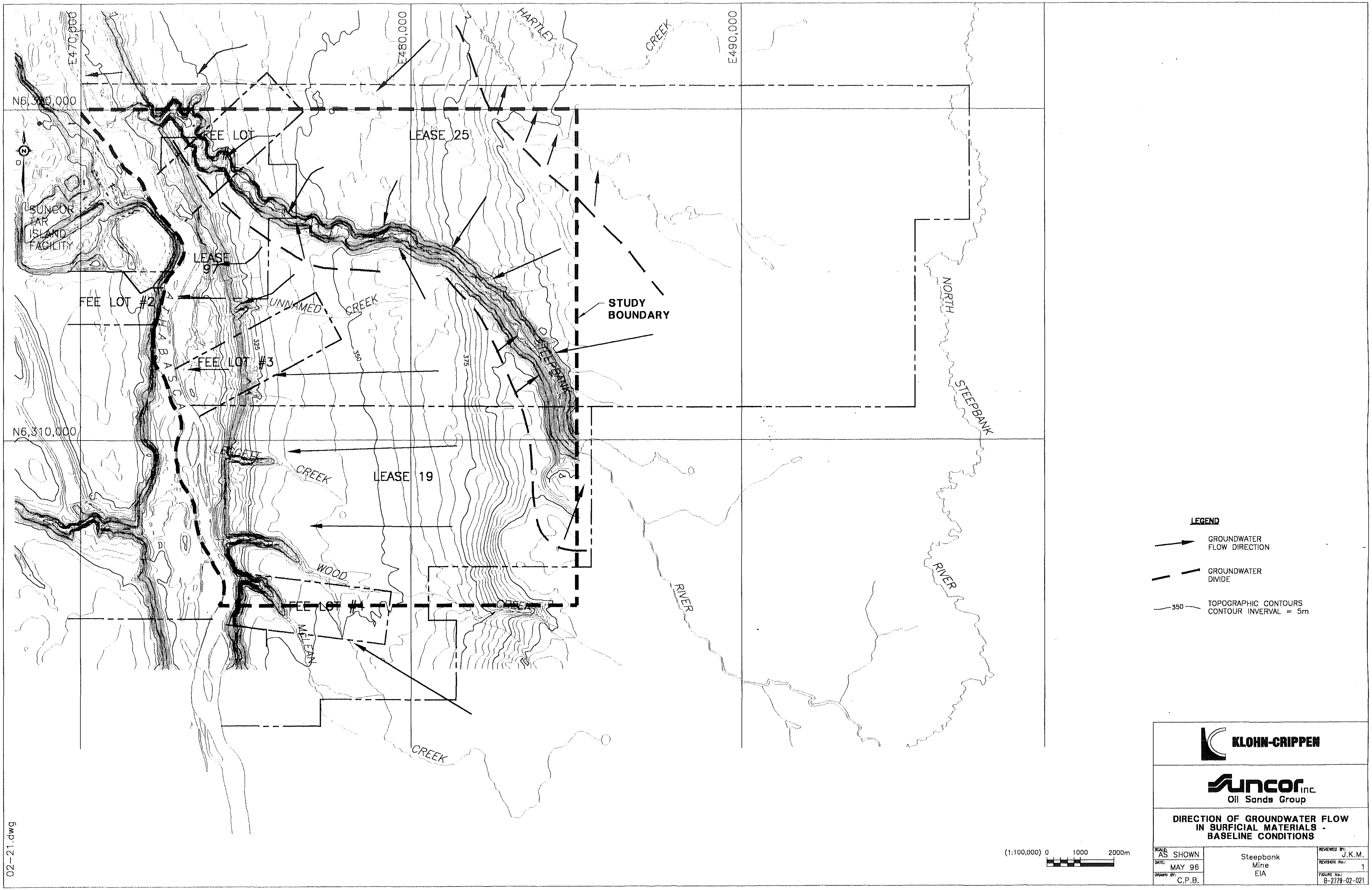
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

STRUCTURE MAP OF UPPER DEVONIAN

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-020

02-20.dwg



KLOHN-CRIPPEN

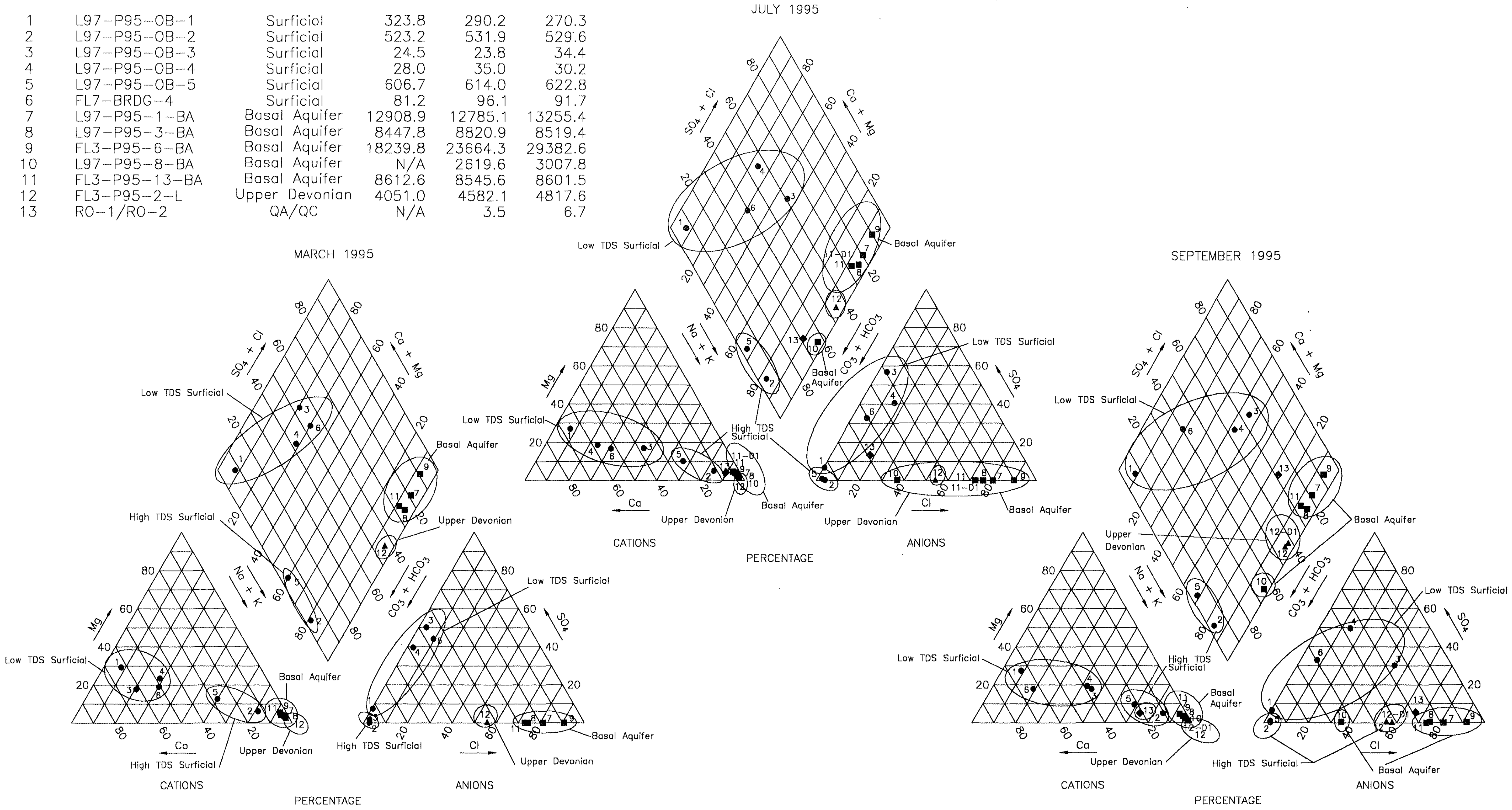
Suncor Inc.
Oil Sands Group

DIRECTION OF GROUNDWATER FLOW IN SURFICIAL MATERIALS - BASELINE CONDITIONS

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: 8-2779-02-021

02-21.dwg

Symbol	Number	Piezometer	Geologic Unit	Total Dissolved Solids (mg/l) March	July	September
●	1	L97-P95-OB-1	Surficial	323.8	290.2	270.3
●	2	L97-P95-OB-2	Surficial	523.2	531.9	529.6
●	3	L97-P95-OB-3	Surficial	24.5	23.8	34.4
●	4	L97-P95-OB-4	Surficial	28.0	35.0	30.2
●	5	L97-P95-OB-5	Surficial	606.7	614.0	622.8
●	6	FL7-BRDG-4	Surficial	81.2	96.1	91.7
■	7	L97-P95-1-BA	Basal Aquifer	12908.9	12785.1	13255.4
■	8	L97-P95-3-BA	Basal Aquifer	8447.8	8820.9	8519.4
■	9	FL3-P95-6-BA	Basal Aquifer	18239.8	23664.3	29382.6
■	10	L97-P95-8-BA	Basal Aquifer	N/A	2619.6	3007.8
■	11	FL3-P95-13-BA	Basal Aquifer	8612.6	8545.6	8601.5
▲	12	FL3-P95-2-L	Upper Devonian	4051.0	4582.1	4817.6
◆	13	RO-1/RO-2	QA/QC	N/A	3.5	6.7



KLOHN-CRIPPEN

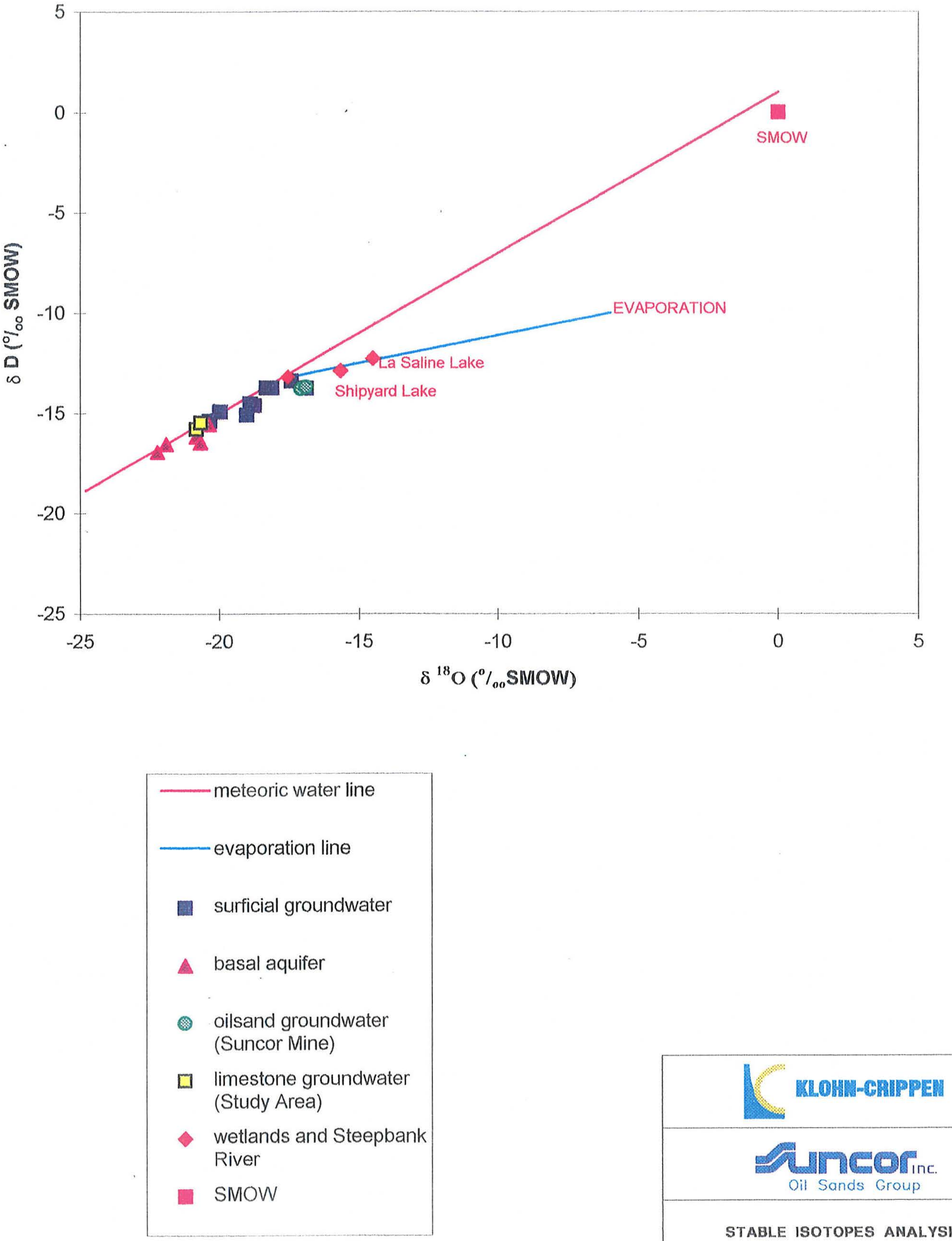
Suncor Inc.
Oil Sands Group

PIPER PLOT
GROUNDWATER SAMPLES
1995

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-022

02-22.dwg

Scatter Diagram of δD and δO^{18}, in surface water and groundwater in the Study Area



KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

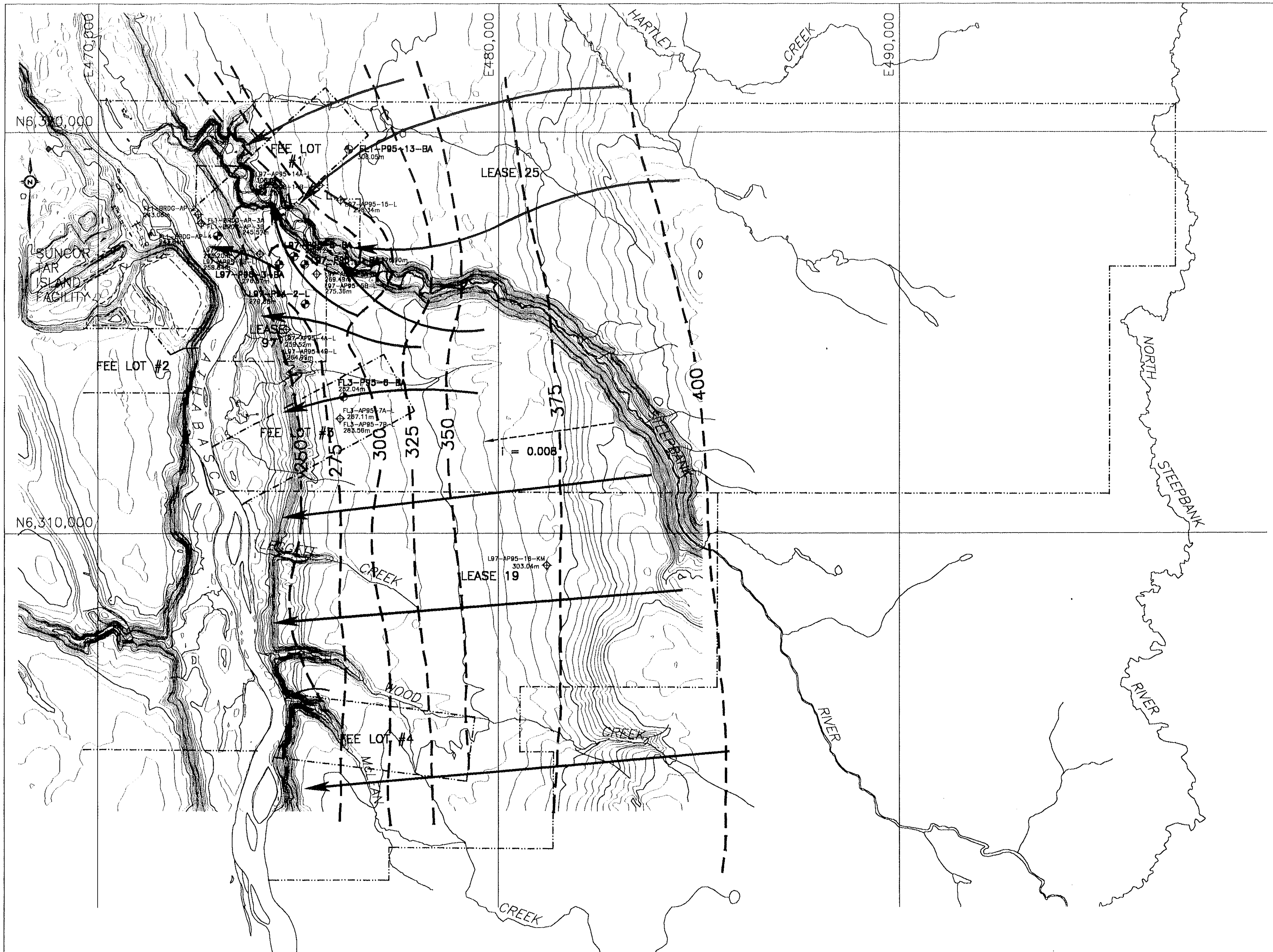
STABLE ISOTOPES ANALYSIS

SCALE: N.T.S.
DATE: 25 03 96
DRAWN BY: C.P.B.

Steepbank
Oilsands
Mine

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: A-2779-02-023

2779w102.dwg



LEGEND

—··—··—	LEASE BOUNDARY
— — —	PIEZOMETRIC SURFACE CONTOUR (MARCH 1995 DATA)
← i = 0.008	HYDRAULIC GRADIENT

(1:100,000) 0 1000 2000m

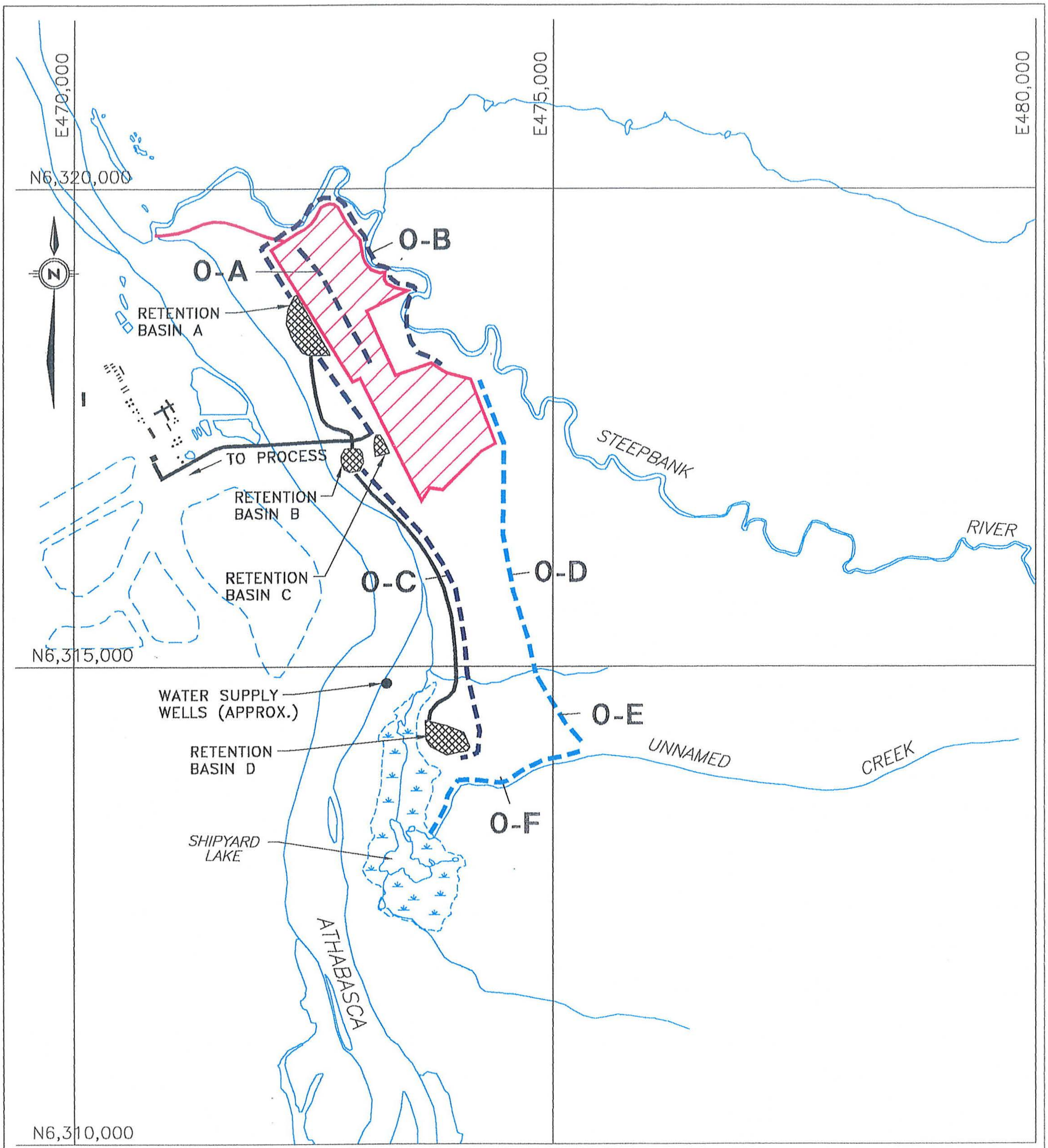
KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

GROUNDWATER FLOW DIRECTIONS IN BASAL AQUIFER AND UPPER DEVONIAN

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-024

02-23.dwg



LEGEND

O-E CHANNEL DESIGNATION

- - - - INTERCEPTION CHANNEL

- - - - MINE DRAINAGE CHANNEL

—— DRAINAGE PIPELINE

▨ MINE AREA

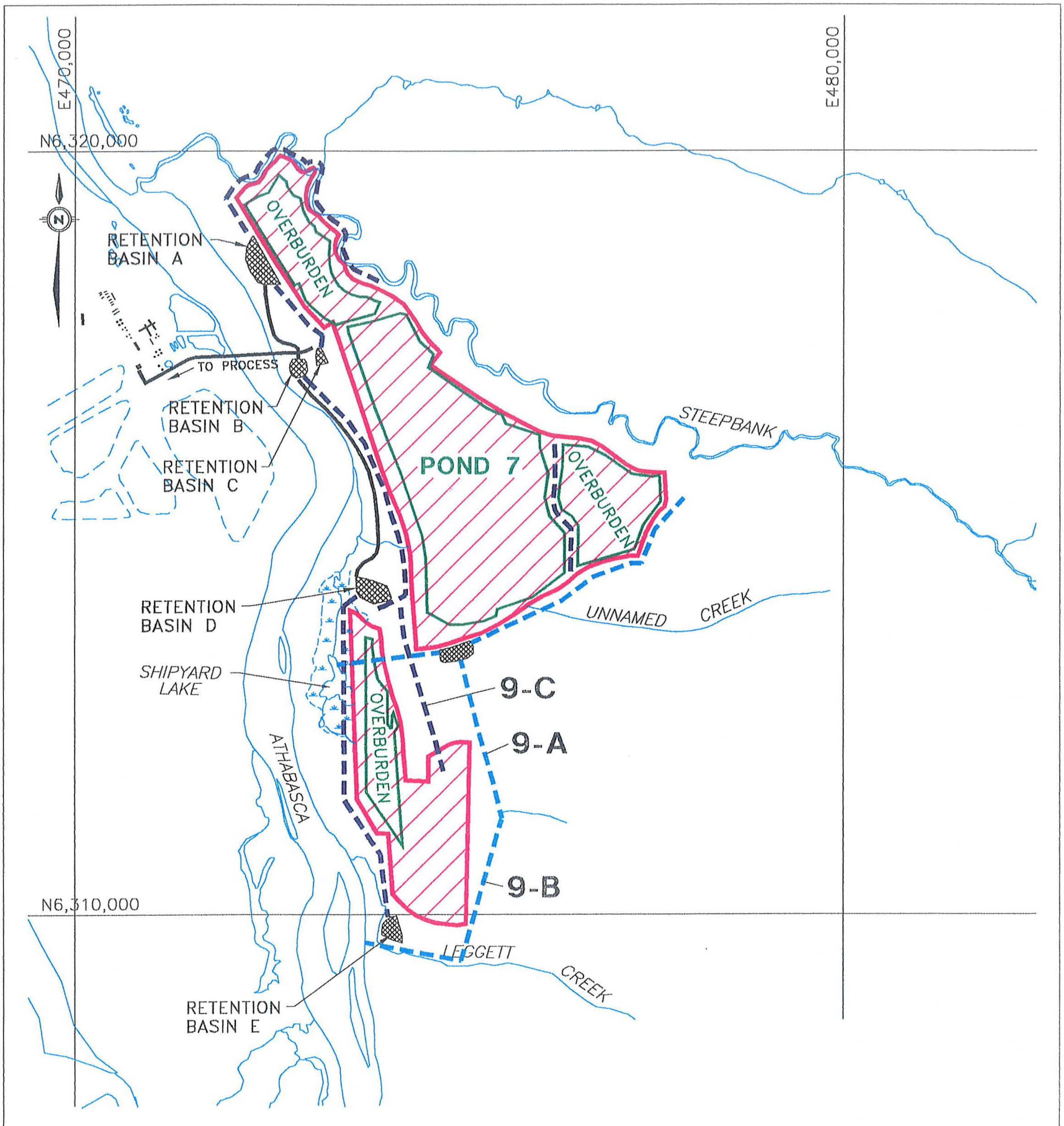
KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

YEAR 2001
STEEPBANK MINE DEVELOPMENT

SCALE: N.T.S.	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: 25 03 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-025

02-24.dwg



LEGEND

0-E CHANNEL DESIGNATION

- - - - INTERCEPTION CHANNEL

- - - - MINE DRAINAGE CHANNEL

— DRAINAGE PIPELINE

▨ MINE AREA

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

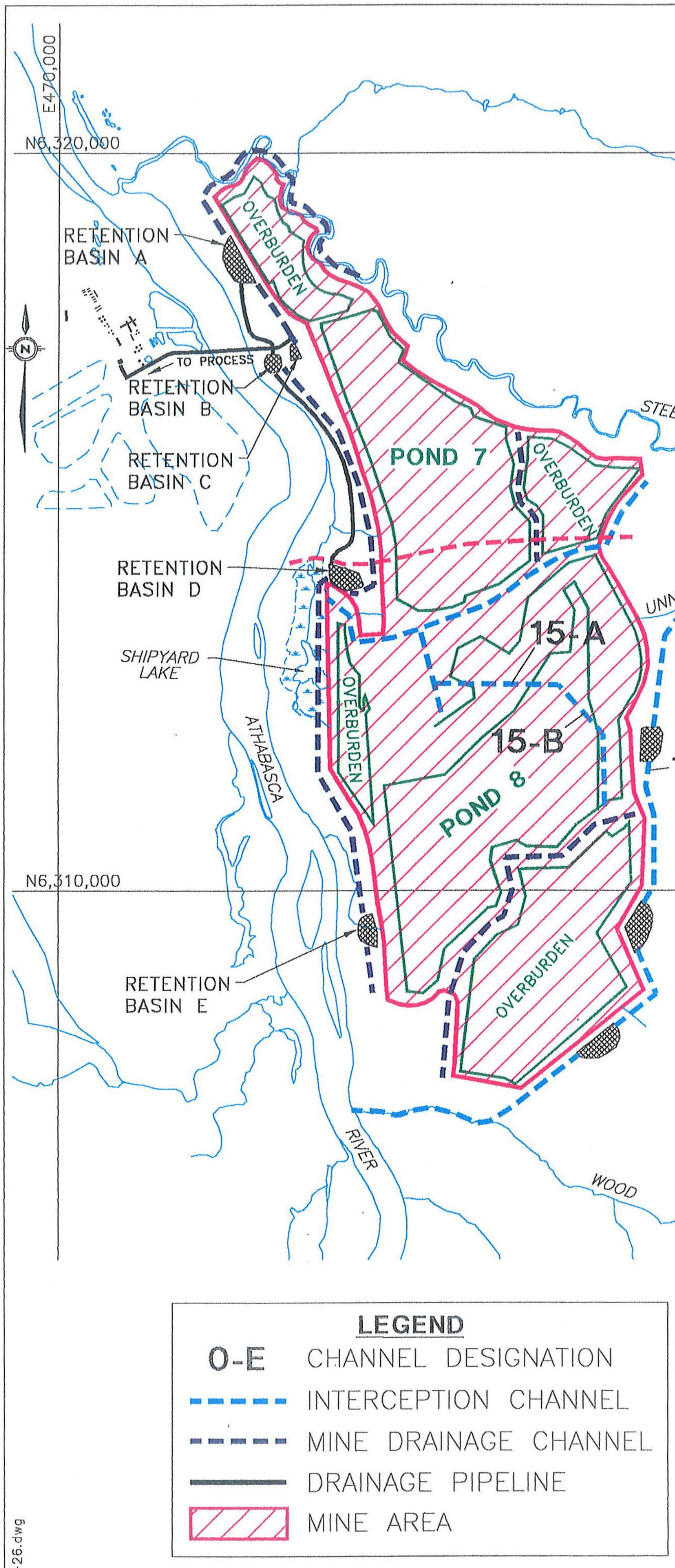
YEAR 2009
STEEPBANK MINE DEVELOPMENT

SCALE: N.T.S.
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: A-2779-02-026

02-25.dwg



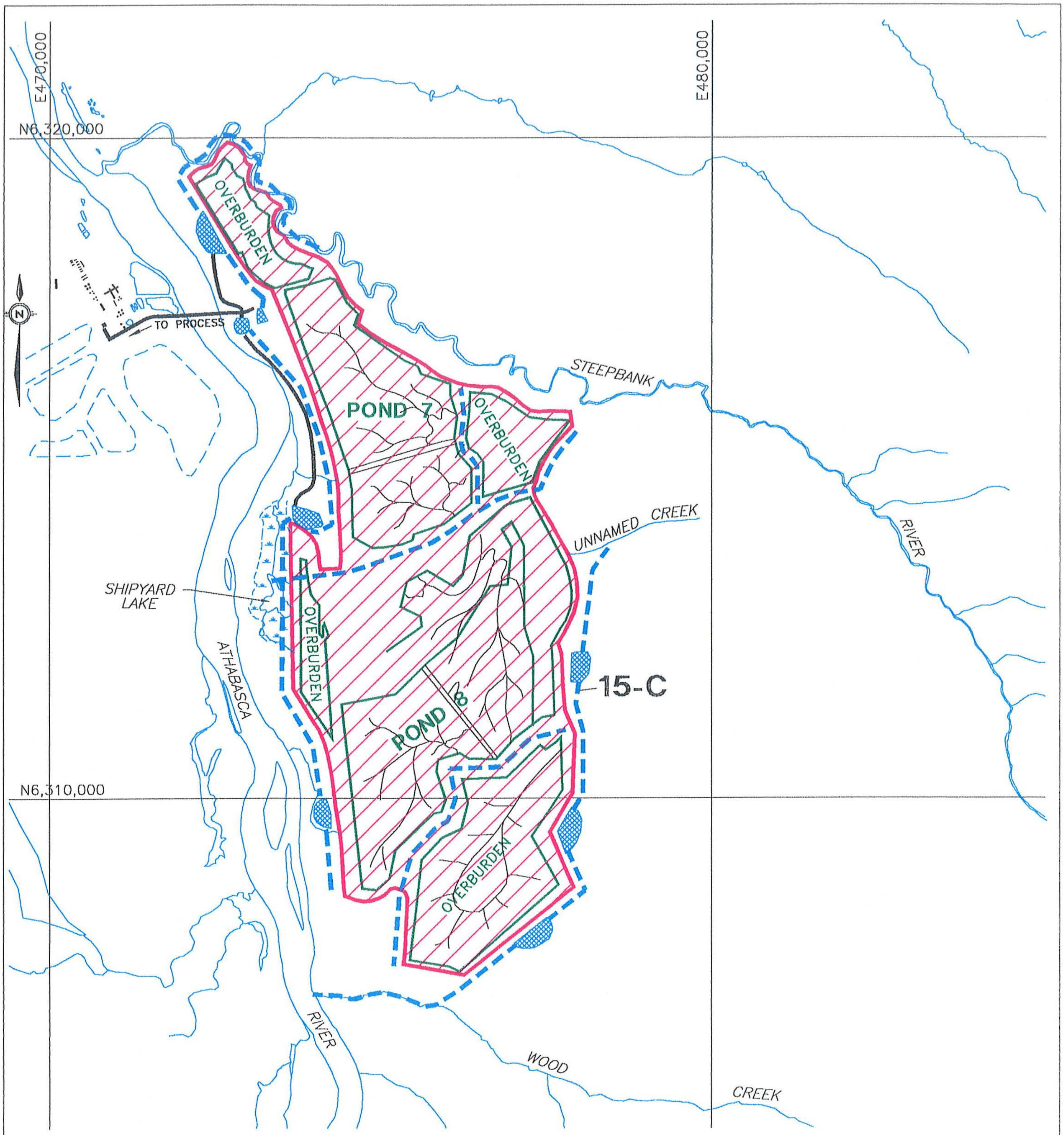
02-26.dwg

KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

YEAR 2020
STEEPBANK MINE DEVELPMENT

SCALE: N.T.S.	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: 25 03 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-027



LEGEND

O-E	MINE DESIGNATION
- - - -	RECLAMATION DRAINAGE CHANNEL
▬▬	DRAINAGE PIPELINE
▨	MINE AREA

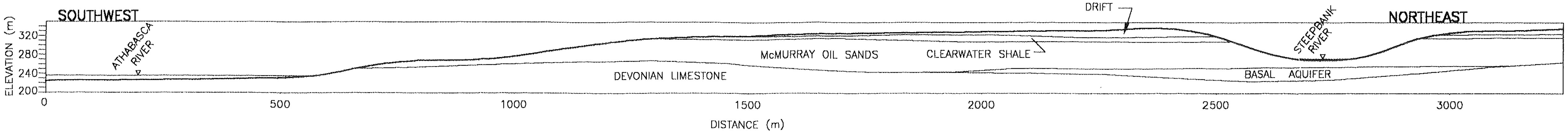
KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

POST RECLAMATION

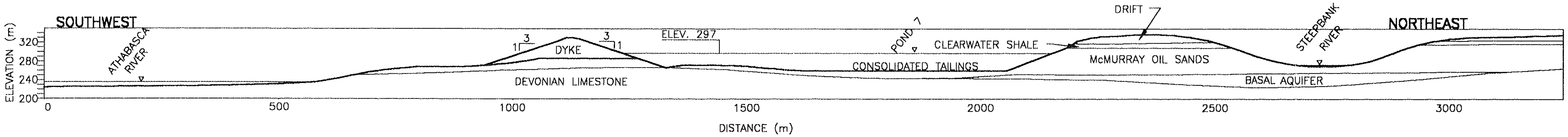
SCALE: N.T.S.	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: A-2779-02-028

02-27.dwg



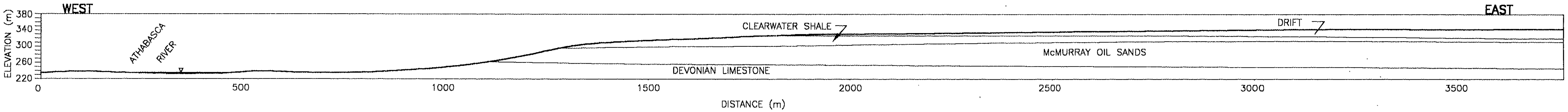
BASELINE CONDITIONS

SECTION C
011



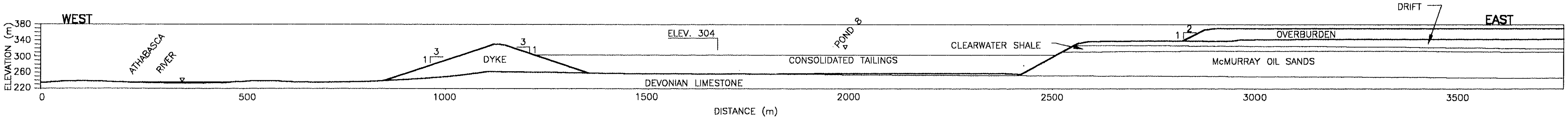
YEAR 2009 MINE CONDITIONS

SECTION C
011



BASELINE CONDITIONS

SECTION D
011



YEAR 2020 MINE CONDITIONS

SECTION D
011

(1:10000) 0 100 200m

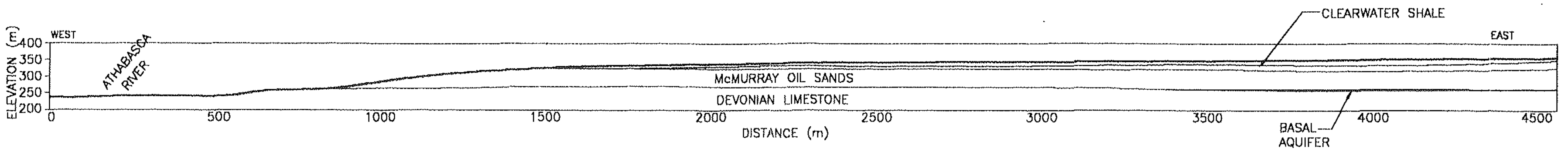
KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

GEOLOGIC CROSS SECTIONS C & D
BEFORE AND AFTER MINING

SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: C.P.B.		FIGURE No.: B-2779-02-029

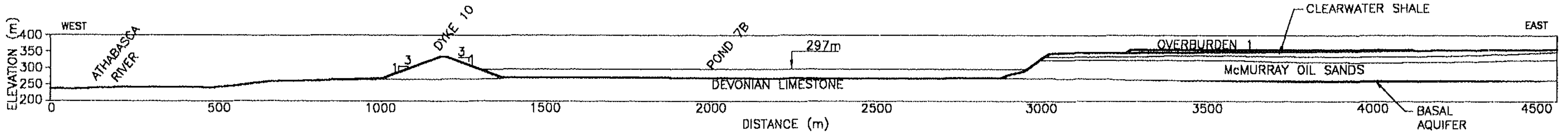
02-28.dwg



BASELINE CONDITIONS

SECTION F 011

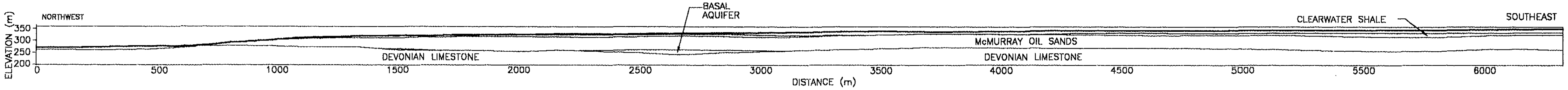
HOR: SCALE B
VERT: SCALE A



YEAR 2009 MINE CONDITIONS

SECTION F 011

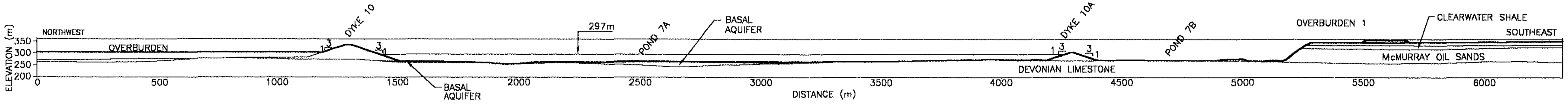
HOR: SCALE B
VERT: SCALE A



BASELINE CONDITIONS

SECTION G 011

HOR: SCALE B
VERT: SCALE A



YEAR 2009 MINE CONDITIONS

SECTION G 011

HOR: SCALE B
VERT: SCALE A

(1:20000) 0 200 400m (SCALE B)
(1:20000) 0 200 400m (SCALE A)

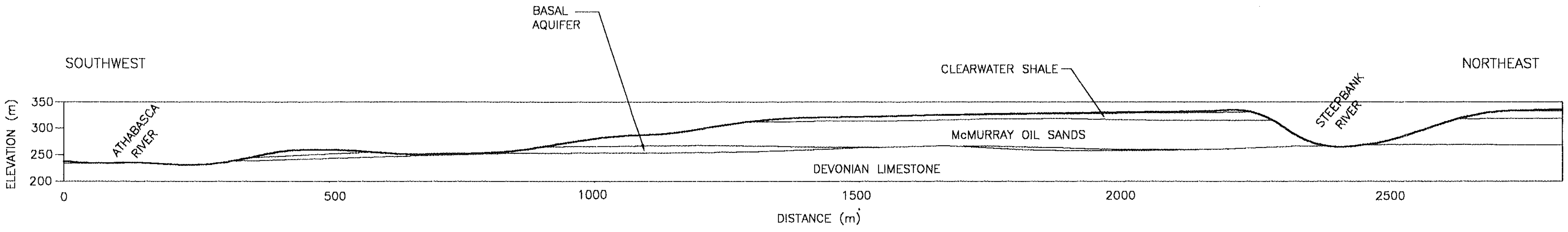
KLOHN-CRIPPEN

Suncor inc.
Oil Sands Group

GEOLOGIC CROSS SECTIONS F & G
BEFORE AND AFTER MINING

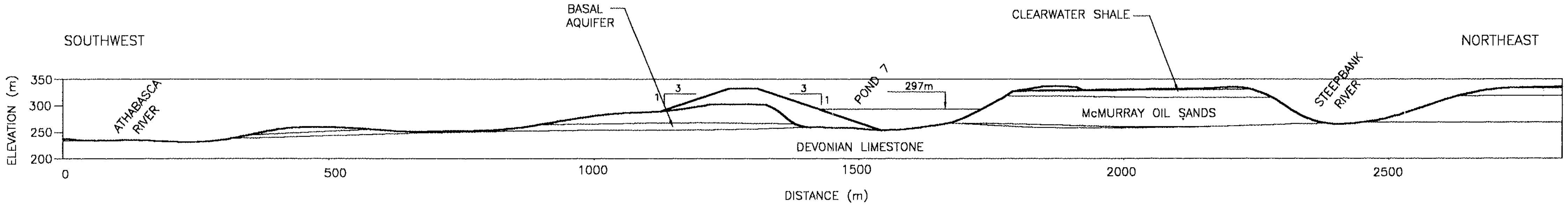
SCALE: AS SHOWN	Steepbank Mine EIA	REVIEWED BY: J.K.M.
DATE: MAY 96		REVISION No.: 1
DRAWN BY: L.G.H.		FIGURE No.: B-2779-02-030

02-29.dwg



BASELINE CONDITIONS

SECTION H 011
HOR: SCALE B
VERT: SCALE A



YEAR 2009 MINE CONDITIONS

SECTION H 011
HOR: SCALE B
VERT: SCALE A

(1:10000) 0 100 200m (SCALE B)
(1:10000) 0 100 200m (SCALE A)

KLOHN-CRIPPEN

Suncor Inc.
Oil Sands Group

GEOLOGIC CROSS SECTION H
BEFORE AND AFTER MINING

SCALE: AS SHOWN
DATE: MAY 96
DRAWN BY: C.P.B.

Steepbank
Mine
EIA

REVIEWED BY: J.K.M.
REVISION No.: 1
FIGURE No.: B-2779-02-031

02-30.dwg

APPENDICES

APPENDIX I

BOREHOLE LOGS AND WELL COMPLETION DETAILS

Steepbank Mine Standpipe Piezometers

Installation ID	Northing	Easting	Ground Elevation	Stick-up	Screen Interval		Water Level (Mar/95)	Water Elevation (Mar/95)
L97-P95-1-BA	6316710	475160	331.2	0.79	93.00	96.00	55.09	276.90
L97-P94-2-L	6315740	475160	332.558	0.81	65.80	68.90	53.71	279.66
L97-P95-3-BA	6316700	474520	325.647	0.91	86.30	89.30	49.89	276.67
FL3-P95-6-BA	6313400	476130	339.25	0.96	82.10	91.30	58.17	282.04
L97-P95-8-BA	6316900	474900	330.655	0.94	77.20	83.30	52.47	279.13
FL1-P95-13-BA	6319580	476240	345.07	.?	111.80	114.90	39.42	306.05
FL1-BRDG-#4	6317415	472990	246.965	.?	1.50	5.20	4.43	243.44
L97-P95-OB#1	6316710	475160	331.2	.?	4.00	9.15	6.90	325.20
L97-P95-OB#2	6315483	475455	336.1	0.56	3.00	5.20	1.84	334.82
L97-P95-OB#3	6316025	475575	338.2	0.71	2.10	5.30	4.10	334.81
L97-P95-OB#4	6316133	475676	337.43	0.84	2.40	5.50	3.48	334.79
L97-P95-OB#5	6318680	475510	336.95	.?	1.80	3.80	2.17	335.68

- Water levels for standpipes are in meters below top of pipe
- Water level measurements were made in March, 1995
- The screen interval refers to the top and bottom depths in meters

TEST HOLE LOG

VERTICAL SCALE: **1cm = 0.5m**

DATE DRILLED: **11 MAR 95 - 11 MAR 95**

DRILL TYPE: **Solid Stem Auger**

ELEV. GROUND (m): **331.20**

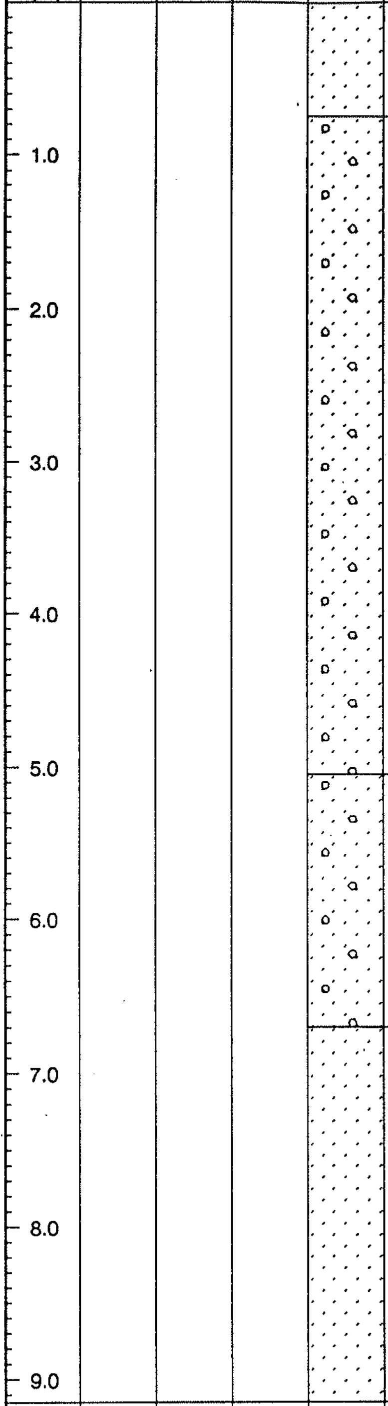
CO-ORDINATES (m): **N 6,316,710 E 475,160**

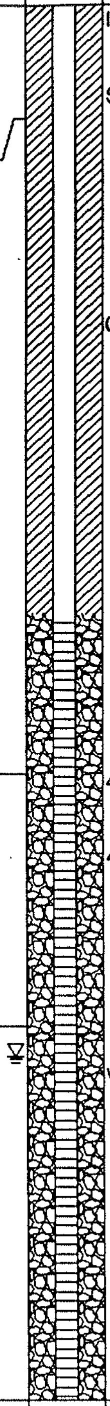
SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					SAND -fine -loose -light brown -dry -loess?		Installation ID L97-P95-OB#1 Site L9795008
0.75					SAND and GRAVEL -loose -medium brown -dry to moist -fluvial		0 - 4 m bentonite chips
5.05					SAND -some gravel -loose -medium brown -dry to moist -fluvial		4 m - EOH uncontrolled collapse 4.0 - 9.14 m 20 slot screen
6.70					SAND -fine to medium -brown -wet		water level in standpipe 6.90 m
9.15					-refusal (rocks) END OF TEST HOLE		





KLOHN-CRIPPEN

10/08/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **DJE** CHECKED BY:

PLATE: **1 of 1** HOLE NO: **L9795OB1**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 0.5m

DATE DRILLED: **11 MAR 95 - 11 MAR 95**

DRILL TYPE: **Solid Stem Auger**

ELEV. GROUND (m): **336.10**

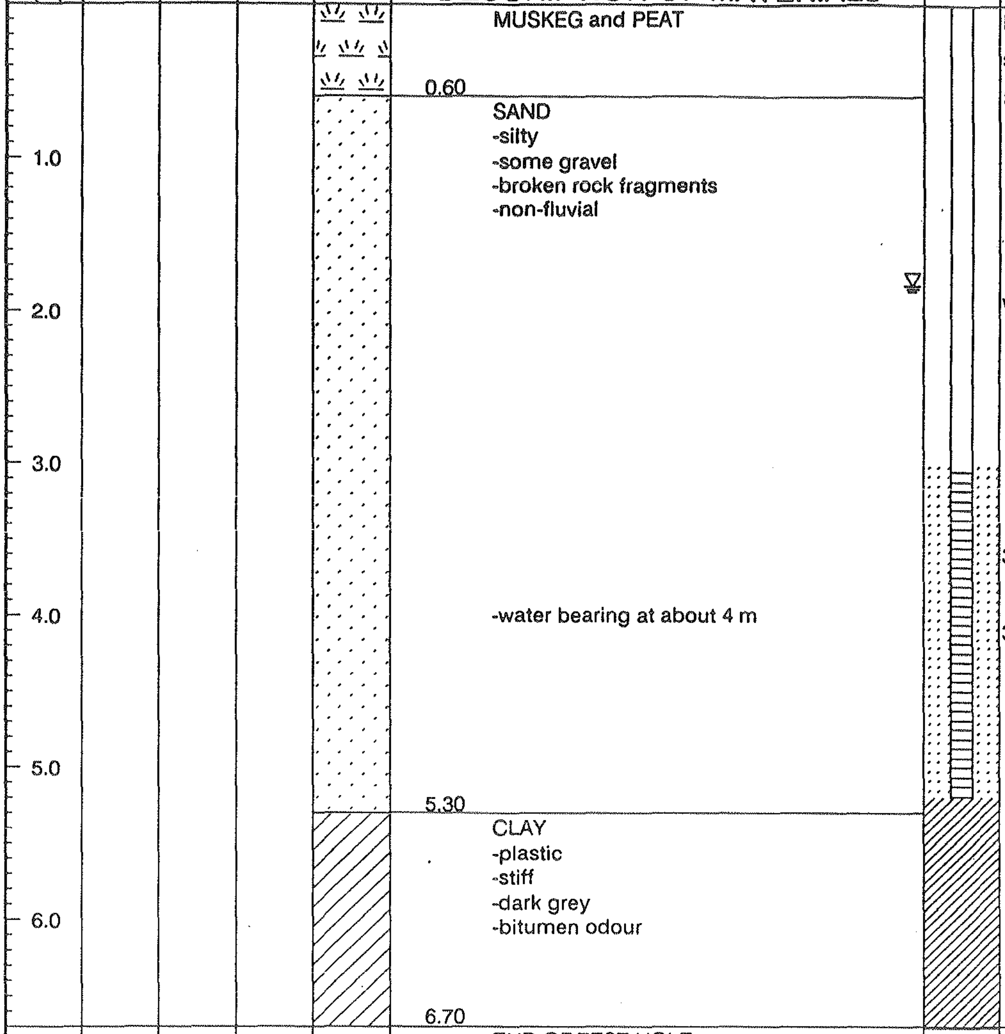
CO-ORDINATES (m): **N 6,315,483 E 475,455**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



MUSKEG and PEAT

0.60

SAND
-silty
-some gravel
-broken rock fragments
-non-fluvial

-water bearing at about 4 m

5.30

CLAY
-plastic
-stiff
-dark grey
-bitumen odour

6.70

END OF TEST HOLE

Installation ID L97-P95-OB#2

stickup 0.56 m

Site L9795017

water level in standpipe 1.84 m

3.0 - 5.2 m 20/40 sand

3.0 - 5.2 m 20 slot screen

KLOHN-CRIPPEN

22/08/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: DJE CHECKED BY:

PLATE: 1 of 1 HOLE NO: L9795OB2

TEST HOLE LOG

VERTICAL SCALE: **1cm = 0.5m**

DATE DRILLED: **11 MAR 95 - 11 MAR 95**

DRILL TYPE: **Solid Stem Auger**

ELEV. GROUND (m): **338.20**

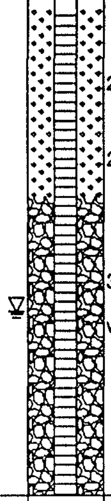
CO-ORDINATES (m): **N 6,316,025 E 475,575**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					SAND -fine to medium -no gravel -medium brown		Installation ID L97-P95-OB#3 stickup 0.71 m
1.0							
2.0							
							2.1 - 3.35 m 20/40 sand
3.0					-becomming moist		2.1 - 5.3 m 20 slot screen
							3.35 m - EOH uncontrolled collapse
4.0							water level in standpipe 4.10 m
5.0							
					5.30 -refusal END OF TEST HOLE		



KLOHN-CRIPPEN

22/08/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **DJE** CHECKED BY:

PLATE: **1 of 1** HOLE NO: **L9795OB3**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 0.5m**

DATE DRILLED: **11 MAR 95 - 11 MAR 95**

DRILL TYPE: **Solid Stem Auger**

ELEV. GROUND (m): **337.43**

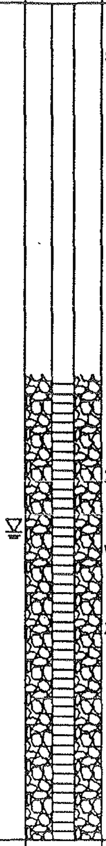
CO-ORDINATES (m): **N 6,316,133 E 475,676**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows/.15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					SAND -fine -trace silt -poorly graded (uniform) -brown		Installation ID L97-P95-OB#4 stickup 0.84 m
1.0							
2.0					-becomming moist		
3.0							2.4 - 5.5 m collapse water level in standpipe 3.48 m
4.0							2.4 - 5.5 m 20 slot screen
5.0							
					5.50		
					-refusal (rocks) END OF TEST HOLE		



KLOHN-CRIPPEN

22/08/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **DJE** CHECKED BY:

PLATE: **1 of 1** HOLE NO: **L9795OB4**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 0.5m

DATE DRILLED: **11 MAR 95 - 11 MAR 95**

DRILL TYPE: **Solid Sem Auger**

ELEV. GROUND (m): **336.95**

CO-ORDINATES (m): **N 6,318,685 E 475,504**

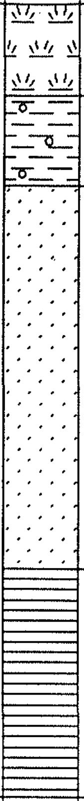
SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.
1.0			
2.0			
3.0			
4.0			
5.0			

SYMBOL



DESCRIPTION OF MATERIALS

PEAT
-brown

0.60

CLAY
-some rocks
-grey
(Till)

1.20

SAND
-silty
-fine to medium
-grey

-brown

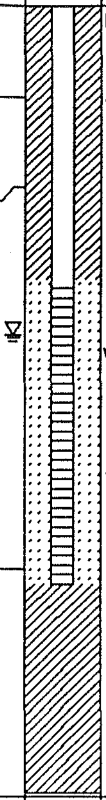
3.70

MUDSTONE
-greenish
(Clearwater)

5.20

END OF TEST HOLE

PIEZOMETER DETAILS



NOTES

Installation ID L97-P95-OB#5

Site L9795022

water level in standpipe 2.17 m

1.8 - 3.8 m 20/40 sand

1.8 - 3.8 m 20 slot screen

KLOHN-CRIPPEN

14/08/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **DJE** CHECKED BY:

PLATE: **1 of 1** HOLE NO: **L9795OB5**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 7 JAN 95 -

DRILL TYPE: Mud Rotary

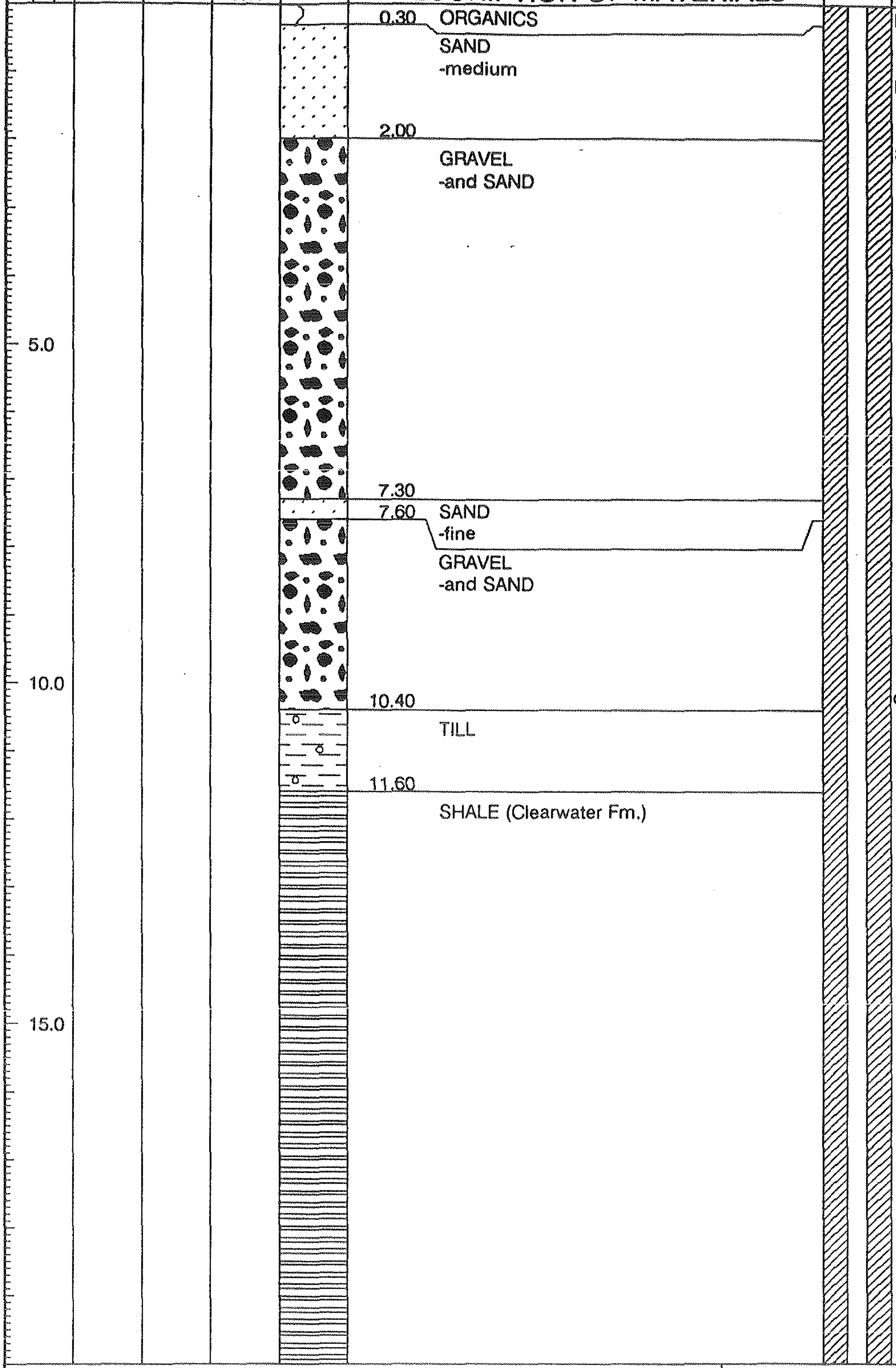
ELEV. GROUND (m): 331.20

CO-ORDINATES (m): N 6,316,710 E 475,160

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m



Depth (m)	Type	Blows .15m	Sample No.	DESCRIPTION OF MATERIALS	NOTES
0.30				ORGANICS	Installation ID L97-P95-1-BA
				SAND -medium	Borehole ID L9795008
2.00				GRAVEL -and SAND	Stick-up 0.79 m PVC 0.4 m steel
7.30				SAND -fine	
7.60				GRAVEL -and SAND	
10.40				TILL	cement - bentonite grout
11.60				SHALE (Clearwater Fm.)	

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 6 HOLE NO: L9795008

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **7 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **331.20**

CO-ORDINATES (m): **N 6,316,710 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows / .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					23.10 OIL SAND (McMurray Fm.)		
25.0							
30.0							
35.0							

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

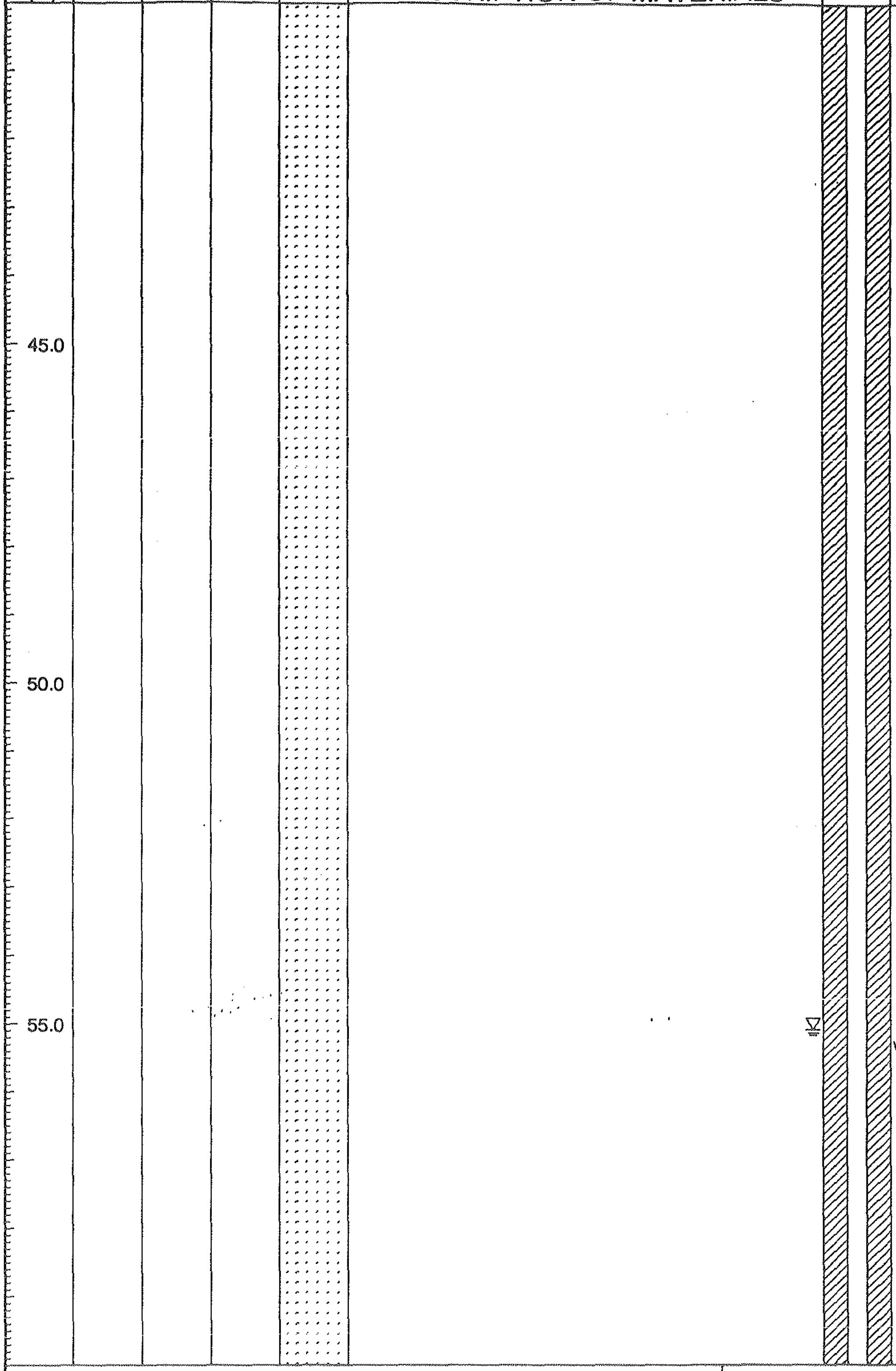
LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 6** HOLE NO: **L9795008**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m
DATE DRILLED: 7 JAN 95 -
DRILL TYPE: Mud Rotary
ELEV. GROUND (m): 331.20
CO-ORDINATES (m): N 6,316,710 E 475,160

SAMPLE DATA				SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
HAMMER WEIGHT kg							
DROP HEIGHT m							
Depth (m)	Type	Blows .15m	Sample No.				



water level 55.09 m

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: PA 2779.02.01
PROJECT: Steepbank Hydrogeology
LOCATION: Suncor, Alberta
LOGGED BY: Suncor CHECKED BY:
PLATE: 3 of 6 HOLE NO: L9795008

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **7 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **331.20**

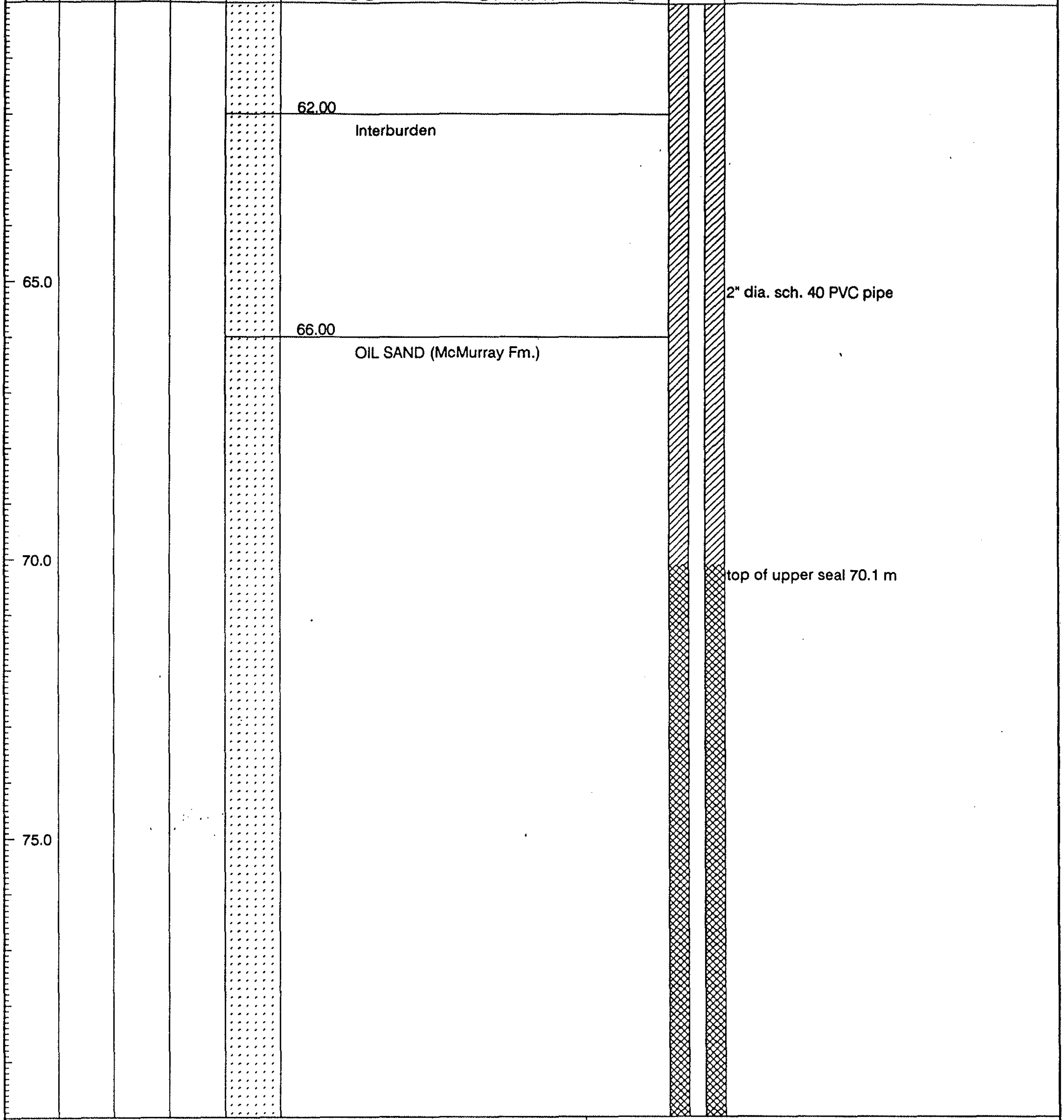
CO-ORDINATES (m): **N 6,316,710 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



62.00 Interburden

66.00 OIL SAND (McMurray Fm.)

2" dia. sch. 40 PVC pipe

top of upper seal 70.1 m

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

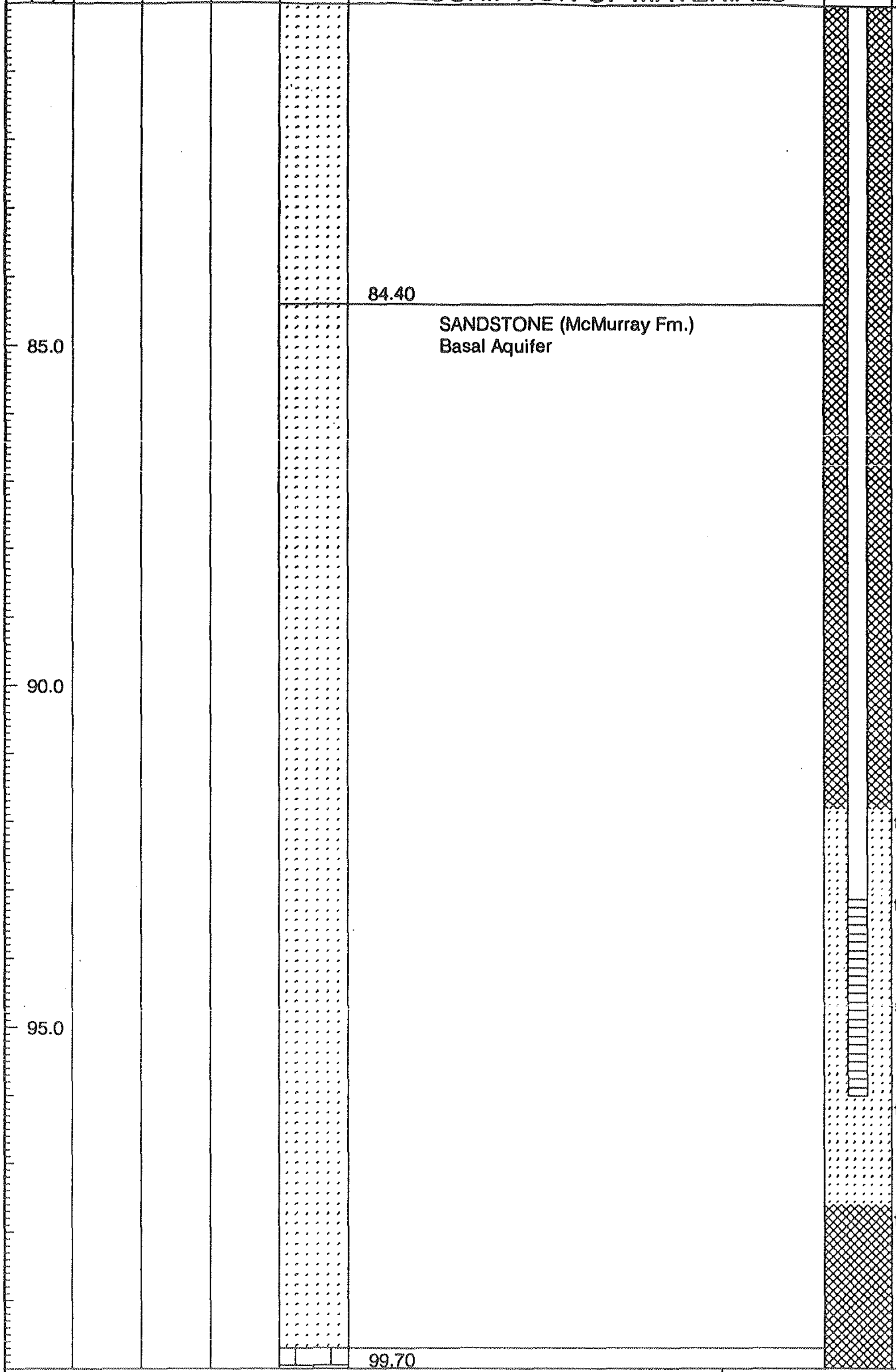
LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 6** HOLE NO: **L9795008**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m	DATE DRILLED: 7 JAN 95 -
SAMPLE DATA	DRILL TYPE: Mud Rotary
HAMMER WEIGHT kg	ELEV. GROUND (m): 331.20
DROP HEIGHT m	CO-ORDINATES (m): N 6,316,710 E 475,160

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



84.40

SANDSTONE (McMurray Fm.)
Basal Aquifer

99.70

top of filter sand 91.8 m

top of screen 93.0 m

sch. 40 screen 0.020 slots

tip of screen 96.0 m

top of bottom seal 97.6 m

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO:	PA 2779.02.01
PROJECT:	Steepbank Hydrogeology
LOCATION:	Suncor, Alberta
LOGGED BY: Suncor	CHECKED BY:
PLATE: 5 of 6	HOLE NO: L9795008

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **7 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **331.20**

CO-ORDINATES (m): **N 6,316,710 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

PIEZOMETER DETAILS

NOTES

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS
					LIMESTONE (Waterways Fm.)
105.0					
110.0					
115.0					
					115.80
					END OF TEST HOLE

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 6** HOLE NO: **L9795008**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **14 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **332.56**

CO-ORDINATES (m): **N 6,315,740 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					0.30 ORGANICS		Installation ID L97-P95-2-L
					SAND		Borehole ID L9795014
					2.40		stick-up 0.81 m PVC 0.45 m steel
					TILL		
					4.80		
5.0					4.8 - 12.3 m not logged		
10.0							cement - bentonite grout
					12.30		
					OIL SAND (McMurray Fm.)		
15.0							

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 4 HOLE NO: L9795014

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **14 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **332.56**

CO-ORDINATES (m): **N 6,315,740 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					20.60 Interburden		
					24.00 OIL SAND (McMurray Fm.)		
25.0							
					28.70 Interburden		
30.0							
					31.70 OIL SAND (McMurray Fm.)		
35.0							
					39.80		

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 4** HOLE NO: **L9795014**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **14 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **332.56**

CO-ORDINATES (m): **N 6,315,740 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					Interburden		
45.0							
50.0						▽	water level 53.71 m
					54.60		
					OIL SAND (McMurray Fm:)		
55.0							

Continued

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 4** HOLE NO: **L9795014**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **14 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **332.56**

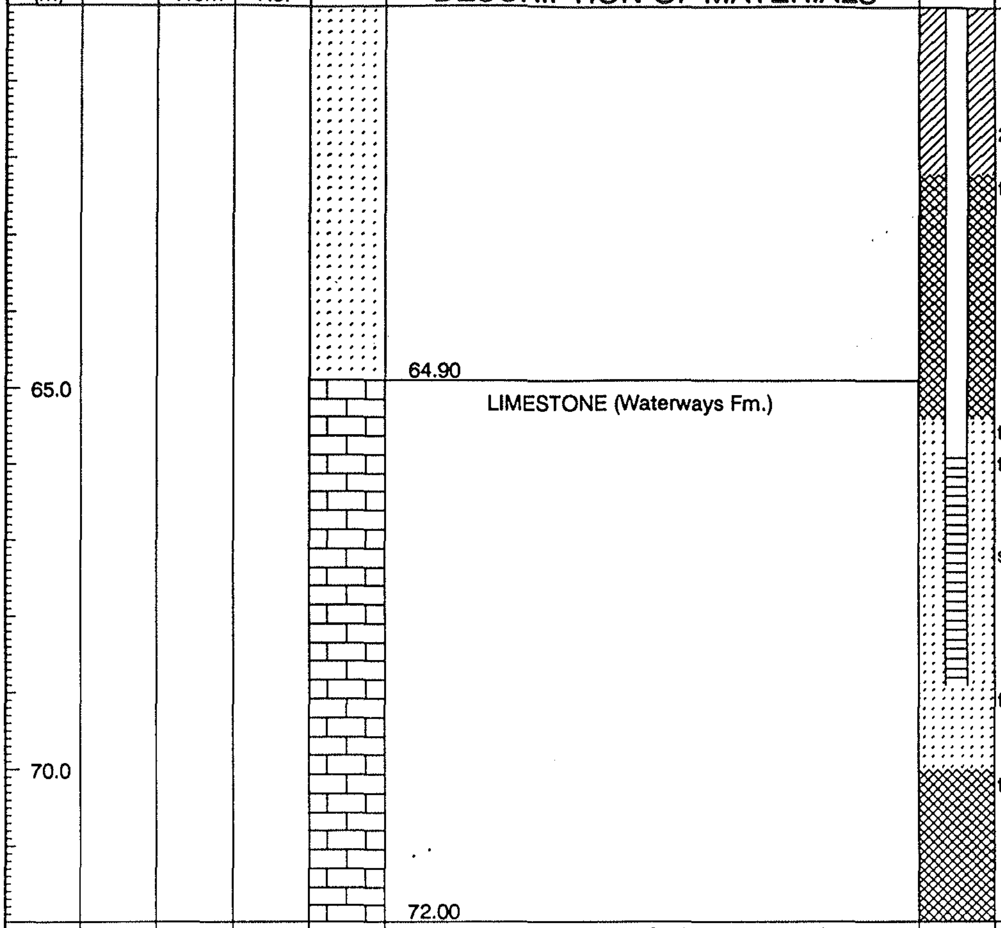
CO-ORDINATES (m): **N 6,315,740 E 475,160**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



64.90

LIMESTONE (Waterways Fm.)

72.00

END OF TEST HOLE (Approximate)

2" dia. sch. 40 PVC pipe

top of upper seal 62.2 m

top of filter sand 65.4 m

top of screen 65.8 m

sch. 40 screen 0.020 slots

tip of screen 68.9 m

top of bottom seal

KLOHN-CRIPPEN

27/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 4** HOLE NO: **L9795014**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 13 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 325.65

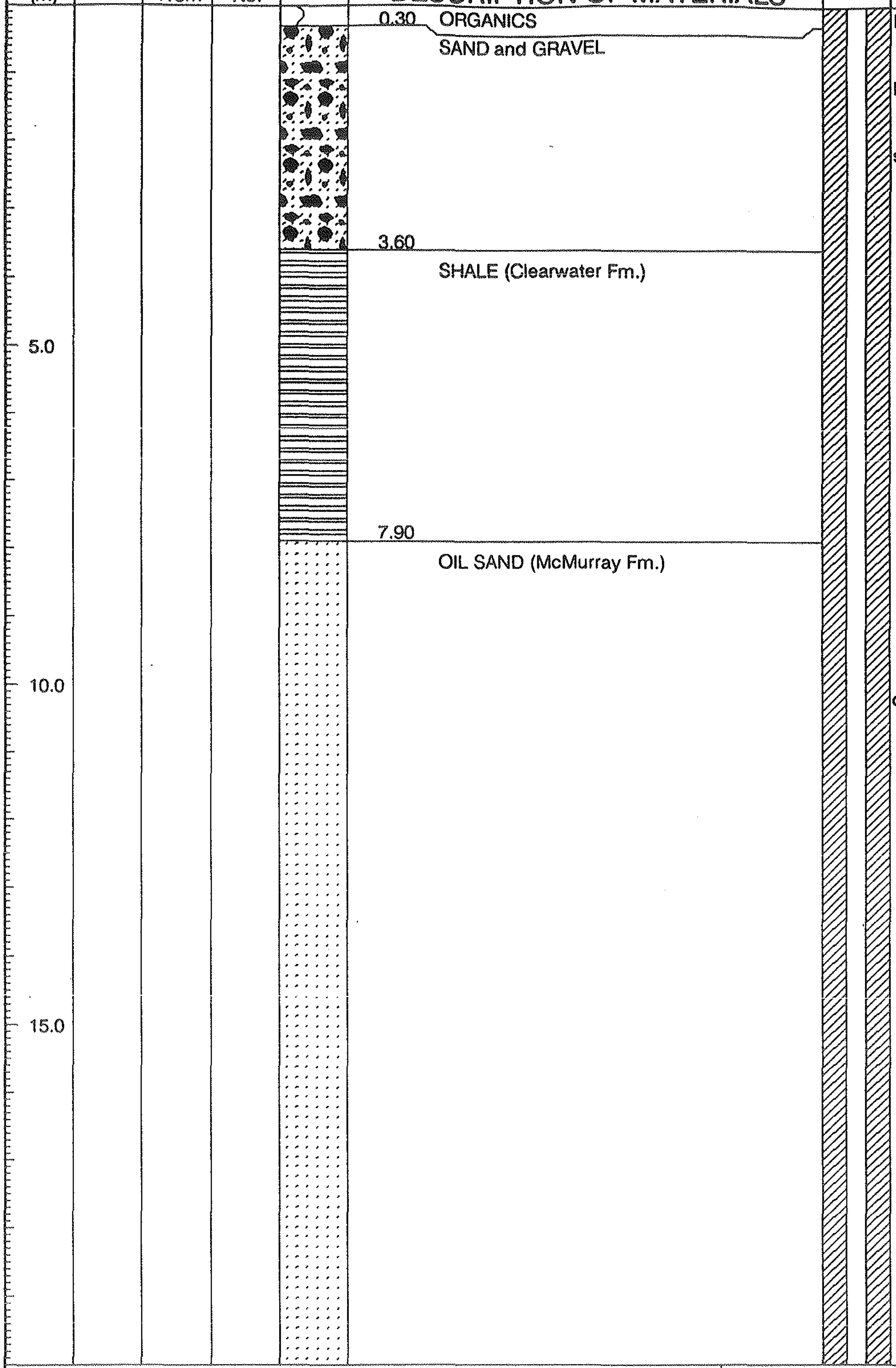
CO-ORDINATES (m): N 6,316,700 E 474,520

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



0.30 ORGANICS

SAND and GRAVEL

3.60 SHALE (Clearwater Fm.)

7.90 OIL SAND (McMurray Fm.)

Installation ID L97-P95-3-BA

Borehole ID L9795005

stick-up 0.91 m PVC
0.41 m steel

cement - bentonite grout

Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 6 HOLE NO: L9795005

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 13 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 325.65

CO-ORDINATES (m): N 6,316,700 E 474,520

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
25.0							
30.0							
35.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 2 of 6 HOLE NO: L9795005

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 13 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 325.65

CO-ORDINATES (m): N 6,316,700 E 474,520

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0					∇		water level 49.89 m
					52.30 Interburden		
55.0							

Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 3 of 6 HOLE NO: L9795005

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: **13 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **325.65**

CO-ORDINATES (m): **N 6,316,700 E 474,520**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					60.50		
					OIL SAND (McMurray Fm.)		
65.0							
70.0							
75.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 6** HOLE NO: **L9795005**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 13 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 325.65

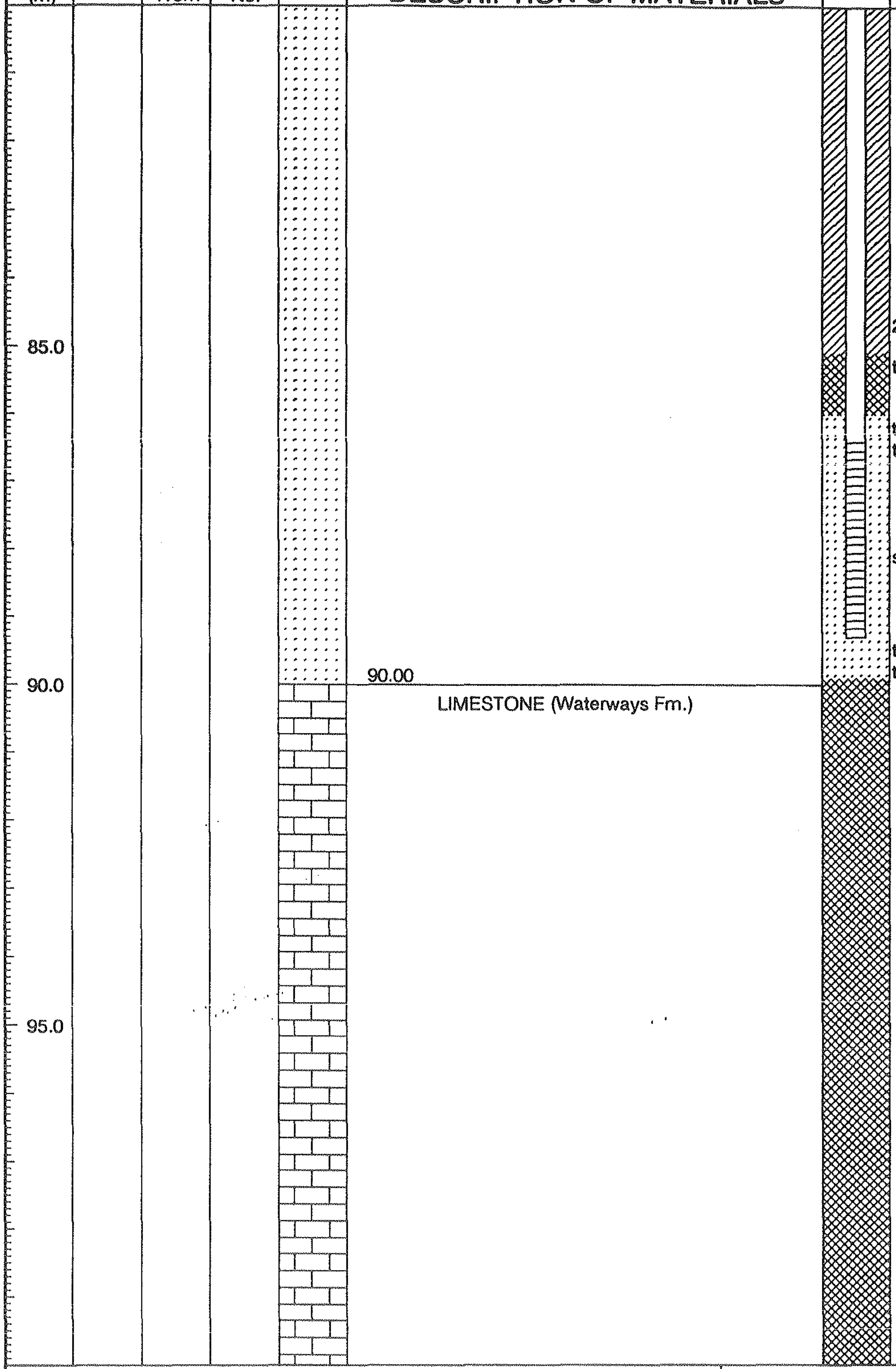
CO-ORDINATES (m): N 6,316,700 E 474,520

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



90.00 LIMESTONE (Waterways Fm.)

2" dia. sch. 40 PVC pipe

top of upper seal 85.1 m

top of filter sand 86.0 m

top of screen 86.3 m

sch. 40 screen 0.020 slots

tip of screen 89.3 m

top of bottom seal 89.6 m

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 5 of 6 HOLE NO: L9795005

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **13 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **325.65**

CO-ORDINATES (m): **N 6,316,700 E 474,520**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					100.40	▨	
					END OF TEST HOLE		total depth 100.4 m

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 6** HOLE NO: **L9795005**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 15 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 318.75

CO-ORDINATES (m): N 6,315,090 E 474,700

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					0.40 ORGANICS		Installation ID L97-AP95-4-L
					SAND -silty 1.50		Borehole ID L9795015
					OIL SAND (McMurray Fm.)		
5.0							
10.0							cement - bentonite grout
15.0							two lead cables

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 4 HOLE NO: L9795015

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **15 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **318.75**

CO-ORDINATES (m): **N 6,315,090 E 474,700**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
25.0							
30.0							
35.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 4** HOLE NO: **L9795015**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **15 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **318.75**

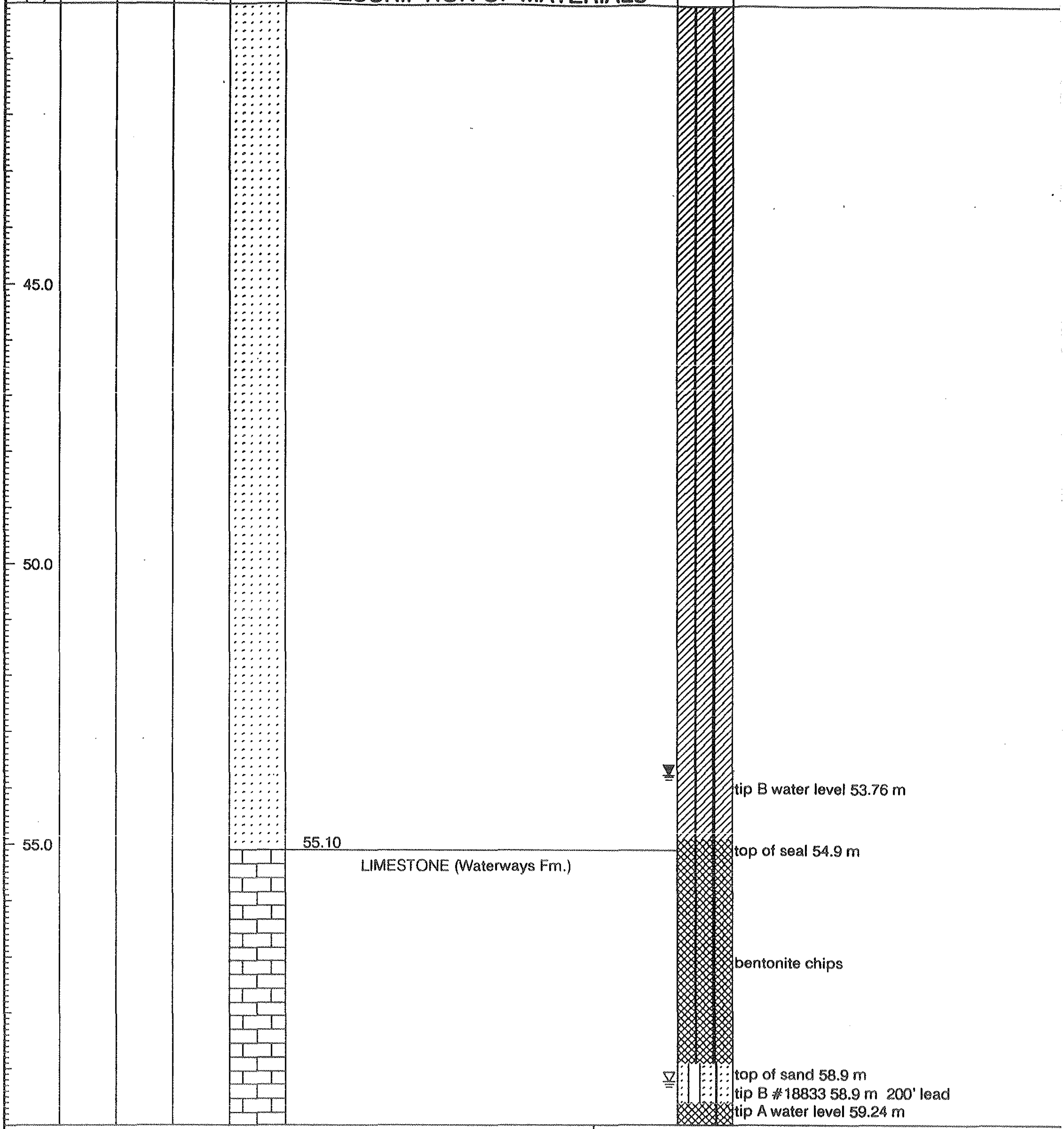
CO-ORDINATES (m): **N 6,315,090 E 474,700**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



55.10

LIMESTONE (Waterways Fm.)

tip B water level 53.76 m

top of seal 54.9 m

bentonite chips

top of sand 58.9 m

tip B #18833 58.9 m 200' lead

tip A water level 59.24 m

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 4** HOLE NO: **L9795015**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **15 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **318.75**

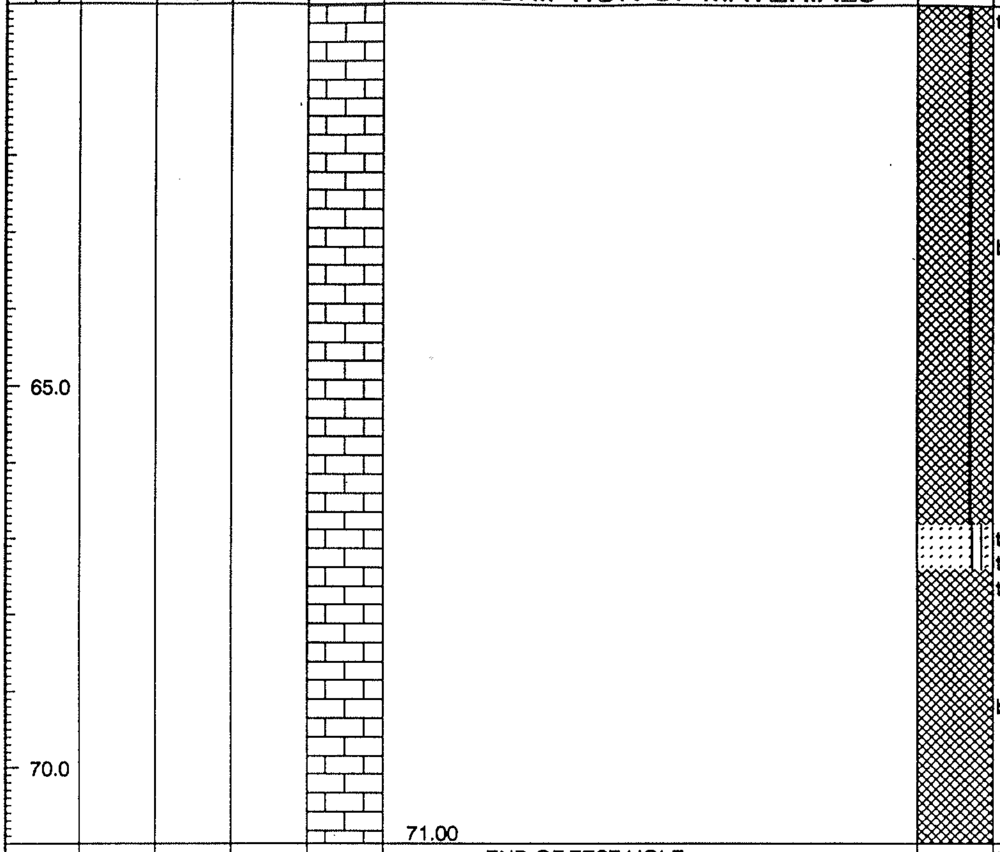
CO-ORDINATES (m): **N 6,315,090 E 474,700**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



END OF TEST HOLE

top of upper seal 59.6 m

bentonite chips

top of sand 66.8 m

tip A #18831 67.1 m 300' lead

top of bottom seal 67.4 m

bentonite chips

total depth 71.0 m

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 4** HOLE NO: **L9795015**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 17 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 337.61

CO-ORDINATES (m): N 6,316,470 E 475,460

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					0.30 ORGANICS		Installation ID L97-AP95-5-L
					SAND -clayey, some gravel		Borehole ID L9795010
					4.30		
5.0					SAND TILL -some gravel		
					6.00		
					CLAY TILL		
					7.00		
10.0							cement - bentonite grout
15.0							two lead cables
					17.00		
					SHALE (Clearwater Fm.)		

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 6 HOLE NO: L9795010

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **17 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.61**

CO-ORDINATES (m): **N 6,316,470 E 475,460**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					23.00 OIL SAND (McMurray Fm.)		
25.0							
30.0							
35.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 6** HOLE NO: **L9795010**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 17 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 337.61

CO-ORDINATES (m): N 6,316,470 E 475,460

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0							
55.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 3 of 6 HOLE NO: L9795010

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: **17 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.61**

CO-ORDINATES (m): **N 6,316,470 E 475,460**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
						▽	tip B water level 62.28 m
65.0							
						▽	tip A water level 68.14 m
70.0							
75.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 6** HOLE NO: **L9795010**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **17 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.61**

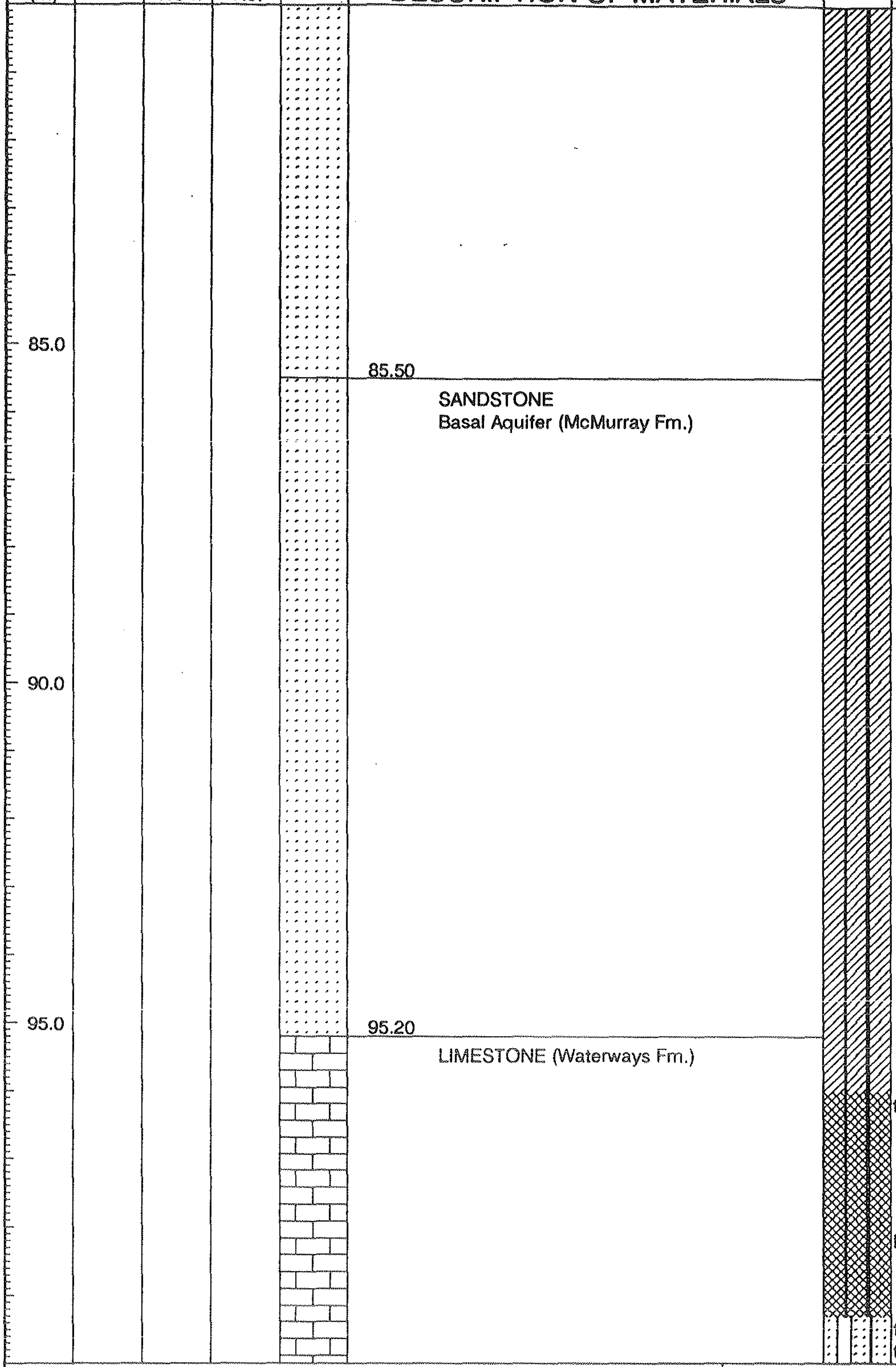
CO-ORDINATES (m): **N 6,316,470 E 475,460**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



85.50

SANDSTONE
Basal Aquifer (McMurray Fm.)

95.20

LIMESTONE (Waterways Fm.)

top of seal 96.0 m

bentonite chips

top of sand 99.3 m

tip B #18828 100.0 m 300' lead

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **5 of 6** HOLE NO: **L9795010**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **17 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.61**

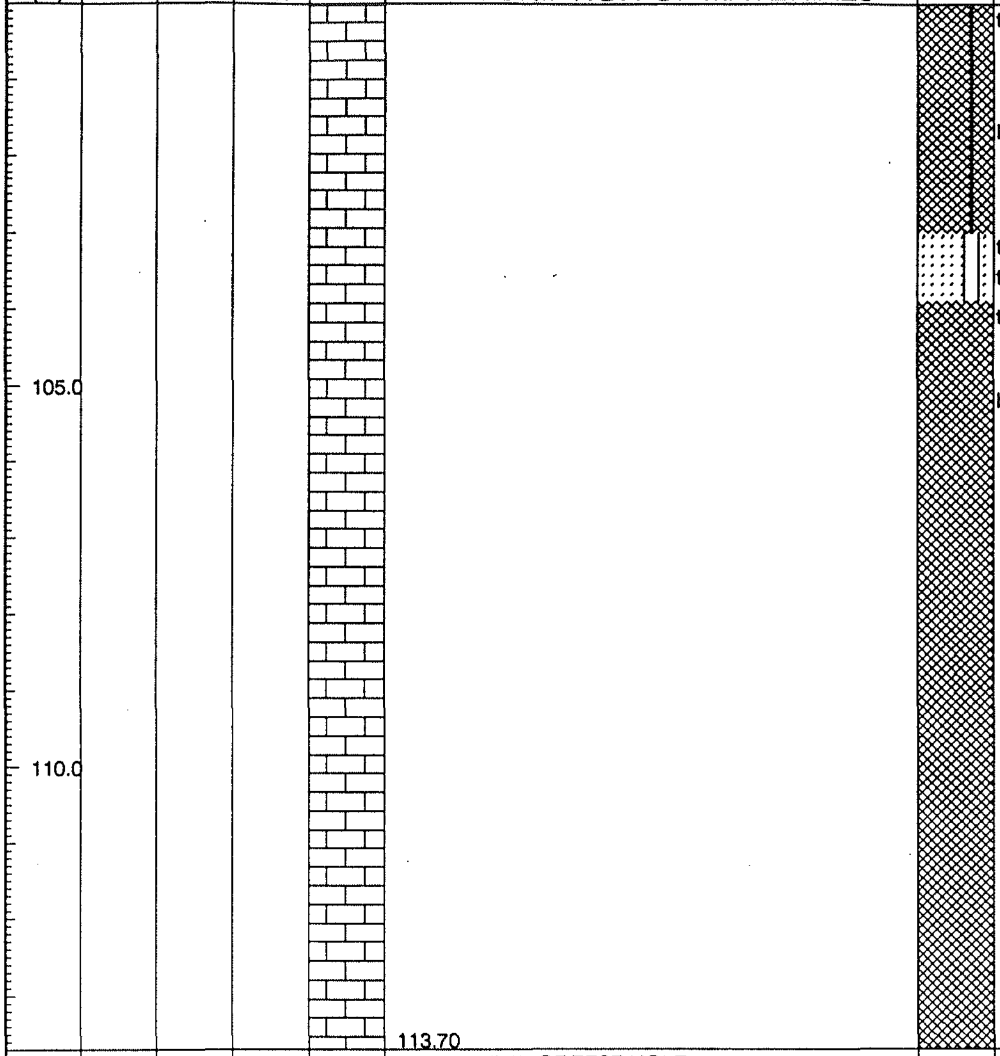
CO-ORDINATES (m): **N 6,316,470 E 475,460**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



top of upper seal 100.0 m

bentonite chips

top of sand 103 m

tip A #18829 103.9 m 400' lead

top of bottom seal

bentonite chips

END OF TEST HOLE

total depth 113.7 m

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 6** HOLE NO: **L9795010**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 23 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 339.25

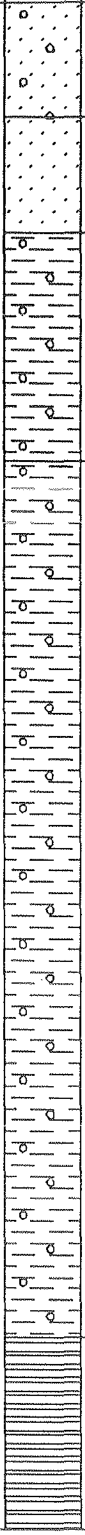
CO-ORDINATES (m): N 6,313,400 E 476,130

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					SAND - silty, gravelly		Installation ID FL3-P95-6-BA
					1.50		Borehole ID FL395004
					SAND TILL -clayey, gravelly -brown		stick-up 0.96 m PVC 0.48 m steel
					3.00		
					CLAY TILL -silty -grey		
5.0							
					6.00		
					TILL -clayey, gravelly		
10.0							cement - bentonite grout
15.0							
					17.50		
					SHALE (Clearwater Fm.)		



Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 1 of 6 HOLE NO: FL395004

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **339.25**

CO-ORDINATES (m): **N 6,313,400 E 476,130**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
25.0							
					26.50 OIL SAND (McMurray Fm.)		
30.0							
35.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 6** HOLE NO: **FL395004**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 23 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 339.25

CO-ORDINATES (m): N 6,313,400 E 476,130

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0							
55.0							
						∇	water depth 58.17 m

Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 3 of 6 HOLE NO: FL395004

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **339.25**

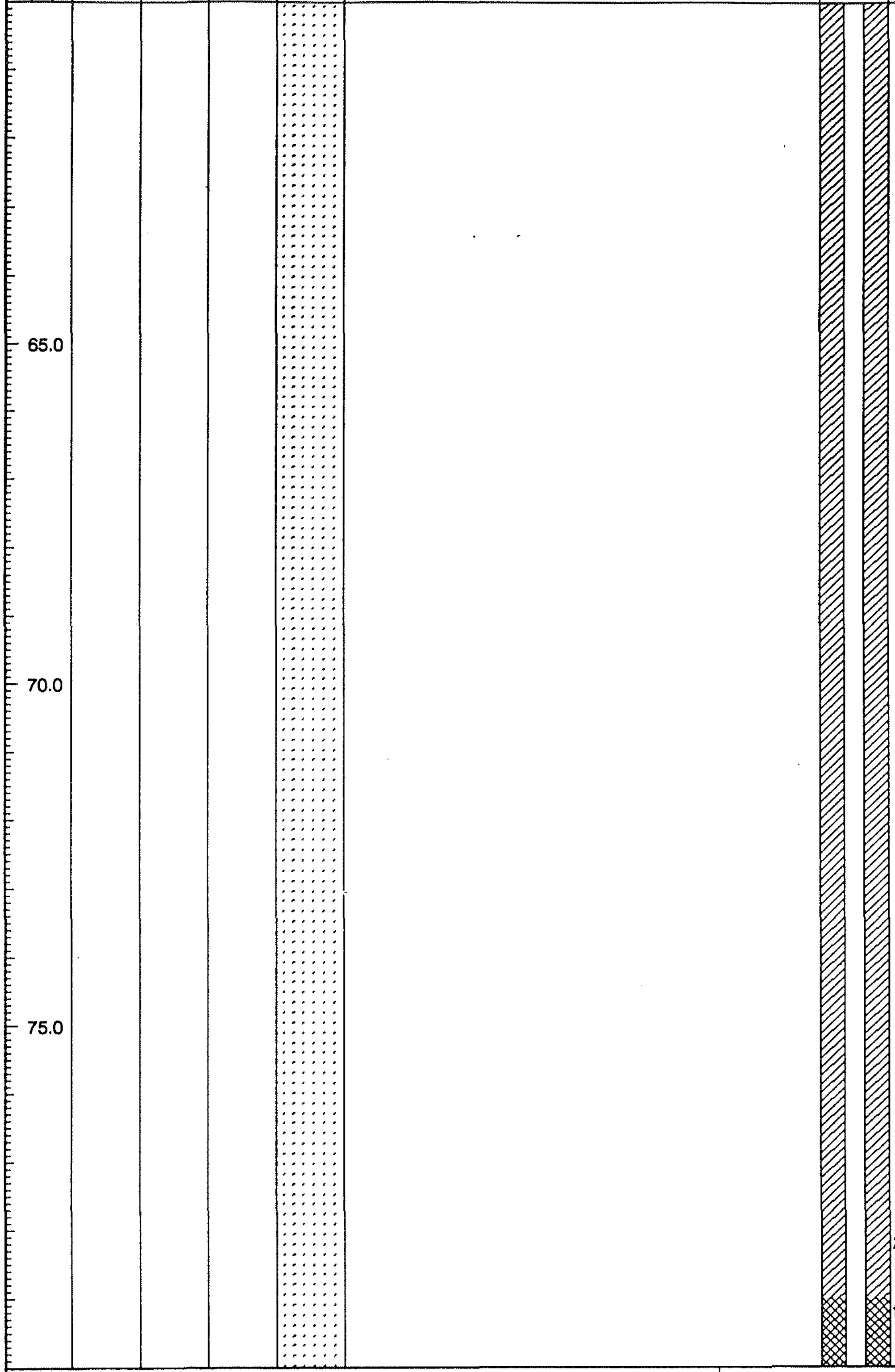
CO-ORDINATES (m): **N 6,313,400 E 476,130**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



2" dia. sch. 40 PVC pipe

top of upper seal 79.0 m

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 6** HOLE NO: **FL395004**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 23 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 339.25

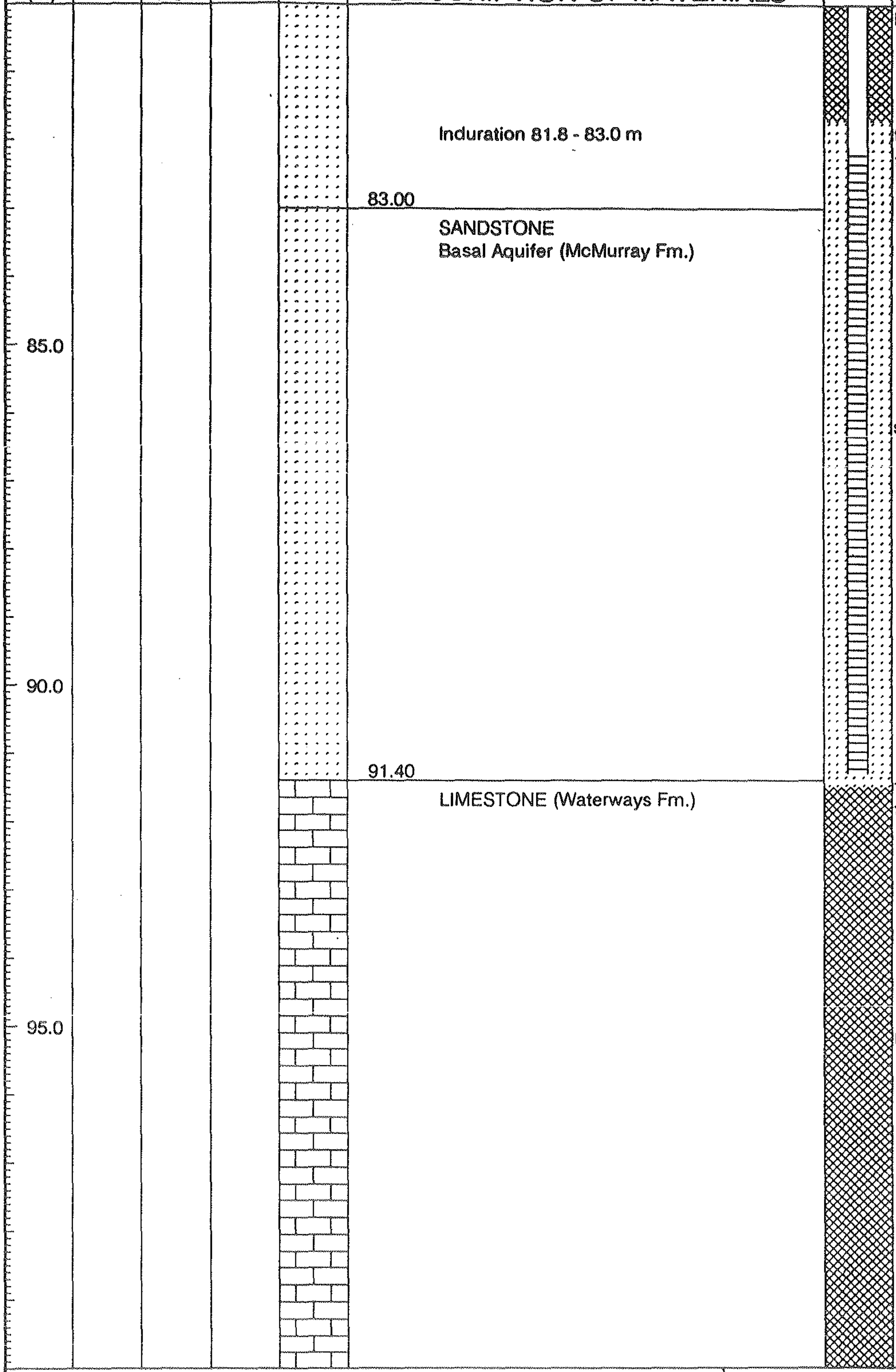
CO-ORDINATES (m): N 6,313,400 E 476,130

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



Induration 81.8 - 83.0 m

83.00

SANDSTONE
Basal Aquifer (McMurray Fm.)

91.40

LIMESTONE (Waterways Fm.)

bentonite

top of filter sand 81.7 m

top of screen 82.1 m

sch. 40 screen 0.020 slots

tip of screen 91.3 m

top of bottom seal 91.5 m

bentonite

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 5 of 6 HOLE NO: FL395004

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **339.25**

CO-ORDINATES (m): **N 6,313,400 E 476,130**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
105.0							
					107.00		
					END OF TEST HOLE		total depth 107.0 m

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 6** HOLE NO: **FL395004**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **338.61**

CO-ORDINATES (m): **N 6,312,840 E 476,050**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					0.40 ORGANICS		Installation ID FL3-AP95-7-L
					SAND		Borehole ID FL395005
					2.00		
					SAND TILL -some gravel		
					3.00		
					CLAY TILL -sandy, some gravel		
5.0							
10.0							cement - bentonite grout
					11.00 0.3 m green SILTSTONE		
					SHALE (Clearwater Fm.)		
15.0							two lead cables
					18.50		
					OIL SAND (McMurray Fm.)		

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 5** HOLE NO: **FL395005**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **338.61**

CO-ORDINATES (m): **N 6,312,840 E 476,050**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
25.0							
30.0							
35.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 5** HOLE NO: **FL395005**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **338.61**

CO-ORDINATES (m): **N 6,312,840 E 476,050**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
					46.50 Interburden		
50.0							
					52.20 OIL SAND (McMurray Fm.)		
55.0							tip B water level 55.05 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 5** HOLE NO: **FL395005**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **23 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **338.61**

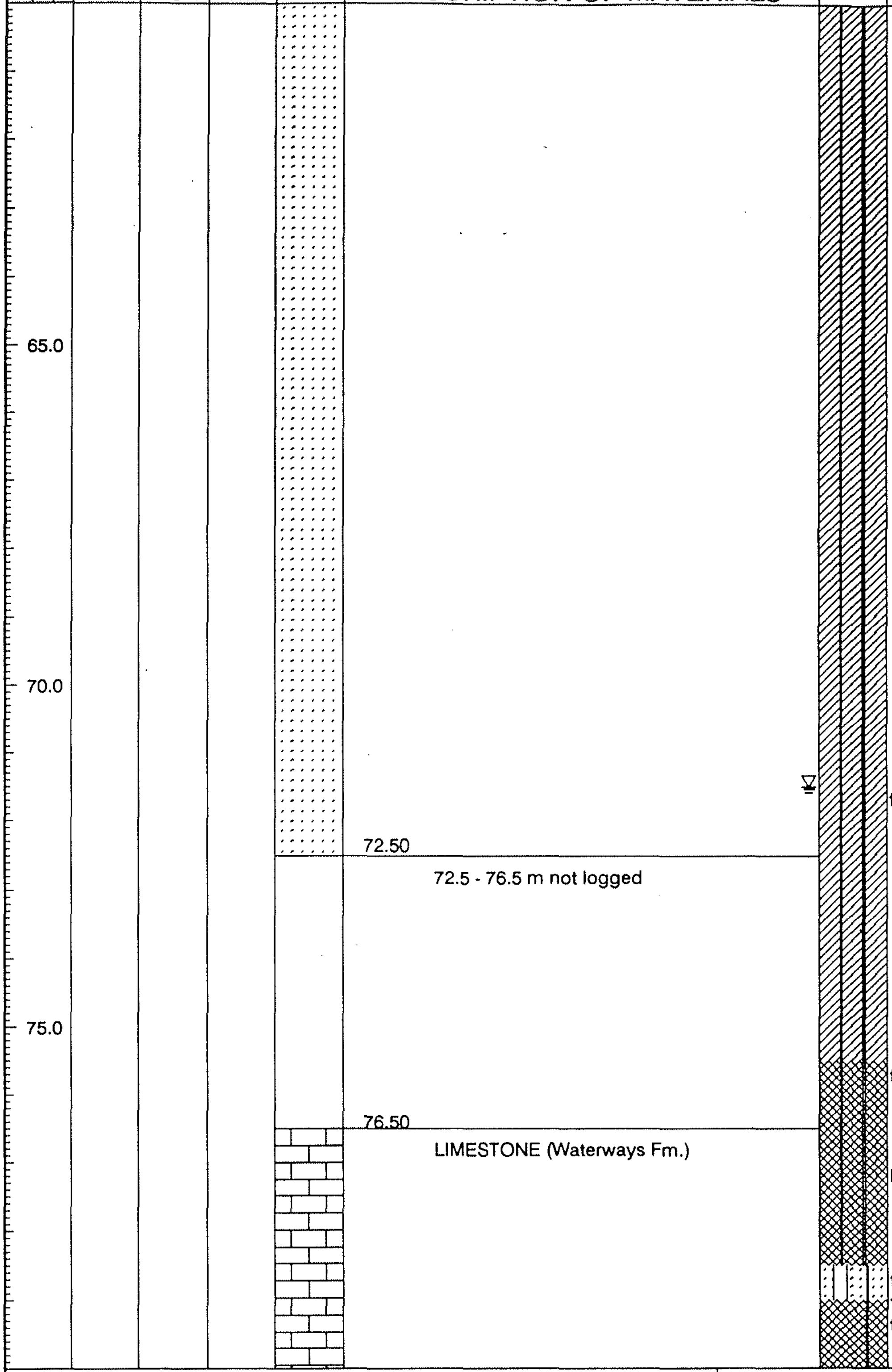
CO-ORDINATES (m): **N 6,312,840 E 476,050**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



72.5 - 76.5 m not logged

LIMESTONE (Waterways Fm.)

tip A water level 71.50 m

top of seal 75.5 m

bentonite chips

top of sand 78.5 m

tip B #18830 79.0 m 300' lead

top of upper seal 79.0 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 5** HOLE NO: **FL395005**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m
DATE DRILLED: 23 JAN 95 -
DRILL TYPE: Mud Rotary
ELEV. GROUND (m): 338.61
CO-ORDINATES (m): N 6,312,840 E 476,050

SAMPLE DATA
HAMMER WEIGHT kg
DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
85.0							bentonite chips
90.0							
							top of sand 91.1 m tip A #16943 91.5 m 320' lead
					91.80		
					END OF TEST HOLE		top of bottom seal 91.5 m total depth 91.8 m

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01
PROJECT: Steepbank Hydrogeology
LOCATION: Suncor, Alberta
LOGGED BY: Suncor CHECKED BY:
PLATE: 5 of 5 HOLE NO: FL395005

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **16 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **330.66**

CO-ORDINATES (m): **N 6,316,900 E 474,900**

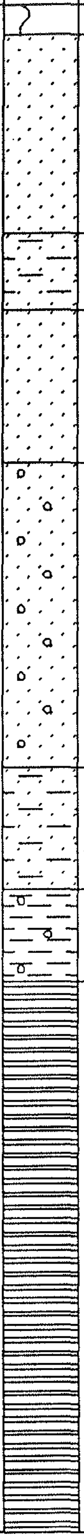
SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.
5.0			
10.0			
15.0			

SYMBOL



DESCRIPTION OF MATERIALS

0.40	ORGANICS
	SAND -silty, clayey -trace gravel
3.00	TILL -sandy, silty, clayey -trace gravel
4.00	CLAY TILL
6.00	SAND -silty, trace gravel
10.00	TILL -sandy, silty, clayey -trace gravel
11.60	CLAY TILL
12.80	SHALE (Clearwater Fm.)

PIEZOMETER DETAILS

NOTES

Installation ID L97-P95-8-BA

Borehole ID L9795006

stick-up 0.94 m PVC
0.41 m steel

cement - bentonite grout

Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 6** HOLE NO: **L9795006**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 16 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 330.66

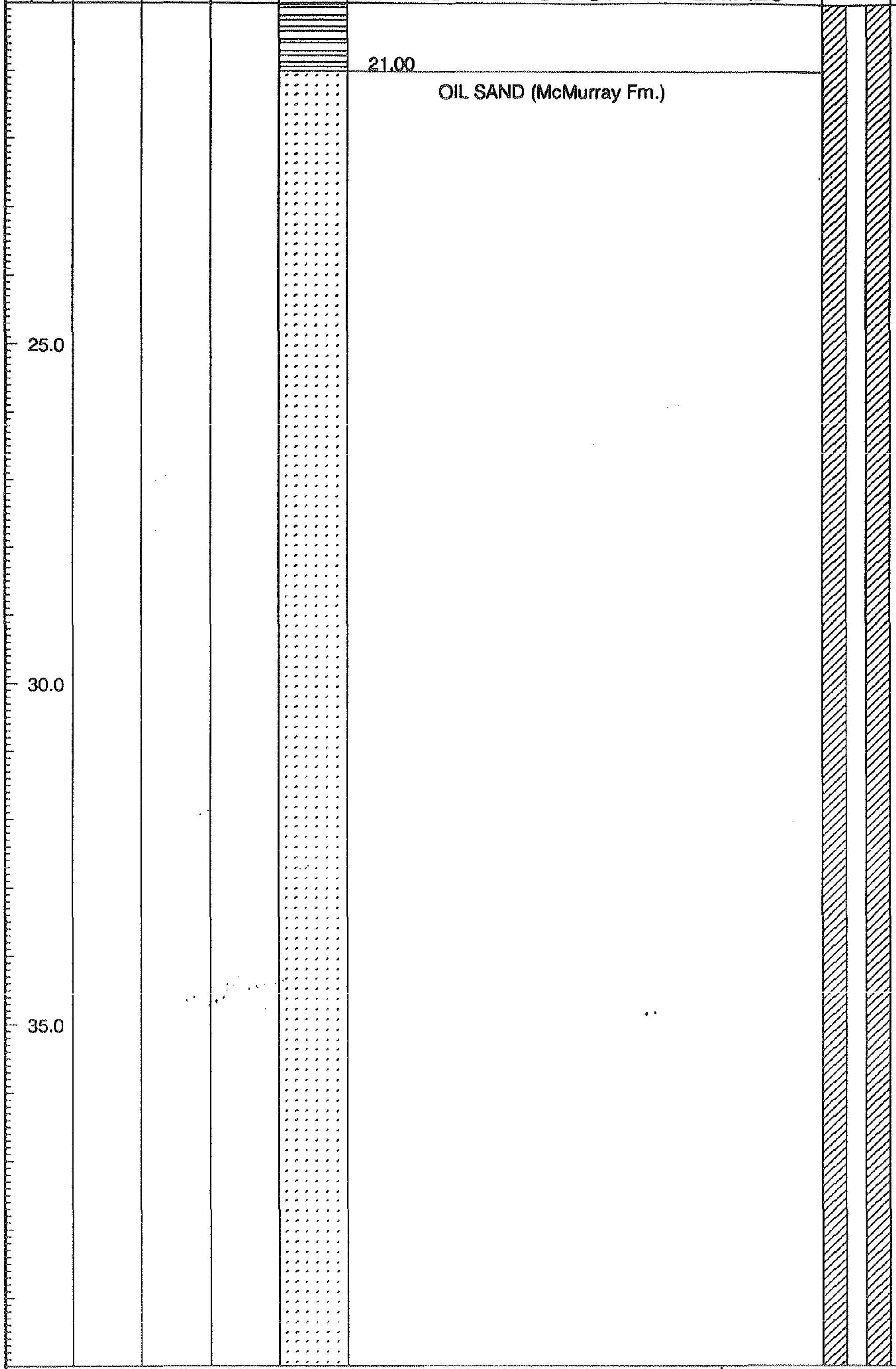
CO-ORDINATES (m): N 6,316,900 E 474,900

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
21.00					OIL SAND (McMurray Fm.)		



Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 2 of 6 HOLE NO: L9795006

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **16 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **330.66**

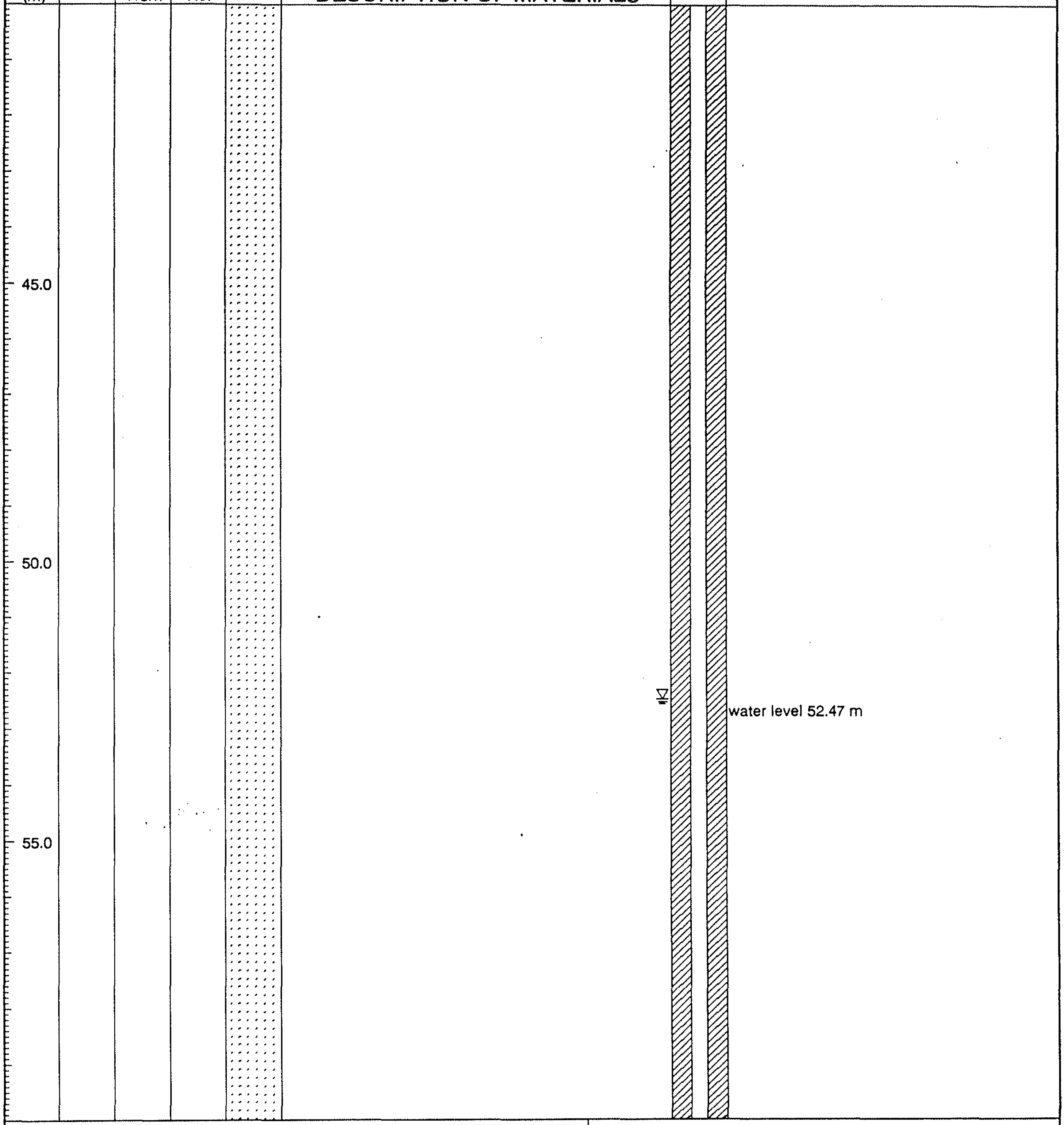
CO-ORDINATES (m): **N 6,316,900 E 474,900**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



water level 52.47 m

Continued

KLOHN-CRIPPEN

28/07/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 6** HOLE NO: **L9795006**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 16 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 330.66

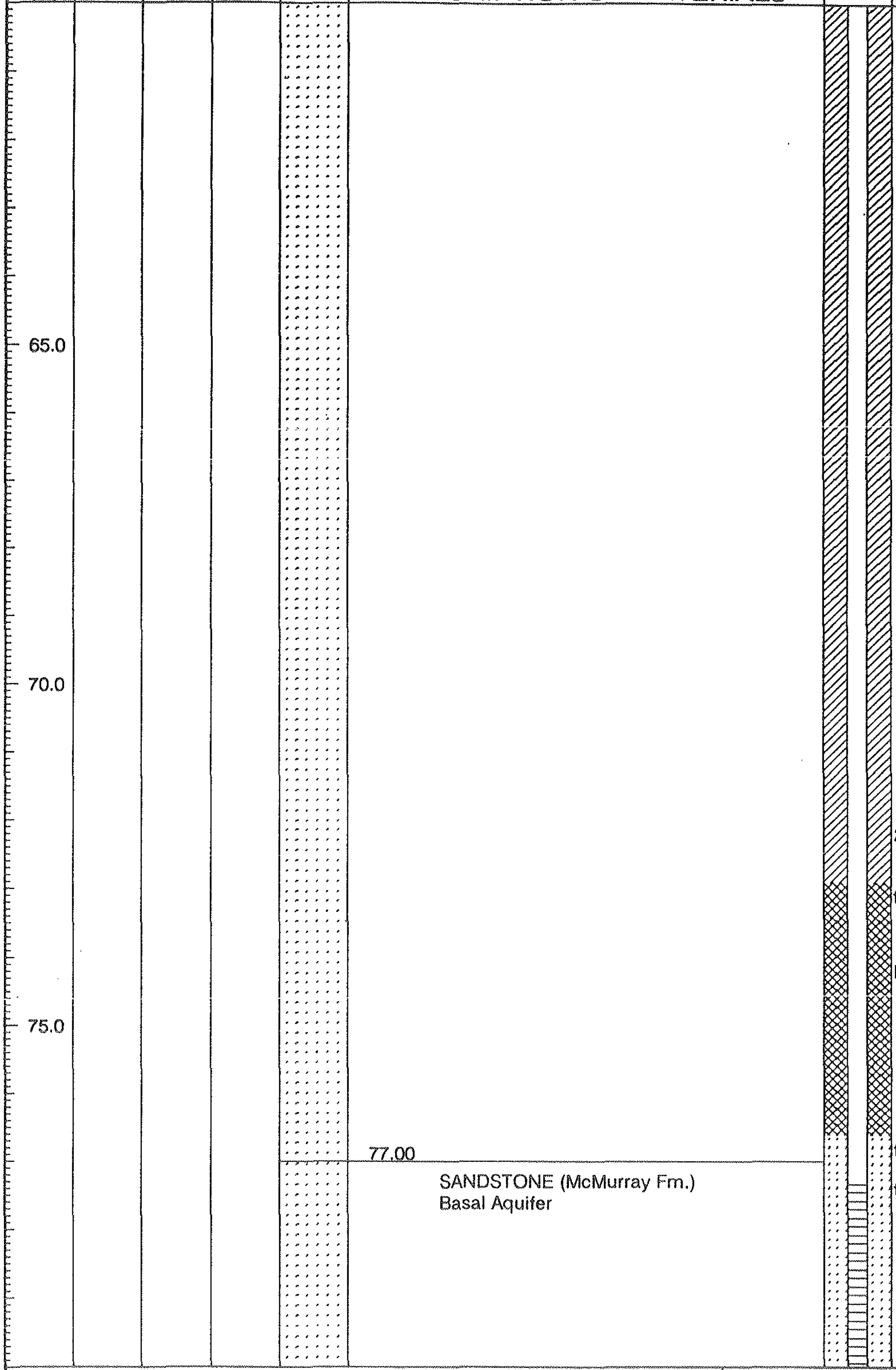
CO-ORDINATES (m): N 6,316,900 E 474,900

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



77.00

SANDSTONE (McMurray Fm.)
Basal Aquifer

2" dia. sch. 40 PVC pipe

top of upper seal 72.9 m

bentonite chips

top of filter sand 76.6 m

top of screen 77.2 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 4 of 6 HOLE NO: L9795006

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **16 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **330.66**

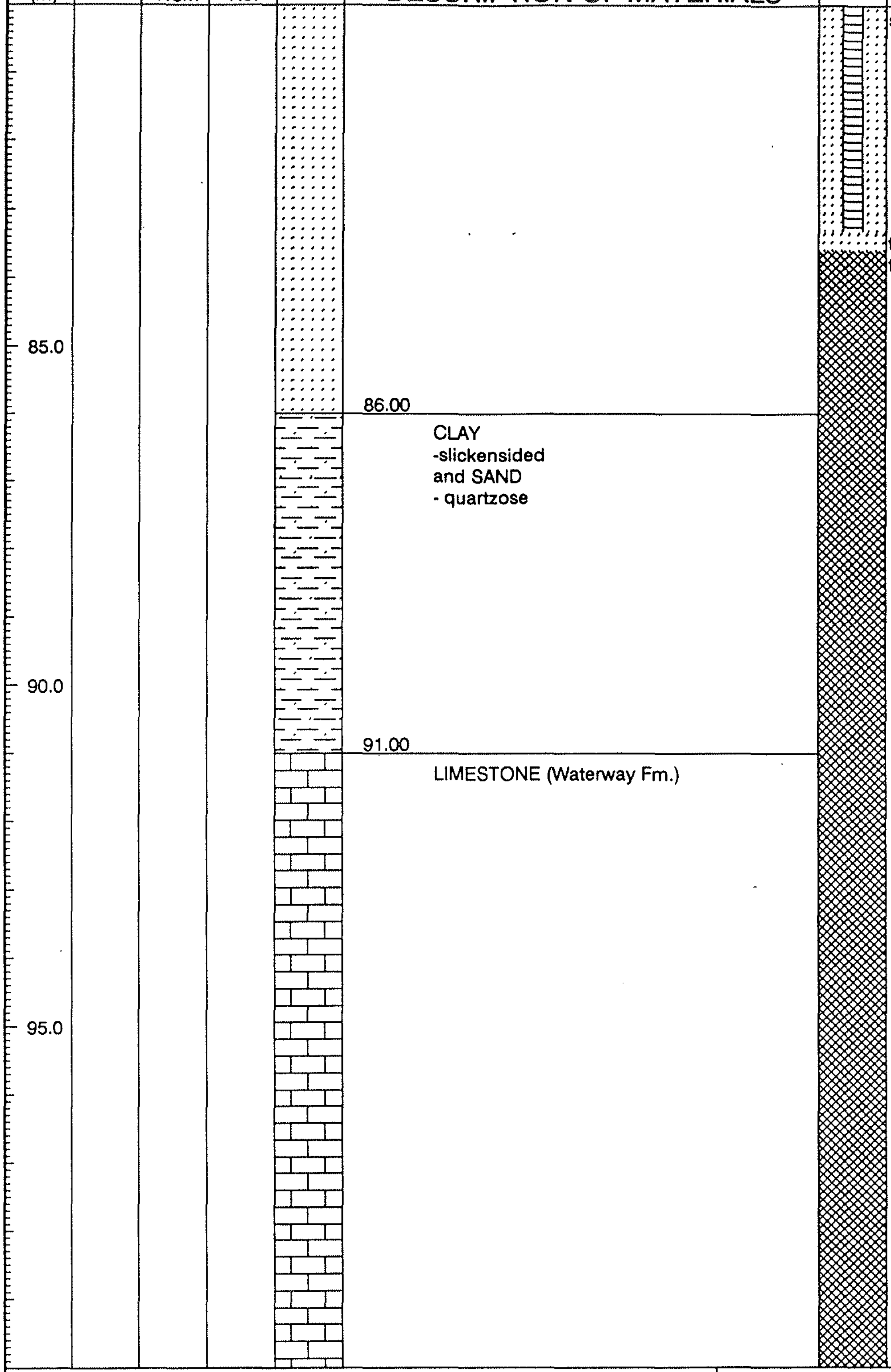
CO-ORDINATES (m): **N 6,316,900 E 474,900**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



86.00

CLAY
-slickensided
and SAND
- quartzose

91.00

LIMESTONE (Waterway Fm.)

sch. 40 screen 0.020 slots

tip of screen 83.3 m

top of bottom seal 83.6 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **5 of 6** HOLE NO: **L9795006**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 16 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 330.66

CO-ORDINATES (m): N 6,316,900 E 474,900

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
105.0							
					108.40 END OF TEST HOLE		

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 6 of 6 HOLE NO: L9795006

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **24 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **315.21**

CO-ORDINATES (m): **N 6,316,960 E 474,070**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
				▨	CLAY TILL	▨	Installation ID L97-AP95-9-L Borehole ID L9795001
				▨	3.40	▨	
				⁘	OIL SAND (McMurray Fm.)	▨	
5.0				⁘		▨	
10.0				⁘		▨	cement - bentonite grout
15.0				⁘		▨	two lead cables

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 6** HOLE NO: **L9795001**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **24 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **315.21**

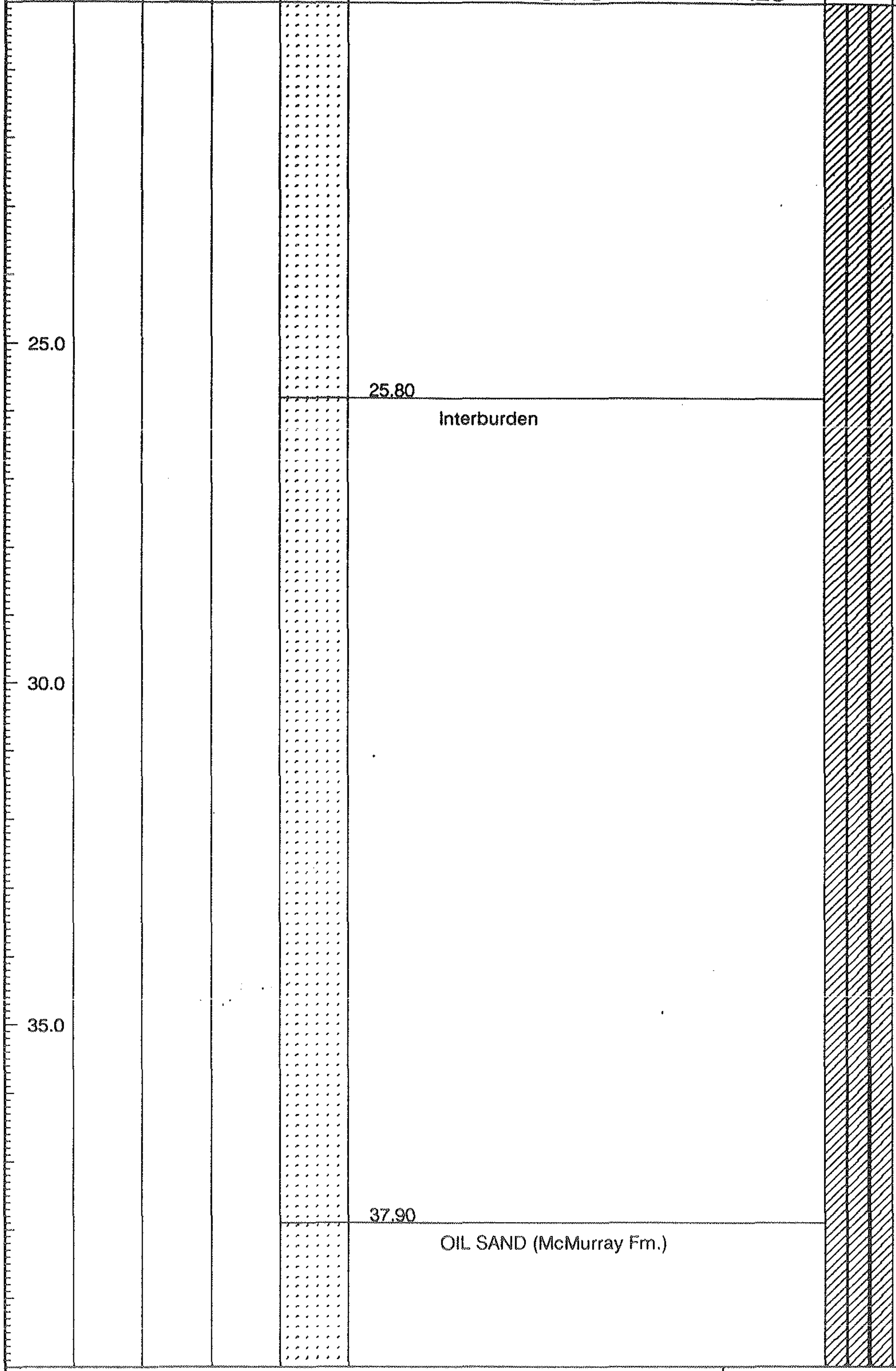
CO-ORDINATES (m): **N 6,316,960 E 474,070**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					25.80 Interburden		
					37.90 OIL SAND (McMurray Fm.)		



Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 6** HOLE NO: **L9795001**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: **24 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **315.21**

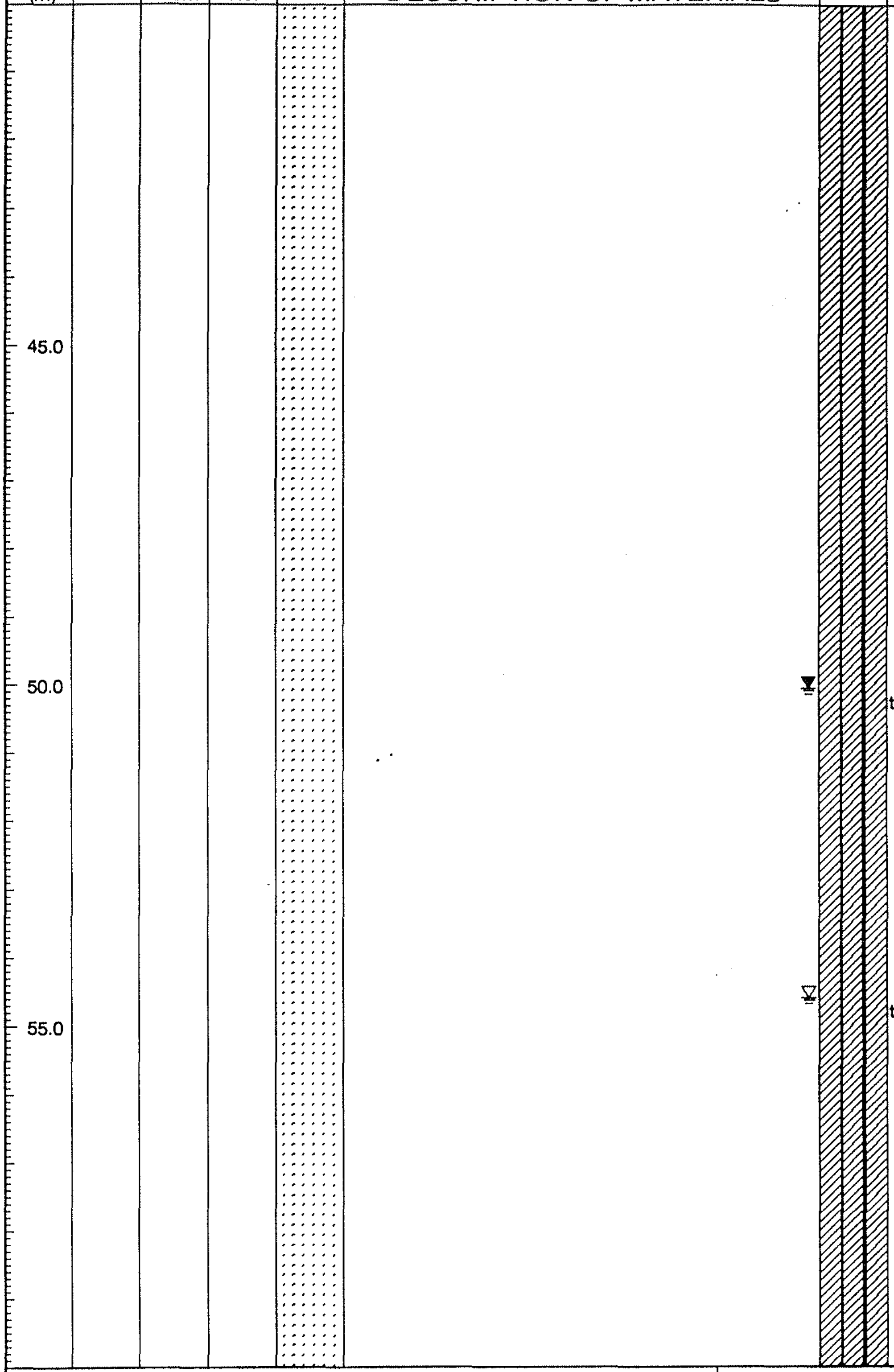
CO-ORDINATES (m): **N 6,316,960 E 474,070**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



tip A water level 50.05 m

tip B water level 54.58 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 6** HOLE NO: **L9795001**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 24 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 315.21

CO-ORDINATES (m): N 6,316,960 E 474,070

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows/.15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
65.0							
					68.30 SANDSTONE (McMurray Fm.) Basal Aquifer		
70.0							
75.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

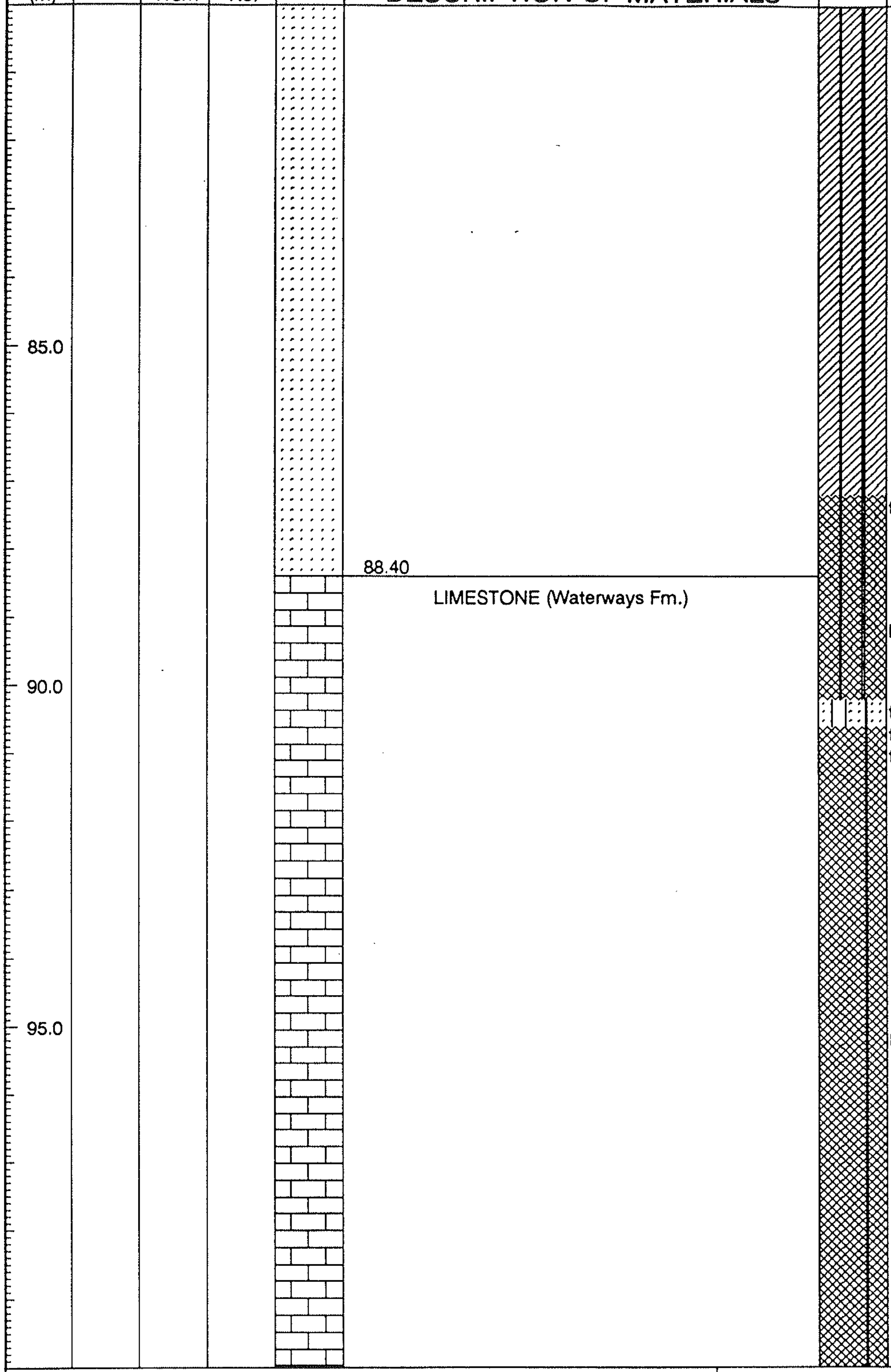
LOGGED BY: Suncor CHECKED BY:

PLATE: 4 of 6 HOLE NO: L9795001

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**	DATE DRILLED: **24 JAN 95 -**
SAMPLE DATA	DRILL TYPE: **Mud Rotary**
HAMMER WEIGHT kg	ELEV. GROUND (m): **315.21**
DROP HEIGHT m	CO-ORDINATES (m): **N 6,316,960 E 474,070**

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



88.40

LIMESTONE (Waterways Fm.)

top of seal 87.2 m

bentonite chips

top of sand 90.2 m

tip B #17506 90.6 m 300' lead

top of upper seal 90.6 m

bentonite chips

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO:	**PA 2779.02.01**
PROJECT:	**Steepbank Hydrogeology**
LOCATION:	**Suncor, Alberta**
LOGGED BY:	**Suncor** CHECKED BY:
PLATE:	**5 of 6** HOLE NO: **L9795001**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **24 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **315.21**

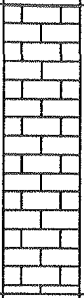
CO-ORDINATES (m): **N 6,316,960 E 474,070**

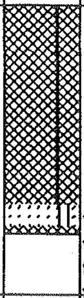
SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					103.80		top of sand 102.6 m tip A #16950 102.9 m 350' lead top of bottom seal 102.9 m total depth 103.0 m
					END OF TEST HOLE		





KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 6** HOLE NO: **L9795001**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

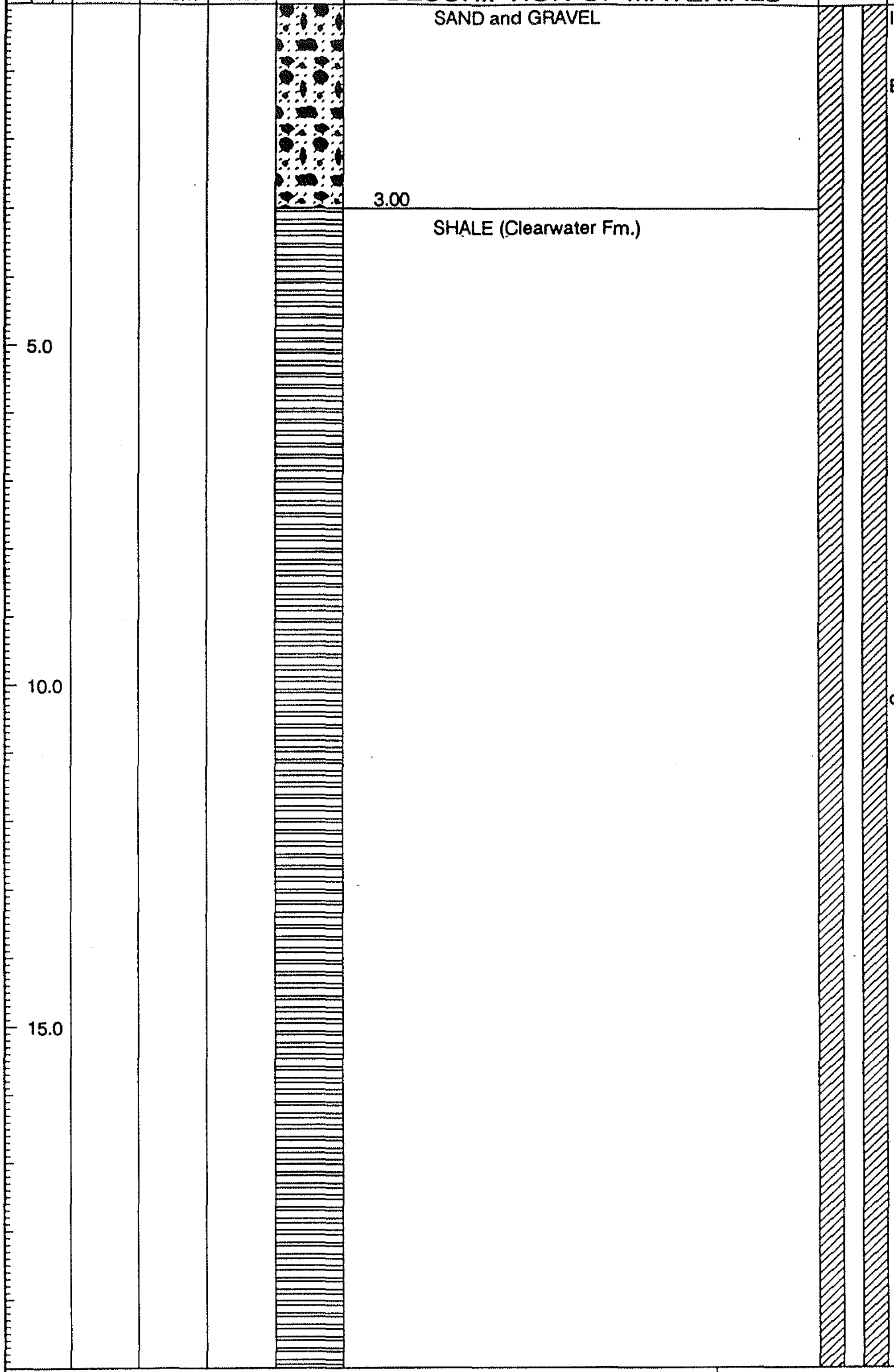
CO-ORDINATES (m): **N 6,319,580 E 476,240**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



SAND and GRAVEL

3.00

SHALE (Clearwater Fm.)

Installation ID FL1-P95-13-BA

Borehole ID FL195003

cement - bentonite grout

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

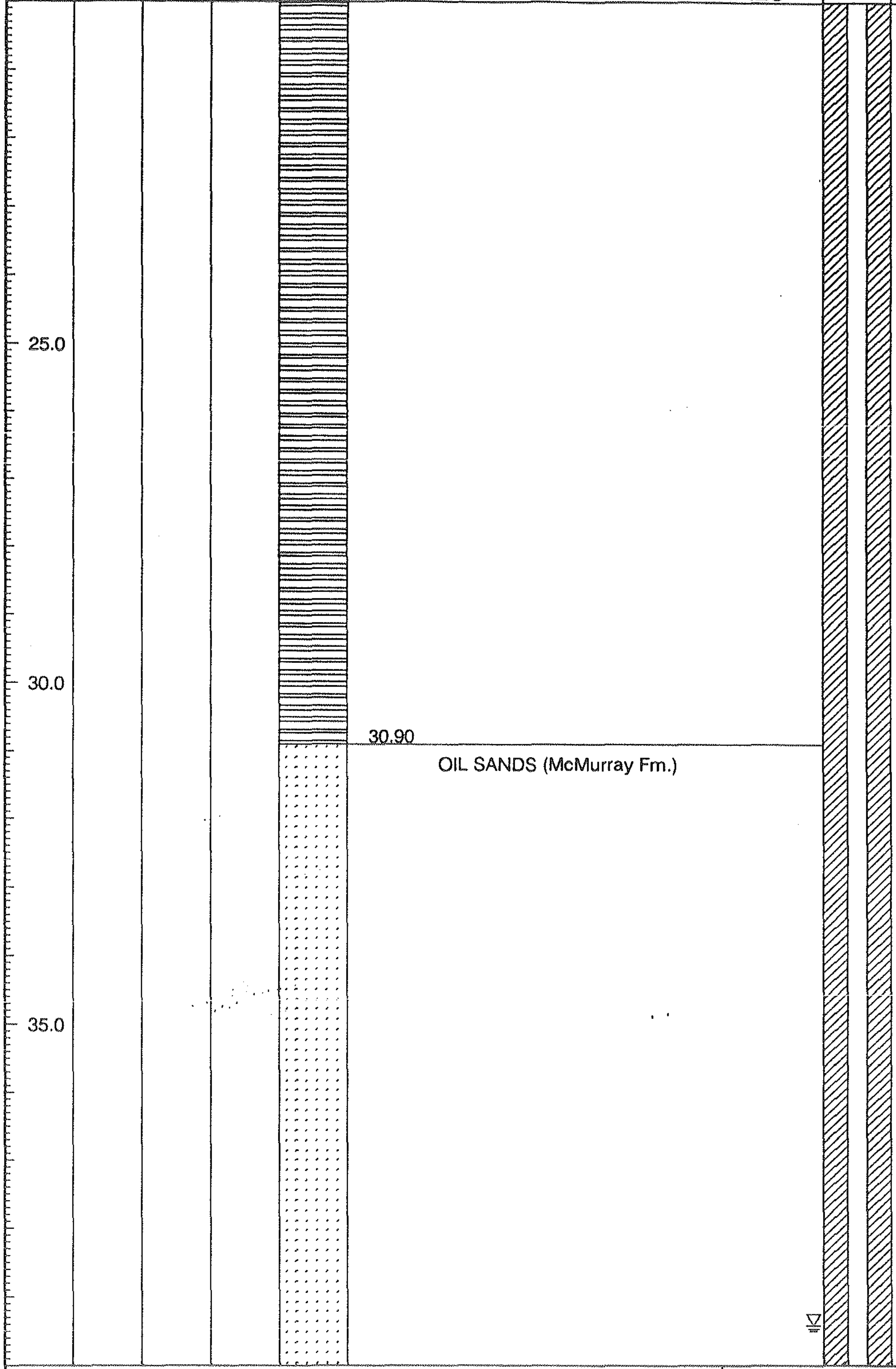
LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE:	1cm = 1.0m	DATE DRILLED:	28 JAN 95 -
SAMPLE DATA		DRILL TYPE:	Mud Rotary
HAMMER WEIGHT	kg	ELEV. GROUND (m):	345.07
DROP HEIGHT	m	CO-ORDINATES (m):	N 6,319,580 E 476,240

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



30.90
OIL SANDS (McMurray Fm.)

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO:	PA 2779.02.01		
PROJECT:	Steepbank Hydrogeology		
LOCATION:	Suncor, Alberta		
LOGGED BY:	Suncor	CHECKED BY:	
PLATE:	2 of 8	HOLE NO:	FL195003

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

CO-ORDINATES (m): **N 6,319,580 E 476,240**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0							
55.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 28 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 345.07

CO-ORDINATES (m): N 6,319,580 E 476,240

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
65.0							
70.0							
75.0							

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 4 of 8 HOLE NO: FL195003

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

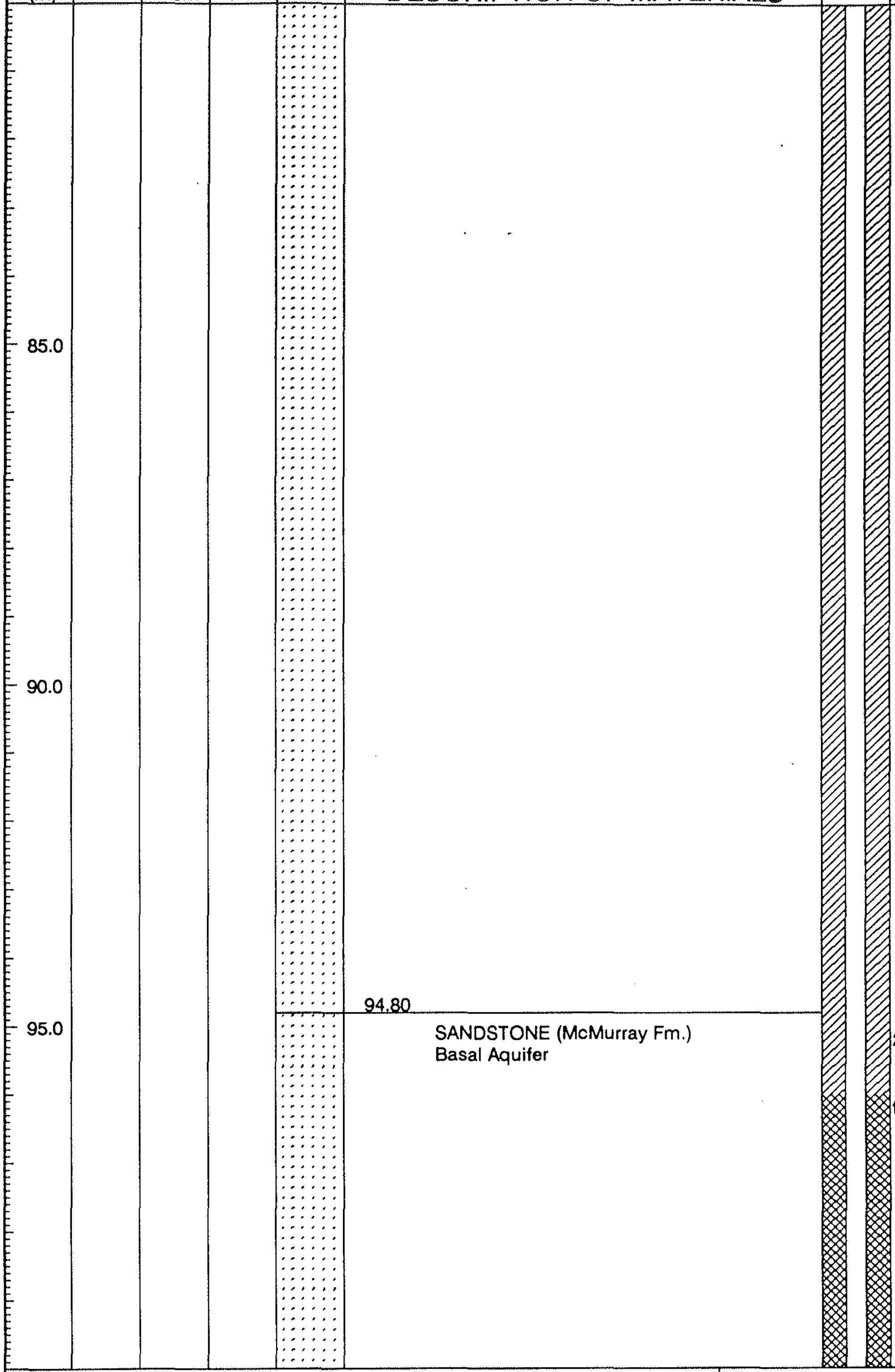
CO-ORDINATES (m): **N 6,319,580 E 476,240**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



SANDSTONE (McMurray Fm.)
Basal Aquifer

2" dia. sch. 40 PVC pipe

top of upper seal 96.0 m

Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **5 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

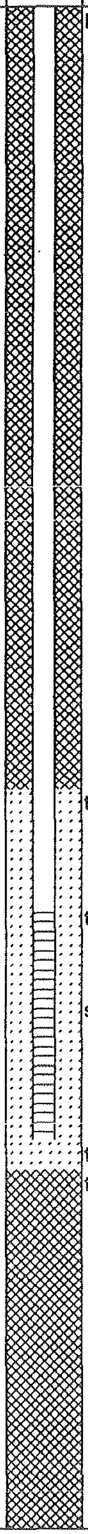
CO-ORDINATES (m): **N 6,319,580 E 476,240**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
							bentonite chips
105.0							
110.0							top of filter sand 110.3 m
							top of screen 111.8 m
							sch. 40 screen 0.020 slots
115.0							tip of screen 114.9 m
							top of bottom seal 115.3 m



Continued

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

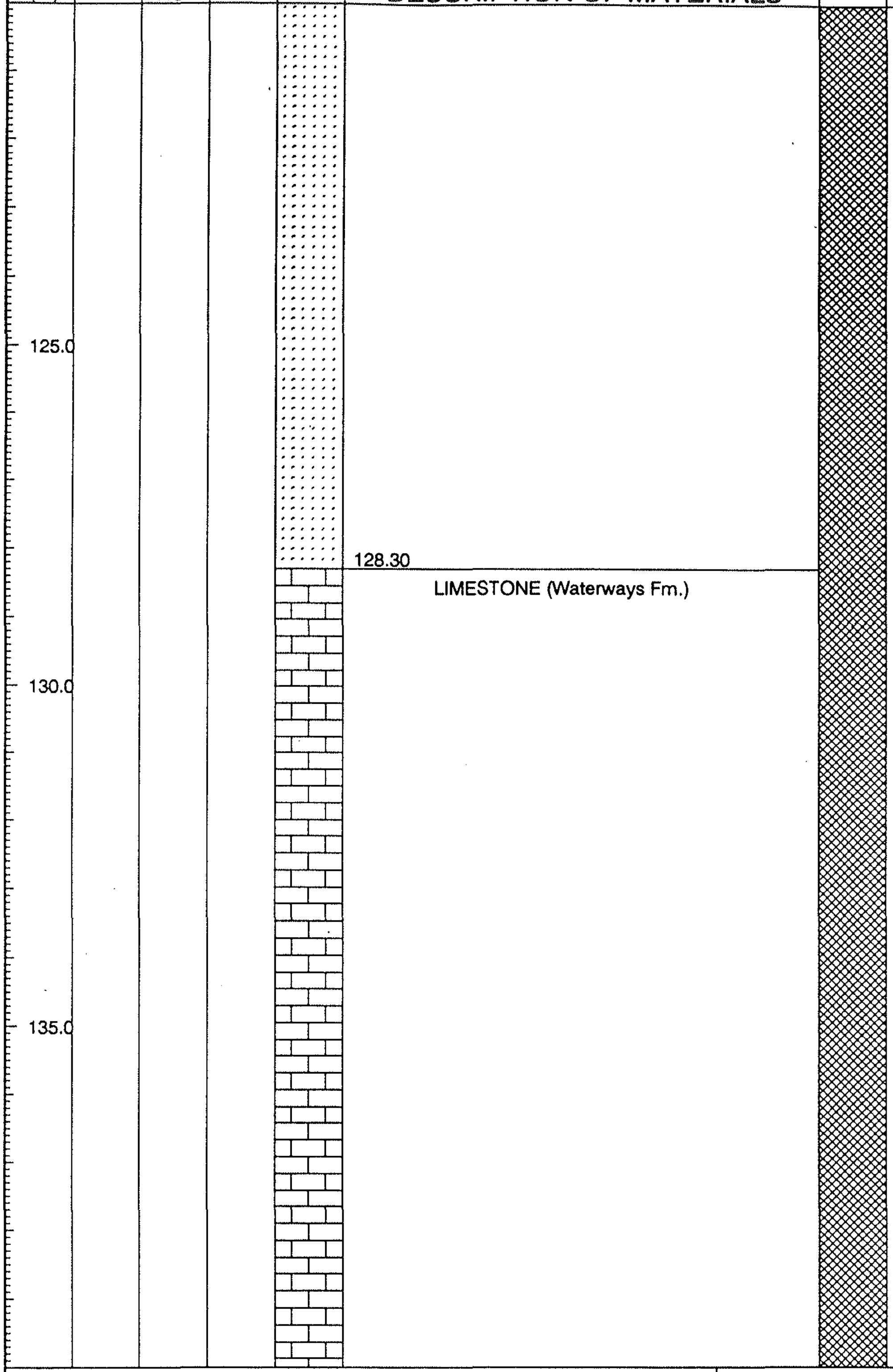
DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

CO-ORDINATES (m): **N 6,319,580 E 476,240**

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



128.30

LIMESTONE (Waterways Fm.)

Continued

16/06/95

KLOHN-CRIPPEN

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **7 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **345.07**

CO-ORDINATES (m): **N 6,319,580 E 476,240**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
				▦	143.30	▩	total depth 143 m
					END OF TEST HOLE		

KLOHN-CRIPPEN

16/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **8 of 8** HOLE NO: **FL195003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **27 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.22**

CO-ORDINATES (m): **N 6,318,680 E 475,510**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.
5.0			
10.0			
15.0			

SYMBOL

DESCRIPTION OF MATERIALS

CLAY TILL
-brown

1.50

GRAVEL
-clay lenses
-angular to sub-rounded

4.50

4.5 - 19.7 m not logged

19.70

PIEZOMETER DETAILS

NOTES

Installation ID L97-AP95-14-L

Borehole ID L9795022

cement - bentonite grout

two lead cables

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 6** HOLE NO: **L9795022**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: **27 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.22**

CO-ORDINATES (m): **N 6,318,680 E 475,510**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows / .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					SHALE (Clearwater Fm.)		
					21.80		
					OIL SAND (McMurray Fm.)		
25.0							
30.0							
					32.50	∇	tip A water level 32.23 m
					Interburden		
35.0						∇	tip B water level 35.00 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 6** HOLE NO: **L9795022**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **27 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.22**

CO-ORDINATES (m): **N 6,318,680 E 475,510**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0							
					54.60 OIL SAND (McMurray Fm.)		
55.0							

Continued

19/06/95

KLOHN-CRIPPEN

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 6** HOLE NO: **L9795022**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **27 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **337.22**

CO-ORDINATES (m): **N 6,318,680 E 475,510**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					60.50 Interburden		
65.0							
					66.20 OIL SAND (McMurray Fm.)		
70.0							
75.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

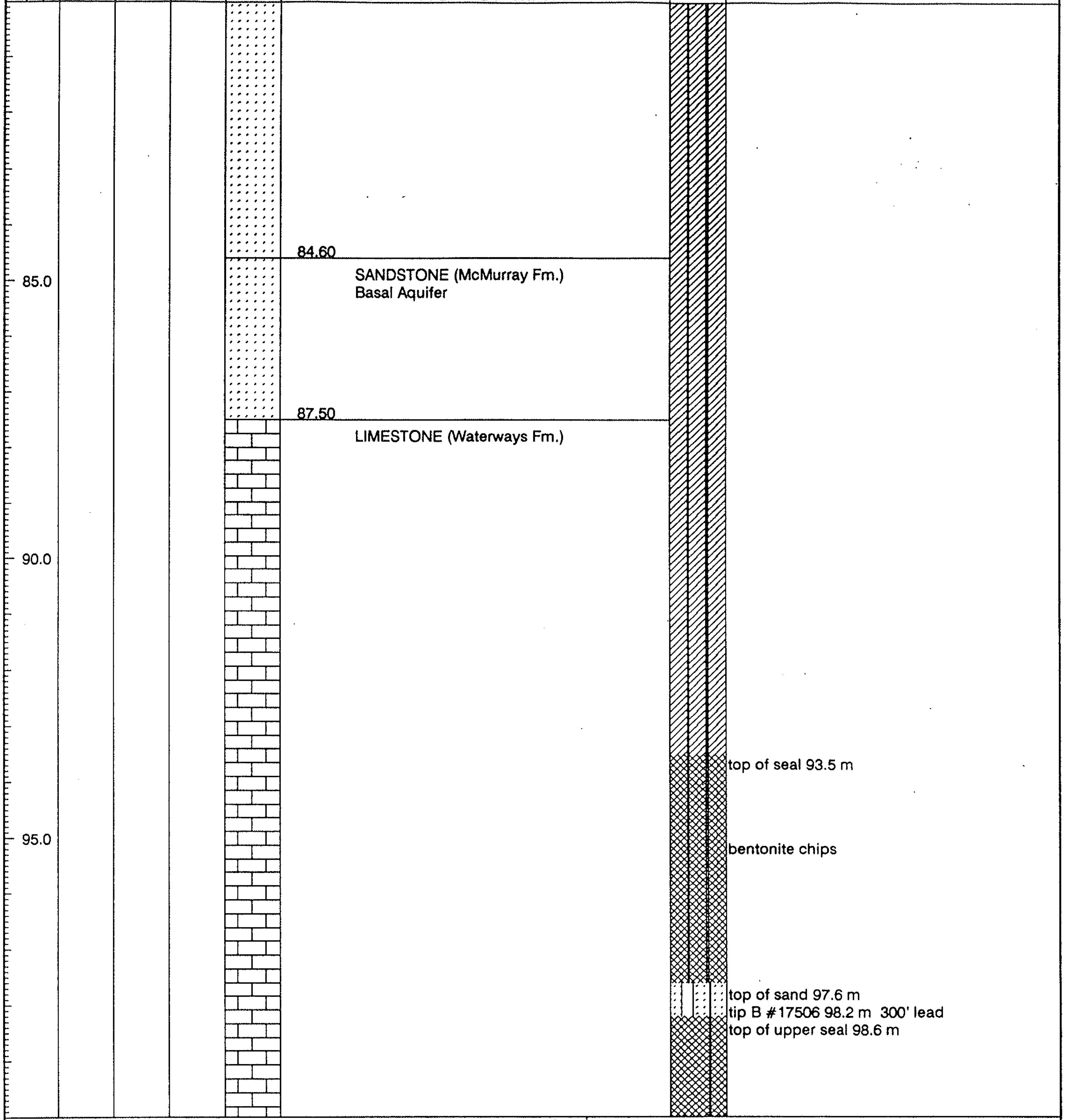
PLATE: 4 of 6 HOLE NO: L9795022

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m
DATE DRILLED: **27 JAN 95 -**
DRILL TYPE: **Mud Rotary**
ELEV. GROUND (m): **337.22**
CO-ORDINATES (m): **N 6,318,680 E 475,510**

SAMPLE DATA
HAMMER WEIGHT kg
DROP HEIGHT m

Depth (m)	Type	Blows / .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



84.60
SANDSTONE (McMurray Fm.)
Basal Aquifer

87.50
LIMESTONE (Waterways Fm.)

top of seal 93.5 m

bentonite chips

top of sand 97.6 m
tip B #17506 98.2 m 300' lead
top of upper seal 98.6 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**
PROJECT: **Steepbank Hydrogeology**
LOCATION: **Suncor, Alberta**
LOGGED BY: **Suncor** CHECKED BY:
PLATE: **5 of 6** HOLE NO: **L9795022**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 27 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 337.22

CO-ORDINATES (m): N 6,318,680 E 475,510

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
							bentonite chips
105.0							top of sand 104.6 m tip A #16950 105.0 m 350' lead top of bottom seal 105.0 m
					105.70 END OF TEST HOLE		total depth 105.7 m

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 6 of 6 HOLE NO: L9795022

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **343.23**

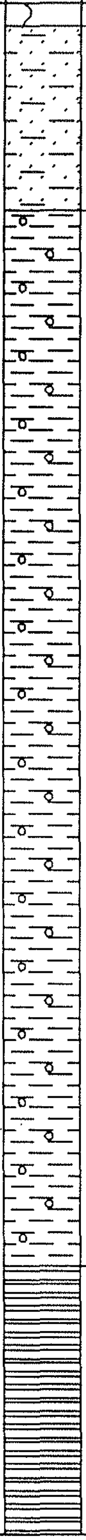
CO-ORDINATES (m): **N 6,318,300 E 476,040**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					0.30 ORGANICS		Installation ID L97-AP95-15-L
					SAND -clayey, gravelly		Borehole ID L9795024
					2.70		
					CLAY TILL -some gravel -grey		
5.0							
10.0							cement - bentonite grout
15.0							one lead cable
					16.50		
					SHALE (Clearwater Fm.)		



Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 5** HOLE NO: **L9795024**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **343.23**

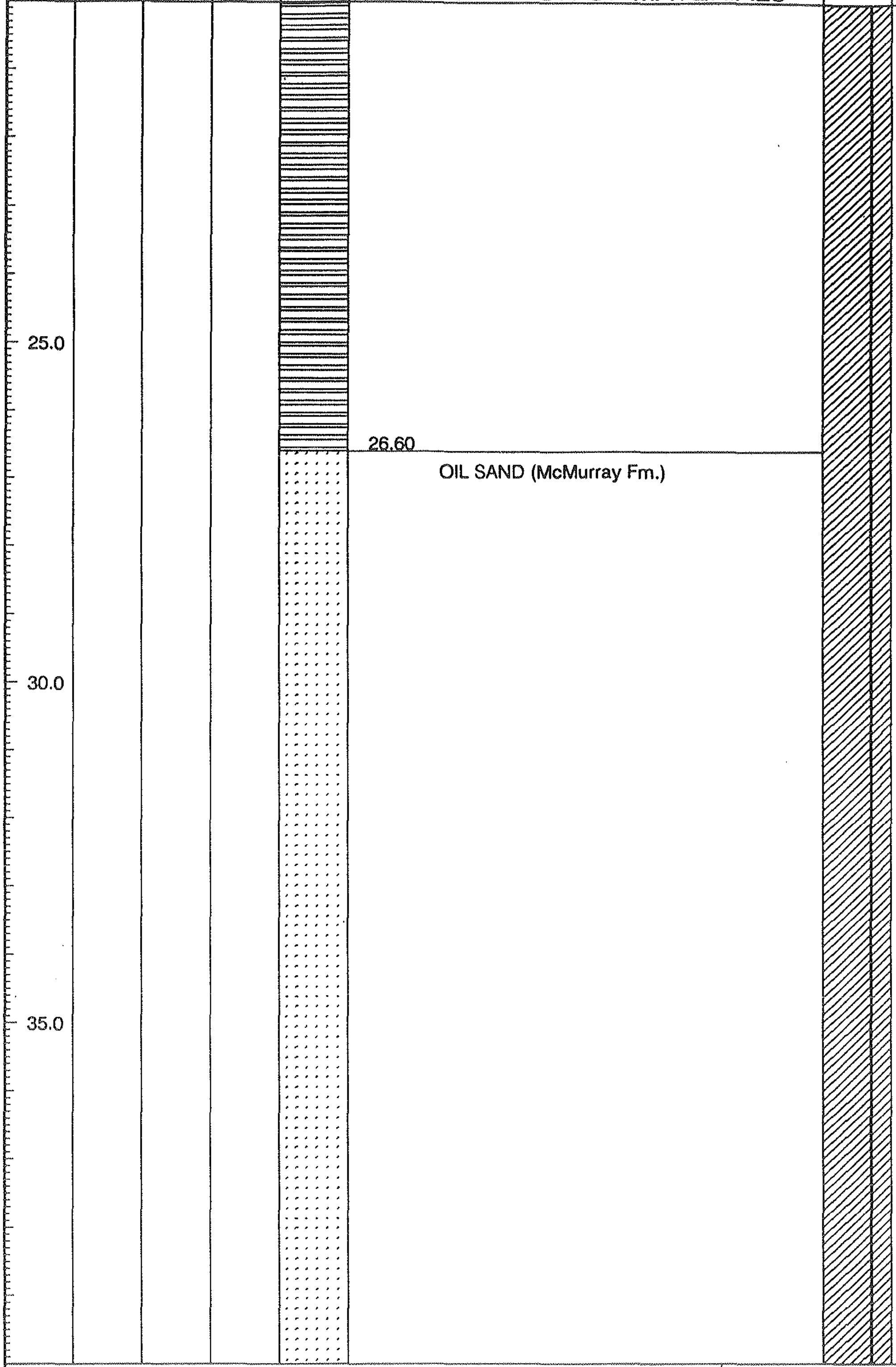
CO-ORDINATES (m): **N 6,318,300 E 476,040**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



26.60

OIL SAND (McMurray Fm.)

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **2 of 5** HOLE NO: **L9795024**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **343.23**

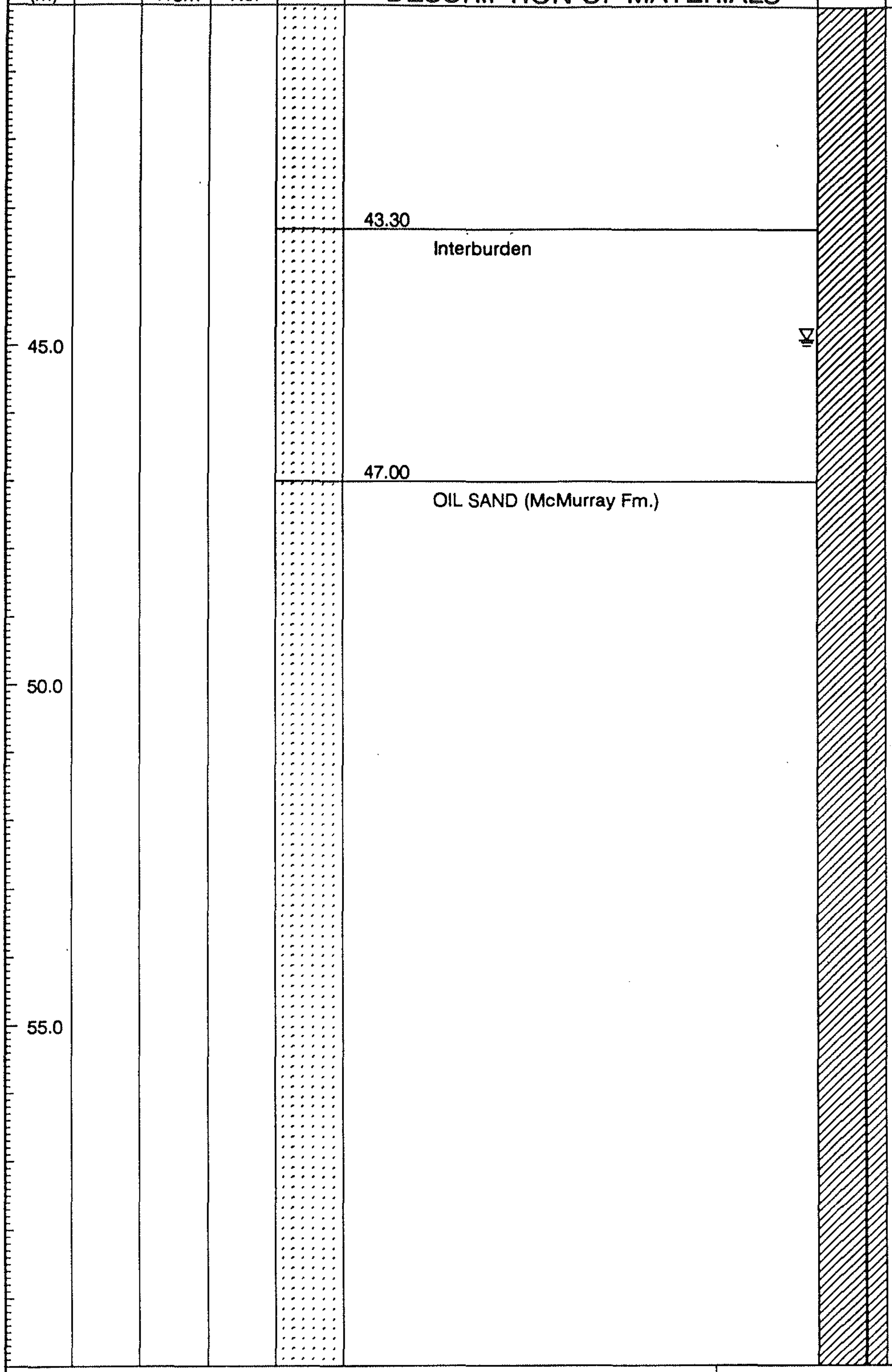
CO-ORDINATES (m): **N 6,318,300 E 476,040**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



43.30
Interburden

47.00
OIL SAND (McMurray Fm.)

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **3 of 5** HOLE NO: **L9795024**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **343.23**

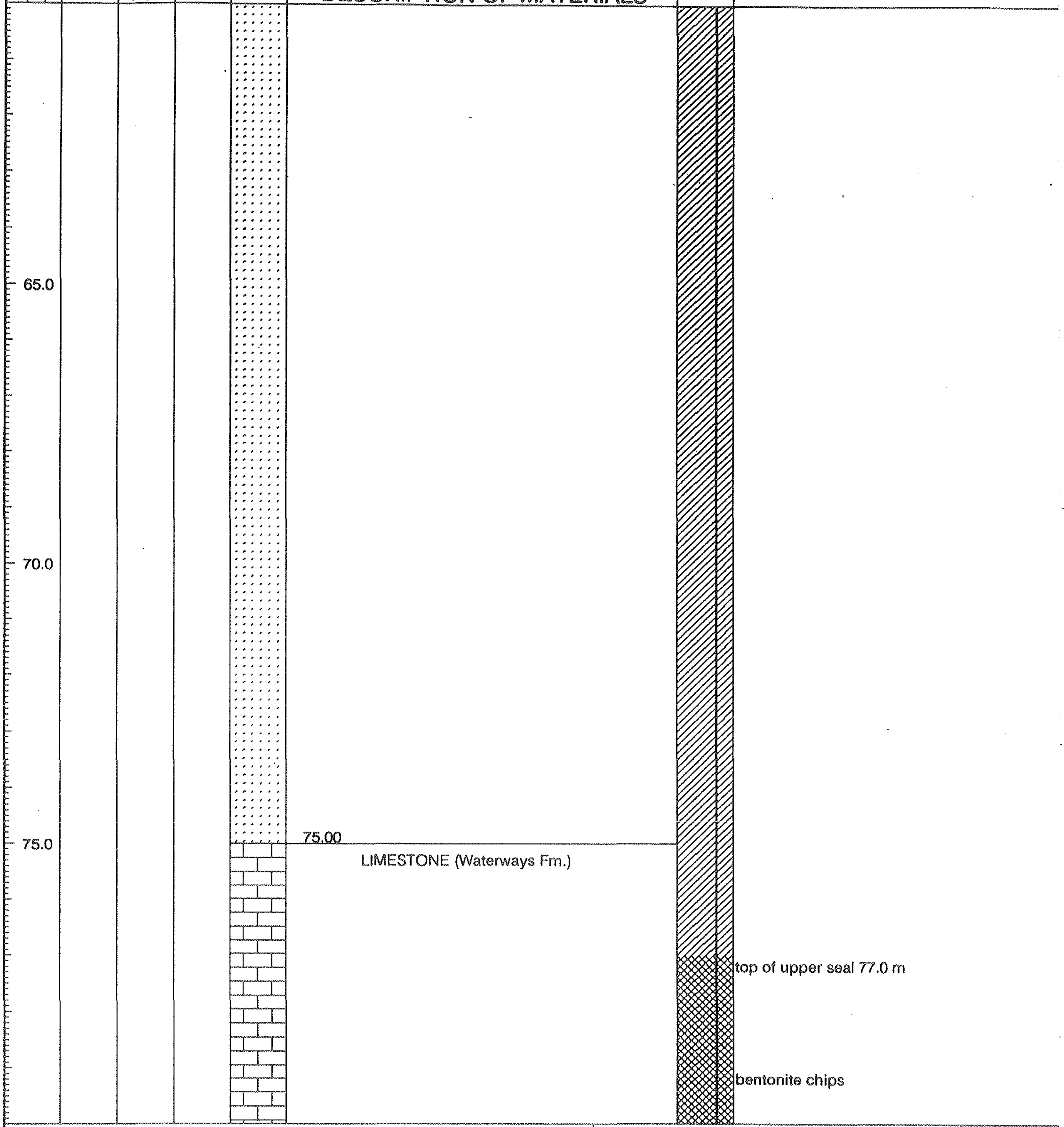
CO-ORDINATES (m): **N 6,318,300 E 476,040**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



LIMESTONE (Waterways Fm.)

top of upper seal 77.0 m

bentonite chips

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **4 of 5** HOLE NO: **L9795024**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **28 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **343.23**

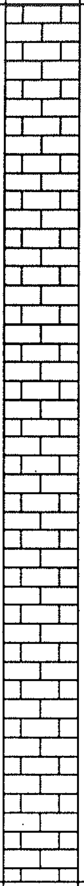
CO-ORDINATES (m): **N 6,318,300 E 476,040**

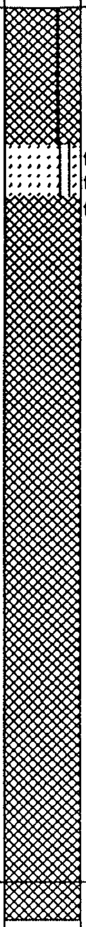
SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
							top of sand 81.8 m tip A #18894 82.5 m top of bottom seal 82.5 m
85.0							
90.0							
					91.50 END OF TEST HOLE		total depth 92.0 m





KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **5 of 5** HOLE NO: **L9795024**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **25 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **369.21**

CO-ORDINATES (m): **N 6,309,200 E 481,200**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
							Installation ID L19-AP95-16-Km
							Borehole ID L1995003
5.0							
10.0							cement - bentonite grout
15.0							one lead cable

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **1 of 8** HOLE NO: **L1995003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**
DATE DRILLED: **25 JAN 95 -**
DRILL TYPE: **Mud Rotary**
ELEV. GROUND (m): **369.21**
CO-ORDINATES (m): **N 6,309,200 E 481,200**

SAMPLE DATA
HAMMER WEIGHT kg
DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
25.0						▨	
					25.50	▨	
				☰	SHALE (Clearwater Fm.)	▨	
30.0				☰		▨	
35.0				☰		▨	

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**
PROJECT: **Steepbank Hydrogeology**
LOCATION: **Suncor, Alberta**
LOGGED BY: **Suncor** CHECKED BY:
PLATE: **2 of 8** HOLE NO: **L1995003**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m
DATE DRILLED: 25 JAN 95 -
DRILL TYPE: Mud Rotary
ELEV. GROUND (m): 369.21
CO-ORDINATES (m): N 6,309,200 E 481,200

SAMPLE DATA
HAMMER WEIGHT kg
DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
45.0							
50.0							
					50.90 OIL SAND (McMurray Fm.)		
55.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01
PROJECT: Steepbank Hydrogeology
LOCATION: Suncor, Alberta
LOGGED BY: Suncor CHECKED BY:
PLATE: 3 of 8 HOLE NO: L1995003

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 25 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 369.21

CO-ORDINATES (m): N 6,309,200 E 481,200

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
65.0							
						∇	
70.0							
75.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 4 of 8 HOLE NO: L1995003

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **25 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **369.21**

CO-ORDINATES (m): **N 6,309,200 E 481,200**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
85.0							
90.0							
95.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **5 of 8** HOLE NO: **L1995003**

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **25 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **369.21**

CO-ORDINATES (m): **N 6,309,200 E 481,200**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
105.0							
110.0							
115.0							

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **6 of 8** HOLE NO: **L1995003**

TEST HOLE LOG

VERTICAL SCALE: 1cm = 1.0m

DATE DRILLED: 25 JAN 95 -

DRILL TYPE: Mud Rotary

ELEV. GROUND (m): 369.21

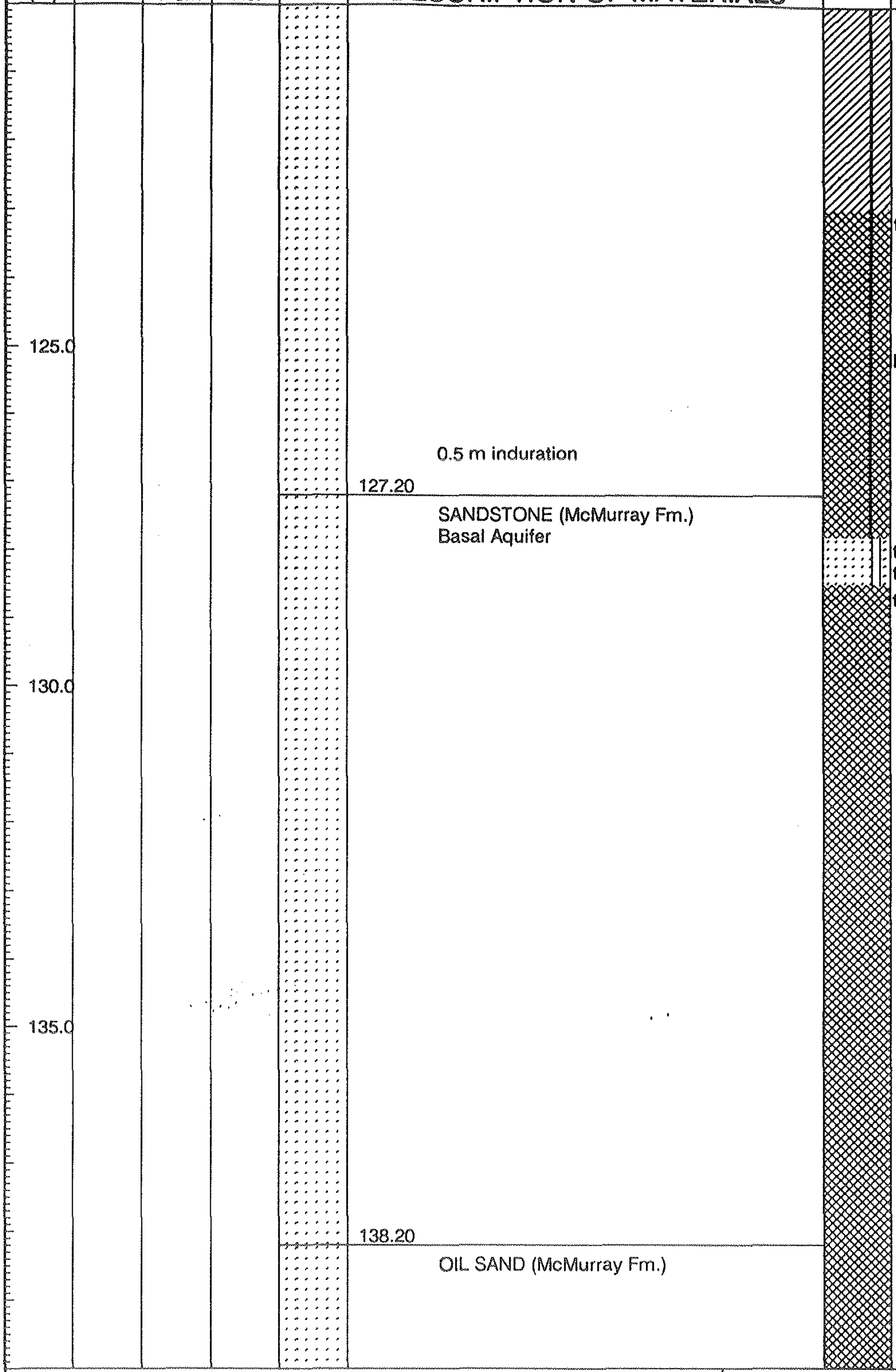
CO-ORDINATES (m): N 6,309,200 E 481,200

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES



0.5 m induration

127.20

SANDSTONE (McMurray Fm.)
Basal Aquifer

138.20

OIL SAND (McMurray Fm.)

top of upper seal 123.0 m

bentonite chips

top of sand 127.8 m
tip A #18888 128.5 m
top of bottom seal 128.5 m

Continued

KLOHN-CRIPPEN

19/06/95

JOB NO: PA 2779.02.01

PROJECT: Steepbank Hydrogeology

LOCATION: Suncor, Alberta

LOGGED BY: Suncor CHECKED BY:

PLATE: 7 of 8 HOLE NO: L1995003

TEST HOLE LOG

VERTICAL SCALE: **1cm = 1.0m**

DATE DRILLED: **25 JAN 95 -**

DRILL TYPE: **Mud Rotary**

ELEV. GROUND (m): **369.21**

CO-ORDINATES (m): **N 6,309,200 E 481,200**

SAMPLE DATA

HAMMER WEIGHT kg

DROP HEIGHT m

Depth (m)	Type	Blows / .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS	NOTES
					142.80		
					LIMESTONE (Waterways Fm.)		
145.0							
					147.50		
					END OF TEST HOLE		total depth 147.5 m

KLOHN-CRIPPEN

19/06/95

JOB NO: **PA 2779.02.01**

PROJECT: **Steepbank Hydrogeology**

LOCATION: **Suncor, Alberta**

LOGGED BY: **Suncor** CHECKED BY:

PLATE: **8 of 8** HOLE NO: **L1995003**

SHEET 1 OF 4

KLOHN-CRIPPEN GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG2

CLIENT: Suncor Inc. Oil Sands Group
JOB NO.: PA2780
PROJECT: Athabasca Bridge
DATE HOLE STARTED: 14/02/95 FINISHED: 14/02/95
LOCATION: east side, north
DATUM:
DIRECTION AZIMUTH: —— DIP (from horiz): 90
ELEV. COLLAR: 242.26 m
CO-ORDINATES: E 472,505.00 m N 6,317,955.00 m
ELEV. TOP OF ROCK: 238.3 m
TOTAL DEPTH OF HOLE: 39.65 m
ELEV. BOTTOM OF HOLE: 202.61 m
MANUFACTURER'S DRILL DESIGNATION: Failing 1500
DRILLING METHOD SOIL: wet rotary ROCK: wet rotary
DRILLING CONTRACTOR: Elgin Exploration Ltd.
FLUID: water CASED TO:
LOGGED BY: JGM DATE: March 1995
ANGLE OF DISCON.: FROM CORE AXIS ☐ TRUE DIP ☒

DEPTH (m)	LITHOLOGIC DESCRIPTION	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY %	R.Q.D. %
4	3.96 LIMESTONE (DEVONIAN BEDROCK) -very weak, some clay, highly disturbed, poor recovery			w=7%			
5	4.40-6.10 m- lost core					19	0
6	6.10-6.27 m- gravel sizes, some clay 6.27-6.52 m- weak, grey 6.52-7.13 m- trace clay, weathered			w=5%	19P		
7	7.13-8.05 m- clayey, extremely weak, weathered, medium plasticity, gravel sized harder pieces, core relatively unfractured, moderately close spaced discontinuities		J	w=3%		64	32
8	Gradation analysis result: 7.95-8.05 m: 63% gravel, 17% sand, 13% silt, 7% clay 8.05-9.15 m- lost core			w=6% w=10%			
9	-extremely weak layers with stronger limestone layers interbedded, slightly weathered, slight bitumen staining, harder layers are 5 to 40 mm thick, clayey layers are thinner, fissured			w=6%			
10				w=6%		70	15
11	11.30-12.20 m- lost core			w=9%			

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▒ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDINC

05/05/9

SHEET 2 OF 4

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG2

DEPTH (m)	LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
	continued see previous page							
12.20	12.20-12.28 m- medium strong, white 12.28-12.36 m- extremely weak clay layer 12.36-12.75 m- medium strong, slightly weathered, white			J	w = 5%	37P		
	12.75-15.25 m- lost core						18	7
	-strong, slightly weathered, whitesh, close spaced discontinuities			J		87P		
15.62	-weak, very close spaced discontinuities, grey, trace clay			⁙	w = 5%			
	15.91-16.73 m- extremely weak, gravel sized harder pieces in medium plasticity clay, wet, nonhomogeneous Gradation analysis result: 16.24-16.35 m: 59% gravel, 9% sand, 19% silt, 13% clay				w = 15% LL = 35% PL = 17%		49	20
	16.73-18.30 m- lost core							
	-very weak to weak, fresh, grey gravel sizes to 150 mm intermixed with 20% clay, extremely weak, medium plasticity, wet, olive grey, very close spaced irregular fractures				w = 12% F = 250kPa			
				J	w = 10% LL = 39% PL = 19%			
					w = 4%		56	31
	20.00-21.35 m- lost core							
	-extremely weak, 70% gravel sized harder pieces, 30% clay, stiff, medium plasticity, saturated, interbedded				w = 11%			

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

⁙ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG2

DEPTH (m)	LITHOLOGIC DESCRIPTION	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST U_c (MPa)	CORE RECOVERY %	R.Q.D. %
22	continued see previous page					
	-very close spaced discontinuities	J	w = 16%			
	22.78-22.90 m- clay is brownish grey					
23					64	4
			w = 13% LL = 28% PL = 14%			
	23.31-24.40 m- lost core					
24						
	24.40-24.46 m- vertical half of core is grey, medium plasticity, clay					
	24.46 -medium strong, very light brown					
	24.87					
25			w = 5%	34P	31	8
	24.87-25.90 m- lost core					
26	-some clay with harder limestone pieces, extremely weak					
	26.40-26.54 m- gradation analysis result: 56% gravel, 26% sand, 10% silt, 8% clay	J				
	26.65		w = 12%			
	-strong, very light brown, moderately close spaced discontinuities				67	30
27	26.94			73P		
	26.94-27.45 m- lost core					
	-weak to medium strong, very light grey, close spaced discontinuities, fractured	J				
	27.82-27.87 m- extremely weak, trace clay mixed in	J				
28	27.82-28.23 m- close spaced discontinuities		w = 6%	10P	86	26
	28.23-28.78 m- very close spaced discontinuities					
	28.78-29.00 m- lost core		w = 4%			
29	-trace clay, weak					
	29.24 -medium strong, very light grey, very close to close spaced discontinuities		w = 4%	44P		
	29.69 -trace clay, some bitumen staining					
30	30.07-30.12- weak, some bitumen staining, vertical joint has clay infilling		w = 2%			
					37	11
31	30.25-32.05 m- lost core					

INSTRUMENT DETAILS

HYDRAULIC CONDUCTIVITY CM/SEC: 10-6 10-4 10-2

RECOVERY DATA: 25 50 75

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG2

continued see previous page

DEPTH (m)		LITHOLOGIC DESCRIPTION	OTHER TESTS	PT. LOAD TEST U_c (MPa)	CORE RECOVERY %	R.Q.D. %
32		- weak, slight bitumen staining				
		32.50-32.75 m clayey	w = 9%		47	0
33		32.75-33.55 m- lost core				
		-trace clay	w = 4%			
34	34.18	-white to olive grey				
		CLAY- trace harder limestone pieces (10%), medium plasticity saturated clay, some interbedding	w = 13%			
	34.81	LIMESTONE 34.81-35.16 m- gravel sizes with slight bitumen staining 35.16-35.44 m- weak				
35			w = 2%	19P	62	30
36		35.44-36.60 m- lost core				
		-weak, light grey 36.67-36.95 m- trace clay, some bitumen staining				
37		36.95-37.03 m- very weak 37.00 m- vertical fracture, slightly weathered, some slickensides 37.03-37.46 m- trace clay infilling, slight bitumen staining	w = 4%			
	37.90	37.46-37.90 m- very weak, 3 fissured, light grey clay layers, 10 mm thick	w = 5%			
38		37.78-38.53 m- close spaced discontinuities	w = 3%		63	26
	38.53	37.90-medium strong, white to light grey		56P		
39		38.53-39.65 m- lost core				
	39.65	End of Hole at 39.65 m Install pneumatic piezometer Response zone 32.50-33.20 m				

INSTRUMENT DETAILS

HYDRAULIC CONDUCTIVITY CM/SEC: 10-6 10-4 10-2

DISCONTINUITY DATA: SEE BOTTOM OF FORM FOR CODES; DIP ANGLE 30 60

RECOVERY DATA: 25 50 75

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

⬚ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

TEST HOLE LOG

VERTICAL SCALE: 1cm = 0.5m

DATE DRILLED: 14 FEB 95 - 15 FEB 95

DRILL TYPE: Failing 1500

ELEV. GROUND (m): 254.86

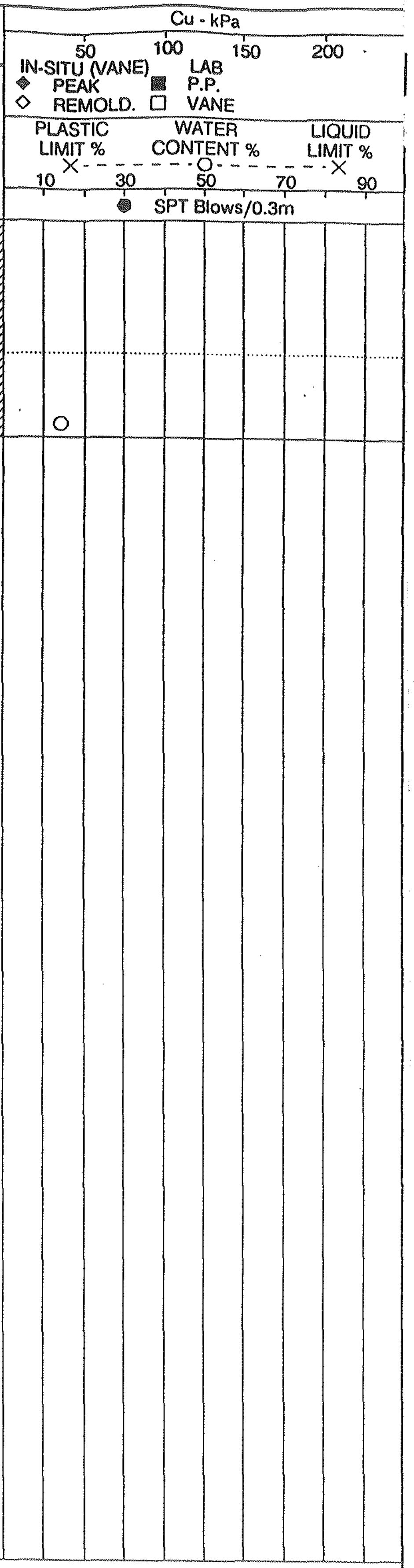
CO-ORDINATES (m): N 6,317,730 E 472,580

SAMPLE DATA

HAMMER WEIGHT 63.5 kg

DROP HEIGHT .76 m

Depth (m)	Type	Blows/.15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS
					TOPSOIL-10 mm thick SAND (ALLUVIUM) (SM) -silty, compact, damp, brown Area cleared by dozer, top 0.2 m exposed by hand Overburden sampled at 1.5 m intervals, soil description between samples is approximate. -saturated(?), a few limestone chips in S1	
1.0						
	SPT	50/100			1.62	



KLOHN-CRIPPEN

08/05/95

JOB NO: PA2780

PROJECT: Athabasca Bridge

LOCATION: east side, centerline

LOGGED BY: JGM CHECKED BY:

PLATE: 1 of 1 HOLE NO: FL1BRDG3

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG3

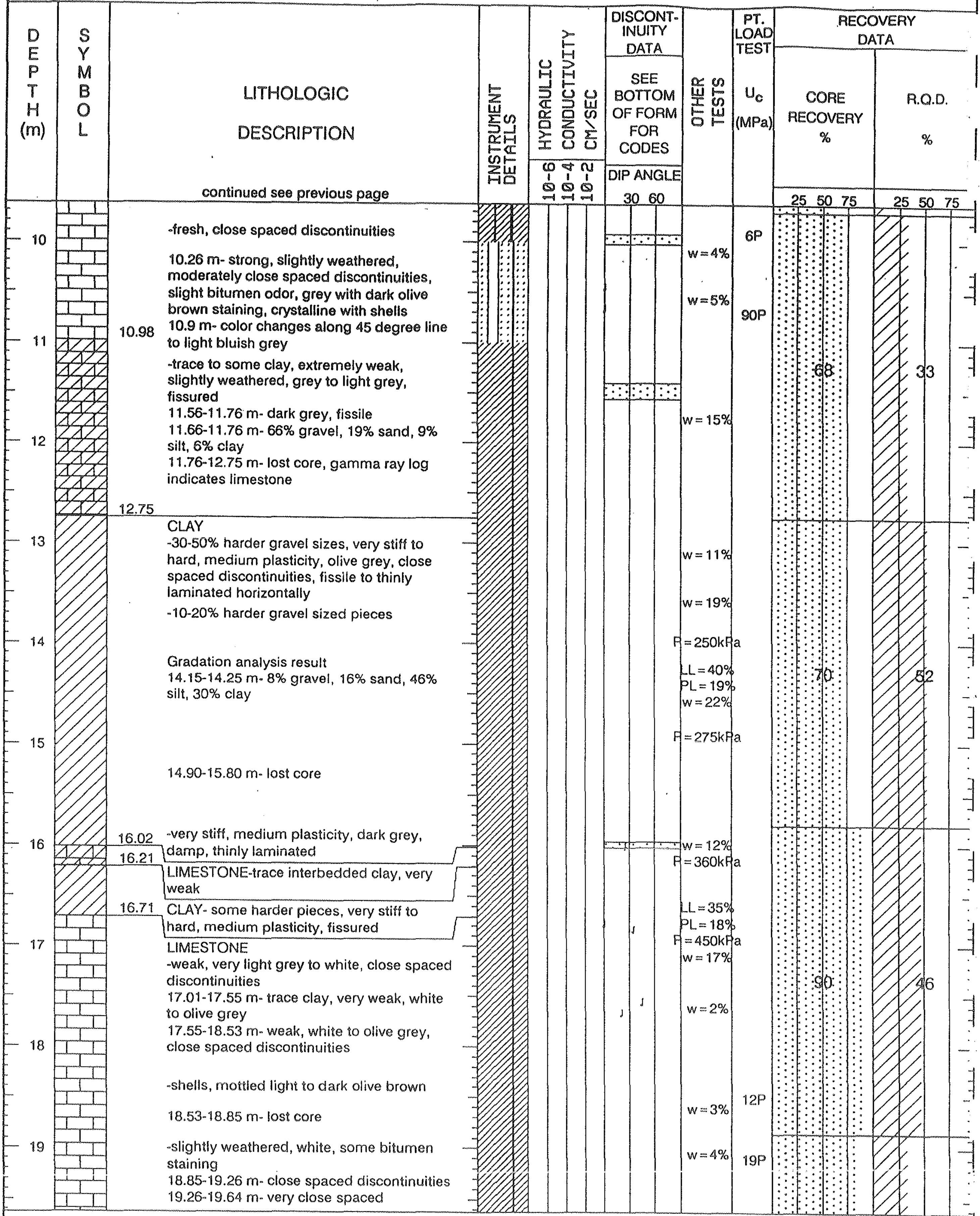
CLIENT: Suncor Inc. Oil Sands Group
JOB NO.: PA2780
PROJECT: Athabasca Bridge
DATE HOLE STARTED: 14/02/95 FINISHED: 15/02/95
LOCATION: east side, centerline
DATUM:
DIRECTION AZIMUTH: ----- DIP (from horiz): 90
ELEV. COLLAR: 254.86 m
CO-ORDINATES: E 472,580.00 m N 6,317,730.00 m
ELEV. TOP OF ROCK: 253.24 m
TOTAL DEPTH OF HOLE: 37.15 m
ELEV. BOTTOM OF HOLE: 217.71 m
MANUFACTURER'S DRILL DESIGNATION: Failing 1500
DRILLING METHOD SOIL: wet rotary ROCK: wet rotary
DRILLING CONTRACTOR: Elgin Exploration Ltd.
FLUID: water CASED TO:
LOGGED BY: JGM DATE: March 1995
ANGLE OF DISCON.: FROM CORE AXIS ☐ TRUE DIP ☒

DEPTH (m)	LITHOLOGIC DESCRIPTION	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY %	R.Q.D. %
1.62	LIMESTONE (DEVONIAN BEDROCK) Core from 2.1 m					
2						
	2.10-3.60 m- lost core					
3					0	0
4	-clayey, extremely weak, light grey to grey, clayey portion is interbedded with harder gravel sizes, clay is medium plasticity, olive grey, fresh		w = 5%			
5					18	12
	4.15-6.65 m- lost core					
6						
	-some bitumen staining along fractures					
7	6.95 m- interbedded limestone and clay, extremely weak to very weak, grey, fractured, very close to close spaced discontinuities, breaks easily along fractures	░	w = 5%			
	7.86-8.00 m- some rust staining		w = 5%			
8.00	-weak, slightly weathered, grey, wet fracture surfaces, some fractures are rust stained		w = 3%	15P	59	15
9	8.45-9.70 m- lost core					

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK
░ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG3



continued see previous page

DEPTH (m)		LITHOLOGIC DESCRIPTION	DISCONTINUITY DATA	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY %	R.Q.D. %
10		-fresh, close spaced discontinuities			6P		
		10.26 m- strong, slightly weathered, moderately close spaced discontinuities, slight bitumen odor, grey with dark olive brown staining, crystalline with shells		w=4% w=5%	90P		
11	10.98	10.9 m- color changes along 45 degree line to light bluish grey					
		-trace to some clay, extremely weak, slightly weathered, grey to light grey, fissured				68	33
		11.56-11.76 m- dark grey, fissile		w=15%			
12		11.66-11.76 m- 66% gravel, 19% sand, 9% silt, 6% clay					
		11.76-12.75 m- lost core, gamma ray log indicates limestone					
	12.75	CLAY					
13		-30-50% harder gravel sizes, very stiff to hard, medium plasticity, olive grey, close spaced discontinuities, fissile to thinly laminated horizontally		w=11%			
		-10-20% harder gravel sized pieces		w=19%			
14				P=250kPa			
		Gradation analysis result 14.15-14.25 m- 8% gravel, 16% sand, 46% silt, 30% clay		LL=40% PL=19% w=22%		70	52
15				P=275kPa			
		14.90-15.80 m- lost core					
16	16.02	-very stiff, medium plasticity, dark grey, damp, thinly laminated		w=12%			
	16.21	LIMESTONE-trace interbedded clay, very weak		P=360kPa			
	16.71	CLAY- some harder pieces, very stiff to hard, medium plasticity, fissured	J	LL=35% PL=18% P=450kPa			
17		LIMESTONE -weak, very light grey to white, close spaced discontinuities		w=17%		90	46
		17.01-17.55 m- trace clay, very weak, white to olive grey	J J	w=2%			
18		17.55-18.53 m- weak, white to olive grey, close spaced discontinuities					
		-shells, mottled light to dark olive brown			12P		
		18.53-18.85 m- lost core		w=3%			
19		-slightly weathered, white, some bitumen staining		w=4%	19P		
		18.85-19.26 m- close spaced discontinuities					
		19.26-19.64 m- very close spaced					

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▒ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

SHEET 3 OF 4

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG3

DEPTH (m)	SYMBOL		LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
			continued see previous page							
			discontinuities							
20			19.64-19.97 m- close spaced discontinuities 19.97-20.54 m- light olive brown, very close to close spaced discontinuities				w=4%			
			20.54 m- 10 mm thick clay layer, hard						86	33
			20.66 m- trace clay, very weak, olive brown, fissured, slickensided, close spaced discontinuities				w=3%			
21			21.17 m- medium strong, light olive brown, moderately close spaced discontinuities				w=4%			
			21.47-21.90 m- lost core					33P		
		22.03	21.90-22.03 m- very light bluish grey							
22			22.03-22.52 m- interbedded extremely weak clay and harder limestone, clay is medium plasticity, wet, fissile, harder pieces are <20 mm thick				w=6%			
			-weak, very light olive grey							
23			22.84-22.96 m- bitumen stained				w=2%			
			23.03- extremely weak, some clay 23.18 m- medium strong 23.33 m- weak, slighly weathered, fissured, some bitumen staining			J			68	23
			-close spaced discontinuities fissure surfaces are bitumen stained			J J	w=2%	13P		
24			23.97-24.95 m- lost core							
25			- very weak (<40 mm) layers interbedded with extremely weak, clayey layers (<20 mm) fractured			J	w=3%			
			24.95-25.10 m- bitumen stained							
26			25.96-26.15 m- medium strong, very light grey				w=.5%			
			-very weak to weak(-), limestone with clayey interbedded layers, close spaced discontinuities, clayey layers are olive grey, harder layers are olive grey to white			J	w=2%		82	36
27								6P		
			27.45-28.00 m- lost core				w=3%			
28			-weak, grey to very light grey			J				
		28.50	at 28.07 m- 15 mm clayey layer				w=2%			
			CLAY -extremely weak, fresh, fissile, interbedded with harder light grey layers, 60-75% clay							
29							w=10%			
		29.23	LIMESTONE -some clay, very weak, maximum harder				w=5%		82	42

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

░ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG3

DEPTH (m)		LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
		continued see previous page							
		piece is 60 mm, some bitumen staining							
30		-olive grey, close spaced discontinuities				w=3%	2P		
		30.49-31.05 m- lost core							
31		-interbedded weak limestone(85%) and extremely weak clayey layers, olive grey to light olive grey, slight bitumen staining, very close spaced discontinuities			J	w=4%			
32						w=3%	12P		
	32.20	32.20-32.46 m- more homogeneous very weak			J J				
		32.46-33.56 m- medium strong, light olive grey, close spaced discontinuities				w=3%		84	34
33									
	33.56	CLAY- extremely weak, olive grey, fissured			J	w=3%	32P		
34	34.12	33.62-34.10 m- lost core							
		LIMESTONE -clayey, very weak, fresh, olive grey, fissile to thinly laminated, occasional harder zones, close spaced discontinuities				w=5%	1P		
35		-increasingly interbedded, 50% weak, and 50% very weak				w=5%		100	85
36		36.00-36.14 m- medium strong with three 5 mm clay layers 36.14 m- clayey, very weak, olive grey, some interbedding with 60% very weak and 40% weak -close spaced discontinuities			J	w=7%			
37	37.10	-very weak, olive grey, fissile, homogeneous							
		End of Hole at 37.15 m Install two pneumatic piezometers Response zones: 10.00-11.00 m 35.70-37.00 m				w=5%			

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▒ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

TEST HOLE LOG

VERTICAL SCALE: **1cm = 0.5m**

DATE DRILLED: **13 FEB 95 - 14 FEB 95**

DRILL TYPE: **Failing 1500**

ELEV. GROUND (m): **246.97**

CO-ORDINATES (m): **N 6,317,415 E 472,990**

SAMPLE DATA

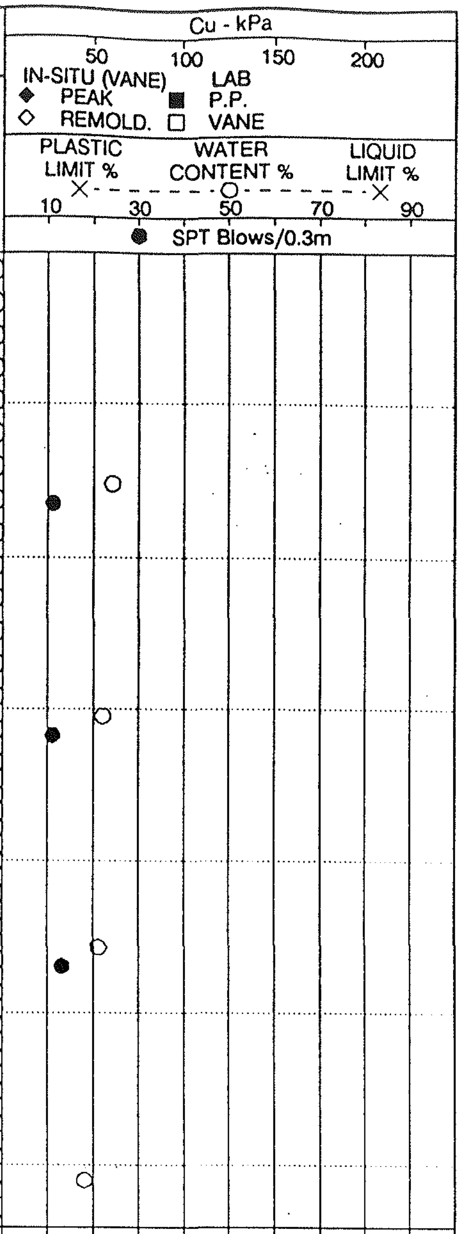
HAMMER WEIGHT **63.5 kg**

DROP HEIGHT **.76 m**

Depth (m)	Type	Blows .15m	Sample No.	DESCRIPTION OF MATERIALS
				TOPSOIL- 10 mm thick SAND (ALLUVIUM) (SM) -some silt, compact, damp, light brown Area cleared by dozer, top 0.2 m exposed by hand Overburden sampled at 1.5 m intervals, soil description between samples is approximate.
1.0				
	SPT	6 5 6	S1	
2.0				
3.0	SPT	4 5 6	S2	-grey, some near horizontal dark grey bands Gradation analysis result on Sample S2: 85% sand 15% silt and clay
4.0	SPT	2 4 9	S3	-6 mm clay layer
5.0				
6.0				6.10
	SPT	5 7 refusal	S4	-trace silt, two horizontal very dark grey bands
				6.40

SYMBOL

PIEZOMETER DETAILS



KLOHN-CRIPPEN

08/05/95

JOB NO: **PA2780**

PROJECT: **Athabasca Bridge**

LOCATION: **east side, south**

LOGGED BY: **JGM** CHECKED BY:

PLATE: **1 of 1** HOLE NO: **FL1BRDG4**

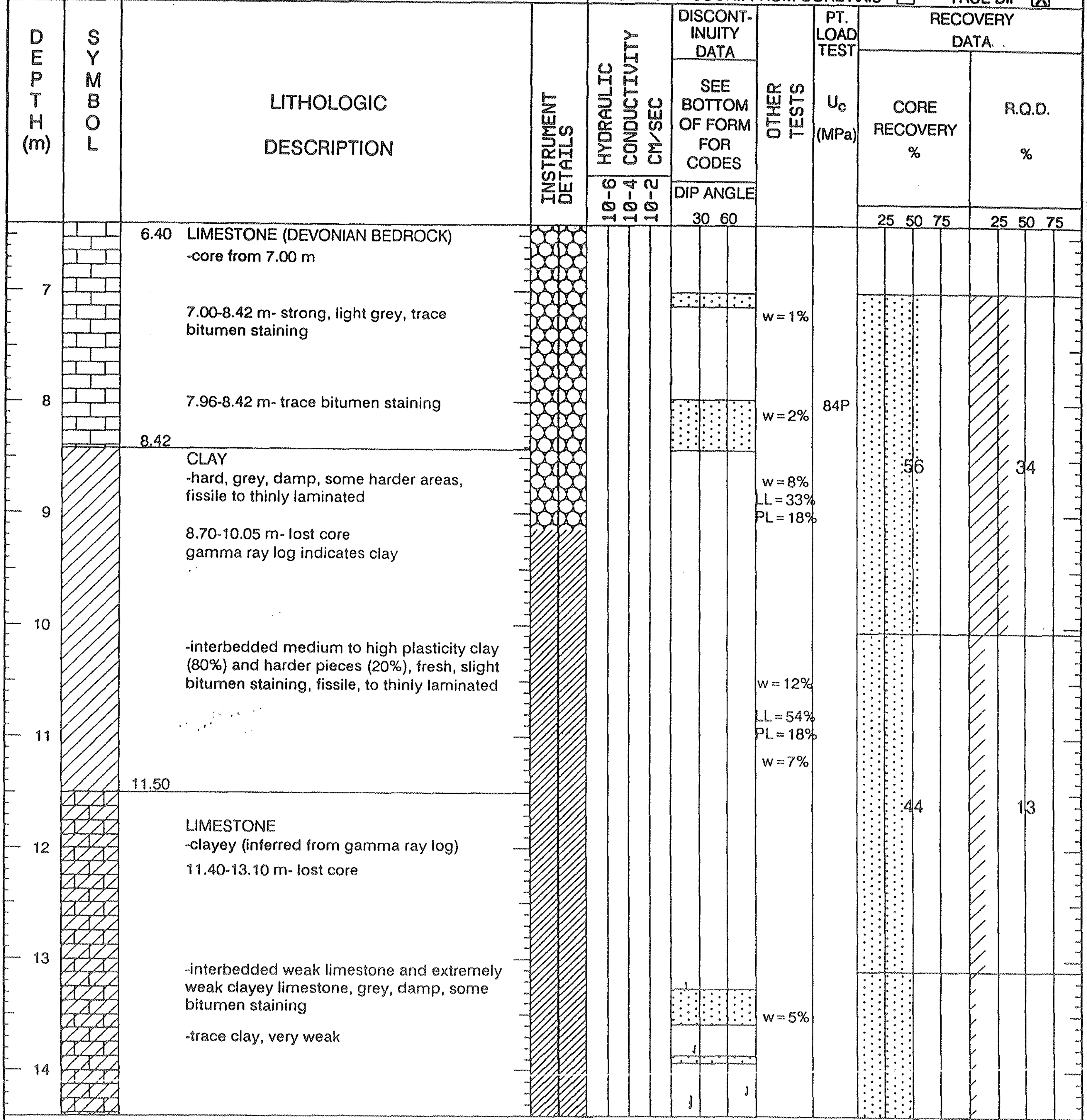
SHEET 1 OF 4

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG4

CLIENT: Suncor Inc. Oil Sands Group
PROJECT: Athabasca Bridge
LOCATION: east side, south
DIRECTION AZIMUTH: —— DIP (from horiz): 90
CO-ORDINATES: E 472,990.00 m N 6,317,415.00 m
TOTAL DEPTH OF HOLE: 37.50 m
MANUFACTURER'S DRILL DESIGNATION: Failing 1500
DRILLING CONTRACTOR: Elgin Exploration Ltd.
LOGGED BY: JGM DATE: March 1995

JOB NO.: PA2780
DATE HOLE STARTED: 13/02/95 FINISHED: 14/02/95
DATUM:
ELEV. COLLAR: 246.97 m
ELEV. TOP OF ROCK: 240.57 m
ELEV. BOTTOM OF HOLE: 209.47 m
DRILLING METHOD SOIL: wet rotary ROCK: wet rotary
FLUID: water CASED TO:
ANGLE OF DISCON.: FROM CORE AXIS ☐ TRUE DIP ☒



6.40 LIMESTONE (DEVONIAN BEDROCK)
-core from 7.00 m

7.00-8.42 m- strong, light grey, trace bitumen staining

7.96-8.42 m- trace bitumen staining

8.42 CLAY
-hard, grey, damp, some harder areas, fissile to thinly laminated

8.70-10.05 m- lost core
gamma ray log indicates clay

-interbedded medium to high plasticity clay (80%) and harder pieces (20%), fresh, slight bitumen staining, fissile, to thinly laminated

11.50 LIMESTONE
-clayey (inferred from gamma ray log)
11.40-13.10 m- lost core

-interbedded weak limestone and extremely weak clayey limestone, grey, damp, some bitumen staining

-trace clay, very weak

Other tests	Pt. load test Uc (MPa)
w = 1%	
w = 2%	84P
w = 8% LL = 33% PL = 18%	
w = 12% LL = 54% PL = 18% w = 7%	
w = 5%	

Core recovery %	R.Q.D. %
56	34
44	13

Discontinuity data: J J J

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK
▒ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG4

continued see previous page

DEPTH (m)	LITHOLOGIC DESCRIPTION	DISCONTINUITY DATA (DIP ANGLE 30 60)	OTHER TESTS	PT. LOAD TEST U_c (MPa)	CORE RECOVERY %	R.Q.D. %
	-some clay, extremely weak, grey, damp		w = 4%		49	5
15	14.60-16.15 m- lost core					
16	-trace clay, extremely weak, grey, slight bitumen staining		w = 4%			
17	-clayey 17.04-17.19 m- weak, trace clay 17.19-18.50 m- some clay to clayey, very weak to weak, harder pieces interbedded, maximum harder piece 60 mm, very slight bitumen staining		w = 7% w = 4%		77	13
18	-clayey, very weak		w = 5%	6P		
	18.50-19.20 m- lost core					
19	-weak, slightly weathered, light grey with extremely weak layers		w = 3%			
20.10	CLAY -extremely weak with a harder pieces, moist, medium plasticity, light olive, slickensided, slight bitumen staining 32% gravel, 18% sand, 29% silt, 21% clay		LL = 47% PL = 22% w = 20%		50	19
21	20.52-22.25 m- lost core					
21.50	LIMESTONE (inferred from gamma ray log)					
22.25	CLAY- extremely weak, high plasticity, light olive, moist, slickensided, isolated weak limestone piece	J	LL = 53% PL = 23% P = 175kPa			
22.70	LIMESTONE- weak, bitumen stained, weathered, trace oil sand filling					
22.90	CLAY- very stiff to hard, fresh, medium plasticity, light olive, slickensided, fissile to thinly laminated at 50 degrees 23.40-23.48 m- 40% gravel, 9% sand, 32% silt, 19% clay	J J	w = 24% P = 300kPa LL = 44% PL = 18% w = 15%		75	22
23.51	LIMESTONE- weak, white 23.8-24.53 m- interbedded white very weak	J				

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

⁚⁚⁚ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG4

DEPTH (m)	SYMBOL	LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST Uc (MPa)	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
		continued see previous page							
		to weak (70%) and extremely weak clay, slightly weathered, some bitumen staining (24.27-24.38 m- clayey, very weak, dark olive grey, fissile) 24.53-25.30 m- lost core				w=9%			
25									
		Interbedded extremely weak CLAY (70%), grey, medium plasticity, fissile and weak LIMESTONE (30%)- light grey, drill breaks at 20 to 80 mm, very slight bitumen staining, fresh				w=10%			
26						w=11%			
						w=13%			
27		Gradation analysis result: 27.10-27.26 m- 15% gravel, 10% sand, 40% silt, 35% clay						79	4
		-weak to medium strong, 5% interbedded clay, drill breaks at 50 mm			J	w=19% LL=36% PL=17%	28P		
28		27.72-28.35 m- lost core							
	28.90	Interbedded CLAY (60%), extremely weak, high plasticity, grey, damp; and LIMESTONE (40%)- very weak to weak, white				w=7%			
29	29.25	CLAY- stiff to very stiff, grey, fissile to thinly laminated, some very weak limestone pieces				w=2%			
		LIMESTONE- medium strong to strong (90%); extremely weak clay (10%), medium plasticity					70P		
30		30.02-30.12 m- very weak, slightly weathered, easily fractured 30.12-30.55 m- weak to medium strong, trace clay, interbedded			J J	w=3%		72	16
31	31.00	30.55-31.40 m- lost core							
		-medium to strong, white to very light brown and grey, very close spaced discontinuities				w=1%			
32					J				
							84P		
					J	w=2%			
33		32.92 m- close spaced discontinuities			J J			88	25
	33.23	-clayey, very weak, grey, with harder inclusions					79P		
	33.70	-strong, white, moderately close spaced discontinuities, no jointing			J				
34	33.99	34.09-34.45 m- lost core							

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

SHEET 4 OF 4

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: FL1BRDG4

continued see previous page

DEPTH (m)	LITHOLOGIC DESCRIPTION	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST U_c (MPa)	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
34.45	-strong, white 34.54-34.84 m- some clay, very weak 34.84-35.14 m- medium strong pieces 35.14-35.38 m- very weak, some clay interbedded		J				
35.38	-medium strong to strong, very close to close spaced discontinuities			w=4% w=2%	61P	57	3
36.16	-clayey, very weak, some harder pieces (30%) 36.20-37.50 m- lost core						
37.50	END OF HOLE AT 37.50 m Install pneumatic piezometer Response zone- 35.66-36.15 m Move 2.1 m north and install slotted standpipe in sand overburden Response zone- 1.50-5.20 m						

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

⁙ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

TEST HOLE LOG

VERTICAL SCALE: 1cm = 0.5m

DATE DRILLED: 16 FEB 95 - 17 FEB 95

DRILL TYPE: Failing 1500

ELEV. GROUND (m): 242.20

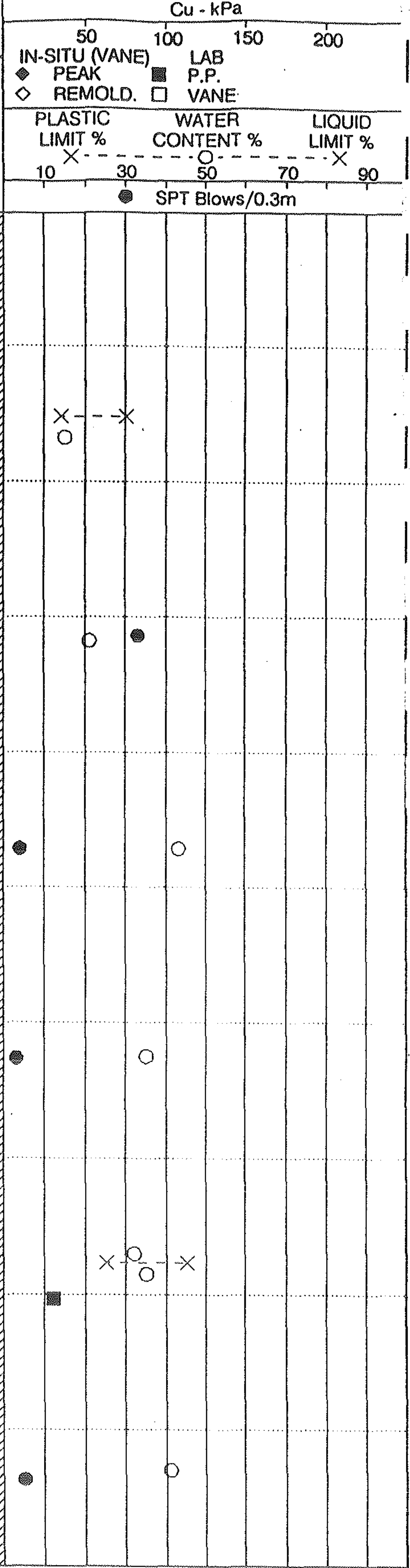
CO-ORDINATES (m): N 6,317,468 E 471,971

SAMPLE DATA

HAMMER WEIGHT 63.5 kg

DROP HEIGHT .76 m

Depth (m)	Type	Blows .15m	Sample No.	DESCRIPTION OF MATERIALS
				Top 1.5 m not sampled. Ground surface is snow packed parking area near existing pumphouse. Overburden sampled at 1.5 m intervals, soil description between samples is approximate.
1.0				
	SPT	43 50/130	S1	CLAY (FILL) (CL-CI) -silty, sandy, trace rounded gravel, low to medium plasticity, frozen, moist, dark olive brown
2.0				
3.0				
	SPT	21 24 9	S2	-stiff (unfrozen), light olive brown
3.30				ALLUVIUM (approximate boundary)
4.0				
4.57	SPT	2 2 2	S3	SAND (ALLUVIUM) (SM)- some silt, trace clay, loose, saturated, dark grey
4.80				CLAY (CL-CI) -silty, trace sand, low to medium plasticity, soft, saturated, grey, several near horizontal organic layers
5.0				
6.0				-sandy, olive brown from 6.10 to 6.17 m -grey from 6.17 m
6.25	SPT	1 1 2	S4	SAND (SM) -silty, trace clay, loose, saturated, grey
7.0				
7.62	SHELBY		T1	CLAY (CI) -silty, trace sand, medium plasticity, soft to firm, saturated, dark olive grey, fine sand partings -gradation analysis result on T1: 4% sand 63% silt 33% clay
8.0				
9.0				
	SPT	3 3 2	S5	



PIEZOMETER DETAILS

Continued

KLOHN-CRIPPEN

08/05/95

JOB NO: PA2780

PROJECT: Athabasca Bridge

LOCATION: west side

LOGGED BY: JGM CHECKED BY:

PLATE: 1 of 2 HOLE NO: L86BRDG1

TEST HOLE LOG

VERTICAL SCALE: **1cm = 0.5m**

DATE DRILLED: **16 FEB 95 - 17 FEB 95**

DRILL TYPE: **Failing 1500**

ELEV. GROUND (m): **242.20**

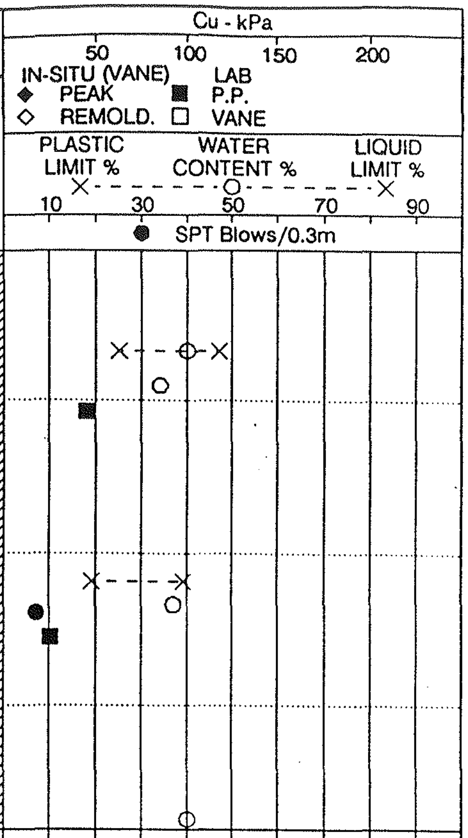
CO-ORDINATES (m): **N 6,317,468 E 471,971**

SAMPLE DATA

HAMMER WEIGHT **63.5 kg**

DROP HEIGHT **.76 m**

Depth (m)	Type	Blows .15m	Sample No.	SYMBOL	DESCRIPTION OF MATERIALS	PIEZOMETER DETAILS
11.0	SHELBY		T2		-sand layers -gradation analysis result on Sample T2: 2% sand 57% silt 41% clay	
12.0						
	SPT	2 3 4	S6			
13.0						
13.82	SPT	30/130	S7		-top of S7, 25 mm of grey silty sand -rest of S7, 75 mm of saturated, firm, dark, olive grey clay	



KLOHN-CRIPPEN

08/05/95

JOB NO: **PA2780**

PROJECT: **Athabasca Bridge**

LOCATION: **west side**

LOGGED BY: **JGM** CHECKED BY:

PLATE: **2 of 2** HOLE NO: **L86BRDG1**

SHEET 1 OF 4

KLOHN-CRIPPEN GEOLOGIC LOG OF DRILL HOLE NO.: L86BRDG1

CLIENT: Suncor Inc. Oil Sands Group
JOB NO.: PA2780
PROJECT: Athabasca Bridge
DATE HOLE STARTED: 16/02/95 FINISHED: 17/02/95
LOCATION: west side
DATUM:
DIRECTION AZIMUTH: ---- DIP (from horiz): 90
ELEV. COLLAR: 242.20 m
CO-ORDINATES: E 471,970.99 m N 6,317,468.32 m
ELEV. TOP OF ROCK: 228.38 m
TOTAL DEPTH OF HOLE: 49.05 m
ELEV. BOTTOM OF HOLE: 193.15 m
MANUFACTURER'S DRILL DESIGNATION: Failing 1500
DRILLING METHOD SOIL: wet rotary ROCK: wet rotary
DRILLING CONTRACTOR: Elgin Exploration Ltd.
FLUID: water CASED TO:
LOGGED BY: JGM DATE: March 1995
ANGLE OF DISCON.: FROM CORE AXIS ☐ TRUE DIP ☒

DEPTH (m)	LITHOLOGIC DESCRIPTION	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY %	R.Q.D. %
14	13.82 LIMESTONE (DEVONIAN BEDROCK) -medium strong to strong, fresh, cherty, light brownish grey 14.40 m- weak to very weak, crumbles along irregular fractures, slightly weathered, light brown, contains cherty nodules, shells				
			32P	100	0
15	15.20 m- medium strong, fresh to slightly weathered, light grey, brownish -light grey to olive, occasional shells	w = 2%	29P		
16	16.05-17.05 m- lost core	w = 1%		35	6
17	17.05 m- weak to medium strong, slightly weathered, dark grey to very light olive 17.24-17.39 m medium strong 17.81-17.84 m- clayey, extremely weak, dark grey				
18	17.95-18.40 m- medium strong 18.40-19.20 m lost core	w = 6%	21P	63	15
19	-weak to medium strong, fresh, light grey to dark grey, occasional shells 19.63-20.5 m- very close spaced discontinuities	w = 11%			
20			9X	54	0
21	20.50-21.60 m- lost core				
	21.60				

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK
▨ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN GEOLOGIC LOG OF DRILL HOLE NO.: L86BRDG1

DEPTH (m)	SYMBOL	LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONT-INUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST U_c (MPa)	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
		continued see previous page							
22		-weak to medium strong, fresh, light grey to dark grey -extremely weak clayey layers at 22.14 (10 mm), 22.35 (10 mm), 22.46 (10 mm), 22.56 (10 mm), 22.83 (15 mm) 22.71-22.82 m- extremely weak, fractures easily into small (<5 mm) pieces 22.86-23.05 m- extremely weak, easily fractured 23.05-24.65 m- lost core, gamma indicates clayey limestone			J	w = 23%		48	0
24.65		-weak to medium strong, light to dark grey, bitumen staining along joint faces, slightly weathered 25.12-25.18 m- extremely weak clayey, easliy fractured, dark grey, dry 25.34-25.52 m- white, extremely weak, slightly weathered 25.52-25.63 m- oil stained, gravel sizes 26.06-26.62 m- very weak 26.62-27.15 m- weak, very light grey, close spaced discontinuities 27.15-27.70 m lost core 27.70-28.25 m- very weak to weak, olive grey, slightly weathered, extremely close to very close spaced discontinuities, slight bitumen staining 28.25-28.75 m- weak to medium strong, white to grey, close spaced discontinuities			J J J J J J J J	w = 4%	6P 16P 17X	82	37
28.66		-clayey, extremely to very weak, medium plasticity, damp, grey, occasional hard concretion (< 15 mm), small slickenside, fissile, horizontally bedded 30.25-30.75 m lost core			J J	w = 12% LL = 37% PL = 19% w = 17% P = 130kPa	24P 1P 7X	84	53
31		-extremely weak, fresh, fissile, occassional hard layers (< 10 mm) 31.28-32.30 m- extremely weak to very weak				P = 210kPa w = 12% LL = 40%			

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

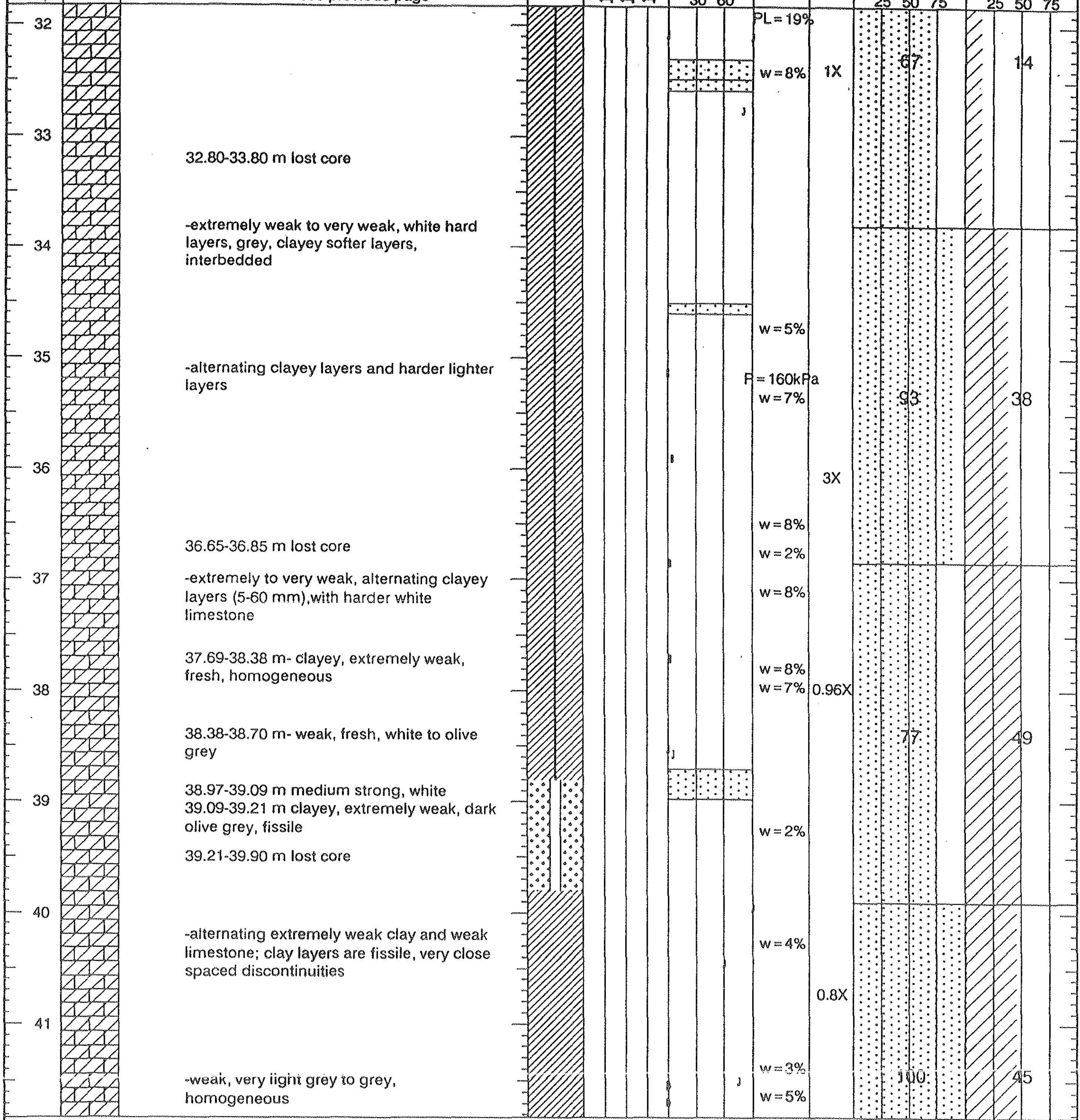
▨ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN **GEOLOGIC LOG OF DRILL HOLE NO.: L86BRDG1**

DEPTH (m)	SYMBOL	LITHOLOGIC DESCRIPTION	INSTRUMENT DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES DIP ANGLE 30 60	OTHER TESTS	PT. LOAD TEST U_c (MPa)	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75

continued see previous page



32.80-33.80 m lost core

-extremely weak to very weak, white hard layers, grey, clayey softer layers, interbedded

-alternating clayey layers and harder lighter layers

36.65-36.85 m lost core

-extremely to very weak, alternating clayey layers (5-60 mm),with harder white limestone

37.69-38.38 m- clayey, extremely weak, fresh, homogeneous

38.38-38.70 m- weak, fresh, white to olive grey

38.97-39.09 m medium strong, white
39.09-39.21 m clayey, extremely weak, dark olive grey, fissile

39.21-39.90 m lost core

-alternating extremely weak clay and weak limestone; clay layers are fissile, very close spaced discontinuities

-weak, very light grey to grey, homogeneous

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

KLOHN-CRIPPEN

GEOLOGIC LOG OF DRILL HOLE NO.: L86BRDG1

continued see previous page

DEPTH (m)	LITHOLOGIC DESCRIPTION	DISCONTINUITY DATA (DIP ANGLE 30 60)	OTHER TESTS	PT. LOAD TEST Uc (MPa)	CORE RECOVERY %	R.Q.D. %
42	41.50 m- slickensides	J				
			w=5%	13X		
43	-very light grey to dark grey, clayey, medium plasticity, fissile, fresh, moderately close spaced discontinuities		w=3%	9P 19X		
		J				
44	-slickensides	J				
	-grey, fresh, homogeneous, fissile, moderately close spaced discontinuities	J			100	100
		J	w=4%			
45		J				
	-slickensides					
			w=5%	7X		
46	-wide spaced discontinuities					
47	-clayey	░				
			w=5%	15X		
	-disturbed, close spaced discontinuities				100	57
48	-very weak		w=4%			
		J				
49	49.05	J J	w=5%	2P		
	End of Hole at 49.05 m Install pneumatic piezometer Response zone 38.8-39.8 m					

Columns not filled on this sheet: INSTRUMENT DETAILS; HYDRAULIC CONDUCTIVITY CM/SEC (10-6, 10-4, 10-2).

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

░ FRACTURED CORE UNCONF. COMP. STRENGTH - X: CROSS BEDDING P: PARALLEL BEDDING

05/05/95

TEST HOLE LOG

VERTICAL SCALE: 1cm = 0.5m

DATE DRILLED: 14 FEB 95 - 14 FEB 95

DRILL TYPE: Failing 1500

ELEV. GROUND (m): 242.26

CO-ORDINATES (m): N 6,317,955 E 472,505

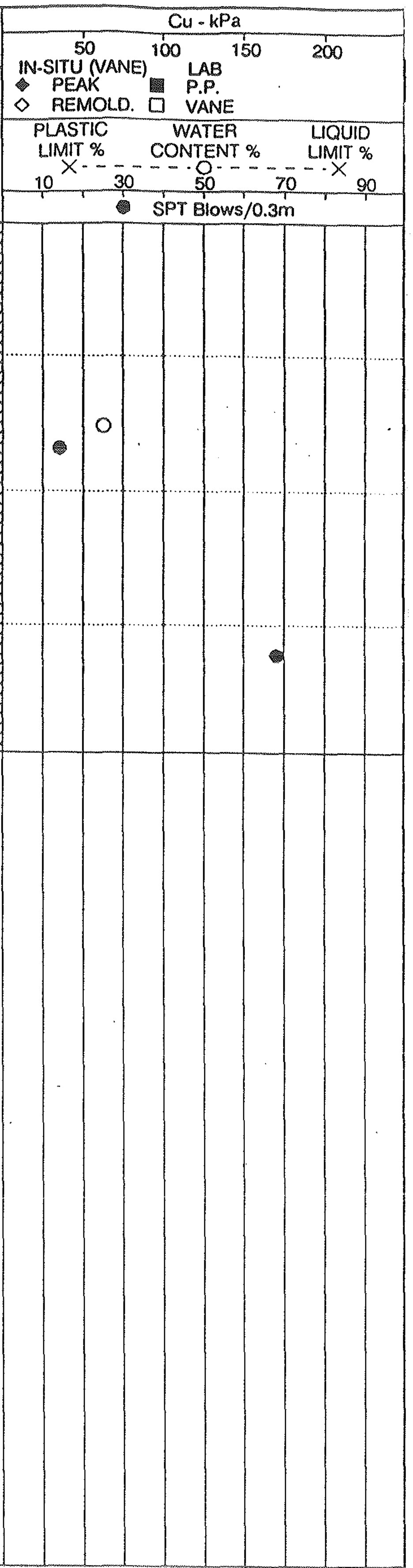
SAMPLE DATA

HAMMER WEIGHT 63.5 kg

DROP HEIGHT .76 m

Depth (m)	Type	Blows .15m	Sample No.	DESCRIPTION OF MATERIALS
				TOPSOIL-13 mm thick SAND (ALLUVIUM) (SM) -silty, compact, damp, brown Area cleared by dozer, top 0.2 m exposed by hand Overburden sampled at 1.5 m intervals, soil description between samples is approximate.
1.0				
				1.50
	SPT	4 7 7		(SP-SM) -trace silt, saturated(?), 10 mm dark brown oil sand lens at 1.72 m Gradation analysis result on sample S1: 90% sand 10% silt and clay
2.0				
3.0				3.05
	SPT	36 40 28		OIL SAND (CRETACEOUS BEDROCK)
				3.96

PIEZOMETER DETAILS



KLOHN-CRIPPEN

08/05/95

JOB NO: PA2780

PROJECT: Athabasca Bridge

LOCATION: east side, north

LOGGED BY: JGM CHECKED BY:

PLATE: 1 of 1 HOLE NO: FL1BRDG2

APPENDIX II

RESULTS OF LABORATORY ANALYSIS OF GROUNDWATER SAMPLES

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB1
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	78.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	22.0	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	10.4	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	1.93	0.05
Chloride - Dissolved	17206L	mg/L	1.2	0.5
Sulphate - (IC)	16309L	mg/L	23.8	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	305.	0.5
pH	10301L	Units	7.19	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	372.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	286.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.41	0.02
Fluoride	09105L	mg/L	0.20	0.05
Specific Conductance	02041L	umhos/Cm	580.	0.02
Total Dissolved Solids	00201L	mg/L	324.	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.136	0.003
Sulphur - (ICP) - Dissolved		mg/L	7.3	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0003	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.10	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	0.01	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.003	0.001
Iron - Dissolved (ICP)	26109L	mg/L	0.06	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.013	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.261	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB1
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.174	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.006	0.001
Ion Balance		Balance		0.94	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB1
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB1
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB2
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		R E S U L T S	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		25.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		7.40	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		186.	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		4.18	0.05
Chloride - Dissolved	17206L	mg/L		9.6	0.5
Sulphate - (IC)	16309L	mg/L		0.7	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		491.	0.5
pH	10301L	Units		7.56	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		599.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		93.0	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		9.00	0.02
Fluoride	09105L	mg/L		0.43	0.05
Specific Conductance	02041L	umhos/Cm		873.	0.02
Total Dissolved Solids	00201L	mg/L		532.	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.018	0.003
Sulphur - (ICP) - Dissolved		mg/L		0.5	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.14	0.01
Arsenic - Dissolved (AA)	33109L	mg/L		0.0005	0.0002
Barium - Dissolved (ICP)	56109L	mg/L		0.12	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L		0.44	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.04	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.046	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.101	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB2
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L		0.006	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.213	0.002
Titanium - Dissolved (ICP)	22111D	mg/L		0.006	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.011	0.001
Ion Balance		Balance		1.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB2
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB2
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB3
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	5.10	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	0.89	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	1.66	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	0.51	0.05
Chloride - Dissolved	17206L	mg/L	< 0.5	0.5
Sulphate - (IC)	16309L	mg/L	10.2	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	9.9	0.5
pH	10301L	Units	5.56	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	12.0	0.5
Total Hardness (as CaCO3)	10602L	mg/L	16.4	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.69	0.02
Fluoride	09105L	mg/L	0.08	0.05
Specific Conductance	02041L	umhos/Cm	43.0	0.02
Total Dissolved Solids	00201L	mg/L	24.5	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.028	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.2	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	0.04	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	< 0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.01	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	< 0.01	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	< 0.001	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.012	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB3
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.031	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L		0.003	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.009	0.001
Ion Balance		Balance		1.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB3
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB3
Sample Date & Time : March 17, 1995
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	SPIKES % RECOV	SPIKES CONT LOWER	SPIKES LIMIT UPPER	CHECK % RECOV	CHECK CONT LOWER	CHECK LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		R E S U L T S	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		4.35	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		1.29	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		2.30	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		1.12	0.05
Chloride - Dissolved	17206L	mg/L	<	0.5	0.5
Sulphate - (IC)	16309L	mg/L		9.7	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		14.7	0.5
pH	10301L	Units		5.62	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		17.9	0.5
Total Hardness (as CaCO3)	10602L	mg/L		16.2	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		6.47	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		48.0	0.02
Total Dissolved Solids	00201L	mg/L		28.0	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.061	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.0	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.06	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	<	0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	<	0.01	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.05	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.002	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.016	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.028	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.006	0.001
Ion Balance		Balance		0.90	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	1	0.1	101.8	91.7	109.1	99.7	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	1	1.0	100.4	92.1	107.1	96.7	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB5
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	64.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	17.8	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	159.	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	2.85	0.05
Chloride - Dissolved	17206L	mg/L	7.8	0.5
Sulphate - (IC)	16309L	mg/L	10.2	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	566.	0.5
pH	10301L	Units	7.13	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	690.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	233.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	8.08	0.02
Fluoride	09105L	mg/L	0.54	0.05
Specific Conductance	02041L	umhos/Cm	1010	0.02
Total Dissolved Solids	00201L	mg/L	607.	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.027	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.7	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0004	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.21	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	0.33	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	0.12	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.044	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.589	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : OB5
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L		0.007	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.302	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L		0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.006	0.001
Ion Balance		Balance		0.99	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB5
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : OB5
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	SPIKES			CHECK		
				% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-1-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-6
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	76.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	105.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	4880	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	31.6	0.05
Chloride - Dissolved	17206L	mg/L	6520	0.5
Sulphate - (IC)	16309L	mg/L	1.0	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2130	0.5
pH	10301L	Units	6.98	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2590	0.5
Total Hardness (as CaCO3)	10602L	mg/L	622.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.26	0.02
Fluoride	09105L	mg/L	0.78	0.05
Specific Conductance	02041L	umhos/Cm	21900	0.02
Total Dissolved Solids	00201L	mg/L	12900	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.029	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.7	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.71	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	3.90	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.967	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.070	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	0.32	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-1-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-6
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		4.70	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.002	0.001
Ion Balance		Balance		1.00	0.01

CHEMEX Labs Alberta Inc.
Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-1-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-6
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED (DD-MM-YY)	BATCH NUMBER	DUP Rr	% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	23-03-95	1	0.0	89.3	66.0	132.7	112.5	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-1-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-6
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-2-L
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-7
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	25.8	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	20.5	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	1560	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	25.8	0.05
Chloride - Dissolved	17206L	mg/L	1440	0.5
Sulphate - (IC)	16309L	mg/L	2.4	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1600	0.5
pH	10301L	Units	7.39	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	1950	0.5
Total Hardness (as CaCO3)	10602L	mg/L	149.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.36	0.02
Fluoride	09105L	mg/L	1.50	0.05
Specific Conductance	02041L	umhos/Cm	6970	0.02
Total Dissolved Solids	00201L	mg/L	4050	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.016	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.6	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	0.04	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0006	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.17	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	3.20	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.291	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.034	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-2-L
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-7
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L		0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		1.26	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		0.98	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-2-L
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-7
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	2	1.0	95.3	90.8	108.8	97.8	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-2-L
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-7
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	SPIKES % RECOV	SPIKES CONT LOWER	SPIKES LIMIT UPPER	CHECK % RECOV	CHECK CONT LOWER	CHECK LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-3-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-8
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		45.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		57.0	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		3290	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		29.9	0.05
Chloride - Dissolved	17206L	mg/L		3880	0.5
Sulphate - (IC)	16309L	mg/L		1.2	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1880	0.5
pH	10301L	Units		7.20	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2290	0.5
Total Hardness (as CaCO3)	10602L	mg/L		347.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.16	0.02
Fluoride	09105L	mg/L		1.00	0.05
Specific Conductance	02041L	umhos/Cm		14200	0.02
Total Dissolved Solids	00201L	mg/L		8450	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.012	0.003
Sulphur - (ICP) - Dissolved		mg/L		2.3	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	<	0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L		0.39	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L		3.93	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L		0.003	0.001
Iron - Dissolved (ICP)	26109L	mg/L	<	0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.645	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.029	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : L97-P95-3-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-8
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		2.74	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		1.03	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-3-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-8
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr		SPIKES			CHECK	
				% RECOV	CONT LOWER	LIMIT UPPER	% RECOV	CONT LOWER	LIMIT UPPER
Calcium - (AA) Dissolved	22-03-95	1	1.1	99.5	94.6	105.6	101.7	95.0	105.0
Magnesium - (AA) Dissolved	22-03-95	1	1.0	99.5	94.1	104.8	97.0	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : L97-P95-3-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-8
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	SPIKES % RECOV	CONT LOWER	LIMIT UPPER	CHECK % RECOV	CONT LOWER	LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-9
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L		14.2	0.01
Magnesium - (AA) Dissolved	12102L	mg/L		3.24	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L		8.90	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L		1.49	0.05
Chloride - Dissolved	17206L	mg/L		4.6	0.5
Sulphate - (IC)	16309L	mg/L		28.8	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		31.6	0.5
pH	10301L	Units		6.23	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		38.5	0.5
Total Hardness (as CaCO3)	10602L	mg/L		48.8	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		4.42	0.02
Fluoride	09105L	mg/L		0.14	0.05
Specific Conductance	02041L	umhos/Cm		142.	0.02
Total Dissolved Solids	00201L	mg/L		81.2	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.168	0.003
Sulphur - (ICP) - Dissolved		mg/L		9.2	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L		0.50	0.01
Arsenic - Dissolved (AA)	33109L	mg/L		0.0003	0.0002
Barium - Dissolved (ICP)	56109L	mg/L		0.03	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L		0.03	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP)	26109L	mg/L		0.42	0.01
Lead - Dissolved (ICP)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L		0.003	0.001
Manganese - Dissolved (ICP)	25109L	mg/L		0.035	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-9
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		0.044	0.002
Titanium - Dissolved (ICP)	22111D	mg/L		0.012	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.007	0.001
Ion Balance		Balance		1.02	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-9
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	1	0.7	98.5	90.8	108.8	100.6	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FL7 BRD6 #4
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-9
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FL3-P95-6-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-10
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	190.	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	158.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	6720	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	82.2	0.05
Chloride - Dissolved	17206L	mg/L	10200	0.5
Sulphate - (IC)	16309L	mg/L	5.0	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1450	0.5
pH	10301L	Units	7.11	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	1770	0.5
Total Hardness (as CaCO3)	10602L	mg/L	1130	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.02	0.02
Fluoride	09105L	mg/L	0.28	0.05
Specific Conductance	02041L	umhos/Cm	30800	0.02
Total Dissolved Solids	00201L	mg/L	18200	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.053	0.003
Sulphur - (ICP) - Dissolved		mg/L	4.9	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	< 0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	0.0016	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	3.00	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	2.33	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	0.014	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.008	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.947	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.277	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FL3-P95-6-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-10
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L		0.019	0.003
Nickel - Dissolved (ICP)	28350L	mg/L		0.032	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L		0.2	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0008	0.0002
Silver - Dissolved (ICP)	47450L	mg/L		0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		8.41	0.002
Titanium - Dissolved (ICP)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L		0.006	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.009	0.001
Ion Balance		Balance		1.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FL3-P95-6-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-10
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	1	2.0	98.2	72.1	119.4	93.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	1	1.0	96.0	79.2	120.7	87.5	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FL3-P95-6-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-10
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FLB-P95-13-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-11
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Calcium - (AA) Dissolved	20103L	mg/L	85.0	0.01
Magnesium - (AA) Dissolved	12102L	mg/L	103.	0.01
Sodium - (Flame Photometer) Dis	11103L	mg/L	3230	0.2
Potassium - (Flame Photometer) Dis	19103L	mg/L	26.8	0.05
Chloride - Dissolved	17206L	mg/L	3920	0.5
Sulphate - (IC)	16309L	mg/L	1.3	0.1
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2050	0.5
pH	10301L	Units	7.13	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2490	0.5
Total Hardness (as CaCO3)	10602L	mg/L	636.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.25	0.02
Fluoride	09105L	mg/L	0.58	0.05
Specific Conductance	02041L	umhos/Cm	14000	0.02
Total Dissolved Solids	00201L	mg/L	8610	1.
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.011	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.8	0.2
Aluminum - Dissolved (ICP)	13109L	mg/L	0.05	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	< 0.0002	0.0002
Barium - Dissolved (ICP)	56109L	mg/L	0.55	0.01
Beryllium - Dissolved (ICP)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP)	05111L	mg/L	3.40	0.01
Cadmium - Dissolved (ICP)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP)	27360L	mg/L	0.005	0.003
Copper - Dissolved (ICP)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP)	26109L	mg/L	< 0.01	0.01
Lead - Dissolved (ICP)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP)	03109L	mg/L	0.753	0.001
Manganese - Dissolved (ICP)	25109L	mg/L	0.077	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	< 0.05	0.05

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON

SUNCOR NEW LEASE
PROJ.#PA27790201

Sample Description : FL8-P95-13-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-11
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Molybdenum - Dissolved (ICP)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP)	15450L	mg/L		0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0003	0.0002
Silver - Dissolved (ICP)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP)	38111L	mg/L		3.96	0.002
Titanium - Dissolved (ICP)	22111D	mg/L		0.007	0.003
Uranium - Dissolved (ICP)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		1.02	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FLB-P95-13-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-11
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE	QA/QC			SPIKES			CHECK	
	ANALYZED	BATCH	DUP	%	CONT	LIMIT	%	CONT	LIMIT
	(DD-MM-YY)	NUMBER	Rr	RECOV	LOWER	UPPER	RECOV	LOWER	UPPER
Calcium - (AA) Dissolved	21-03-95	1	1.2	99.4	94.6	105.6	98.5	95.0	105.0
Magnesium - (AA) Dissolved	20-03-95	1	1.0	97.7	94.1	104.8	97.5	95.8	104.8
Sodium - (Flame Photometer) Dis	20-03-95	2	0.2	100.4	91.7	109.1	100.6	93.5	105.7
Potassium - (Flame Photometer) Dis	20-03-95	2	0.0	99.6	92.1	107.1	95.8	93.9	105.7
Chloride - Dissolved	20-03-95	3	0.0	98.0	90.8	108.8	97.2	94.3	105.6
Sulphate - (IC)	21-03-95	10	2.4	100.0	91.3	108.3	101.0	90.7	104.7
Total Alkalinity (as CaCO3)	17-03-95	3	0.1	NOT APPLICABLE			NOT APPLICABLE		
pH	17-03-95	3	0.2	NOT APPLICABLE			NOT APPLICABLE		
Silicon - Dissolved (ICP)	23-03-95	10	0.8	103.6	59.1	142.3	111.8	60.9	147.2
Fluoride	20-03-95	2	0.0	106.1	82.0	122.1	100.9	92.6	111.1
Specific Conductance	17-03-95	1	0.2	NOT APPLICABLE			NOT APPLICABLE		
Nitrite plus Nitrate Nitrogen as N	18-03-95	1	0.0	97.3	93.1	105.1	99.1	87.8	107.9
Sulphur - (ICP) - Dissolved	23-03-95	10	0.7	NOT APPLICABLE			NOT APPLICABLE		
Aluminum - Dissolved (ICP)	23-03-95	10	0.1	106.9	89.8	115.5	111.0	94.2	111.5
Arsenic - Dissolved (AA)	24-03-95	2	1.0	90.7	72.1	119.4	95.8	75.3	122.4
Barium - Dissolved (ICP)	23-03-95	10	1.0	103.5	92.6	107.9	105.0	93.6	105.6
Beryllium - Dissolved (ICP)	23-03-95	10	0.0	105.6	88.2	118.0	106.8	89.2	110.9
Boron - Dissolved (ICP)	23-03-95	10	1.4	101.1	92.2	109.7	104.7	90.6	111.0
Cadmium - Dissolved (ICP)	23-03-95	10	0.0	103.2	83.5	121.6	106.2	86.6	113.1
Chromium - Dissolved (ICP)	23-03-95	10	3.0	108.6	87.0	116.3	108.8	89.8	109.8
Cobalt - Dissolved (ICP)	23-03-95	10	3.2	103.2	86.4	114.4	104.0	88.3	107.8
Copper - Dissolved (ICP)	23-03-95	10	0.0	102.1	90.1	104.7	103.6	90.7	103.7
Iron - Dissolved (ICP)	23-03-95	10	0.0	105.5	88.8	114.6	107.0	92.2	112.0
Lead - Dissolved (ICP)	23-03-95	10	0.0	99.4	86.8	113.1	106.5	91.6	106.7
Lithium - Dissolved (ICP)	23-03-95	10	0.0	94.1	74.2	111.3	96.0	82.6	107.0
Manganese - Dissolved (ICP)	23-03-95	10	0.5	106.9	87.3	112.7	105.7	89.1	107.1
Mercury - Dissolved (CVAA)	22-03-95	1	0.0	114.0	66.0	132.7	128.0	69.9	131.2
Molybdenum - Dissolved (ICP)	23-03-95	10	0.0	108.9	87.0	117.6	108.2	90.5	109.8
Nickel - Dissolved (ICP)	23-03-95	10	0.0	103.8	83.5	117.0	106.7	90.4	110.1
Phosphorus - Dissolved (ICP)	23-03-95	10	1.7	97.0	84.0	113.4	96.7	85.1	106.3
Selenium - Dissolved (AA)	24-03-95	2	0.0	100.6	79.2	120.7	93.8	76.6	122.4
Silver - Dissolved (ICP)	23-03-95	10	0.0	98.9	84.8	107.3	102.5	93.1	104.1

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

BATCH SPECIFIC QUALITY ASSURANCE REPORT FOR :
KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAN EMMERSON
PROJ.#PA27790201

Sample Description : FL3-P95-13-BA
Sample Date & Time : 13-03-95
Sampled By : DT
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 95-00280-11
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : March 31, 1995

PARAMETER	DATE ANALYZED (DD-MM-YY)	QA/QC BATCH NUMBER	DUP Rr	SPIKES % RECOV	SPIKES CONT LOWER	SPIKES LIMIT UPPER	CHECK % RECOV	CHECK CONT LOWER	CHECK LIMIT UPPER
Strontium - Dissolved (ICP)	23-03-95	10	1.1	103.1	93.3	107.6	105.7	94.1	106.9
Titanium - Dissolved (ICP)	23-03-95	10	0.0	103.6	91.9	113.8	105.2	93.5	110.7
Uranium - Dissolved (ICP)	23-03-95	10	0.0	72.9	51.6	138.3	94.7	76.9	119.8
Vanadium - Dissolved (ICP)	23-03-95	10	3.2	105.1	89.1	114.4	106.3	93.1	108.8
Zinc - Dissolved (ICP)	23-03-95	10	0.3	101.5	86.1	117.4	102.3	89.4	109.7

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK 7110

Sample Description : OB-1
Sample Date & Time : 03-07-95 1200
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 04. 1995
Sample Station Code :

Chemex Worksheet Number : 95-01909-OB-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11. 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	79.8	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	19.9	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	8.80	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	2.30	0.02
Chloride - Dissolved	17206L	mg/L	0.7	0.5
Sulphate - Dissolved	16306L	mg/L	18.3	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	262.	0.5
pH	10301L	Units	7.68	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	319.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	281.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.51	0.02
Fluoride	09105L	mg/L	0.20	0.05
Specific Conductance	02041L	umhos/Cm	514.	0.02
Turbidity	02074L	NTU	400.	0.1
Cyanide (Available)	06608L	mg/L	< 0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	290.	1.
Dissolved Organic Carbon	06104L	mg/L	3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.156	0.003
Total Phosphorus as P	15406L	mg/L	0.400	0.003
Sulphur - (ICP) - Dissolved		mg/L	6.4	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.10	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	< 0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.003	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	0.004	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.14	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK 7110

Sample Description : OB-1
Sample Date & Time : 03-07-95 1200
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 04, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01909-OB-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.007	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.455	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.007	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0004	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.149	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.040	0.001
Ion Balance		Balance		1.07	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507007-01 Sample Type:WATER Collected:07/03/95 12:00	**OB-1**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/06/95	TT
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	07/05/95	07/17/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507007-01 Sample Type:WATER Collected:07/03/95 12:00	**OB-1**							
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	M
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M.
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	M
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	M
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	M
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	M
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
E507007-02 Sample Type:WATER Collected:07/03/95 14:00	**OB-4**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/06/95	TT
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Acenaphthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Phenanthrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Anthracene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Fluoranthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJ
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJ
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : OB#2
Sample Date & Time : 29-06-95 1440
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 OB#2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	22.8	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	6.20	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	189.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	3.30	0.02
Chloride - Dissolved	17206L	mg/L	14.2	0.5
Sulphate - Dissolved	16306L	mg/L	0.8	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	485.	0.5
pH	10301L	Units	8.10	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	591.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	82.5	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	8.90	0.02
Fluoride	09105L	mg/L	0.52	0.05
Specific Conductance	02041L	umhos/Cm	883.	0.02
Turbidity	02074L	NTU	180.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.047	0.001
Total Dissolved Solids	00201L	mg/L	532.	1.
Dissolved Organic Carbon	06104L	mg/L	12.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.007	0.003
Total Phosphorus as P	15406L	mg/L	0.209	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.1	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.14	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.09	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.51	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	0.004	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.08	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : OB#2
Sample Date & Time : 29-06-95 1440
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 OB#2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.052	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.137	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.2	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.191	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L		0.003	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.017	0.001
Ion Balance		Balance		0.98	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK #7110

Sample Description : OB-3
Sample Date & Time : 04-07-95 1045
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 05, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01924-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	3.30	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	0.90	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	4.20	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	0.70	0.02
Chloride - Dissolved	17206L	mg/L	< 0.5	0.5
Sulphate - Dissolved	16306L	mg/L	9.9	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	7.1	0.5
pH	10301L	Units	5.65	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	8.7	0.5
Total Hardness (as CaCO3)	10602L	mg/L	12.0	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.88	0.02
Fluoride	09105L	mg/L	0.11	0.05
Specific Conductance	02041L	umhos/Cm	35.0	0.02
Turbidity	02074L	NTU	425.	0.1
Cyanide (Available)	06608L	mg/L	< 0.001	0.001
Phenols	06537L	mg/L	0.003	0.001
Total Dissolved Solids	00201L	mg/L	24.	1.
Dissolved Organic Carbon	06104L	mg/L	4.5	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.024	0.003
Total Phosphorus as P	15406L	mg/L	0.690	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.4	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.12	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.02	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.002	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.02	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.012	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.003	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.03	0.01

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions and low conductivity.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK #7110

Sample Description : OB-3
Sample Date & Time : 04-07-95 1045
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 05, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01924-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.001	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.007	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.027	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.024	0.001

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions and low conductivity.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK 7110

Sample Description : ~~OB-1~~ OB-4
Sample Date & Time : 03-07-95 1400
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 04, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01909-OB-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	7.70	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	1.50	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	3.20	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	0.80	0.02
Chloride - Dissolved	17206L	mg/L	3.1	0.5
Sulphate - Dissolved	16306L	mg/L	11.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	12.4	0.5
pH	10301L	Units	5.87	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	15.2	0.5
Total Hardness (as CaCO3)	10602L	mg/L	25.4	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	5.64	0.02
Fluoride	09105L	mg/L	0.08	0.05
Specific Conductance	02041L	umhos/Cm	54.0	0.02
Turbidity	02074L	NTU	360.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.003	0.001
Total Dissolved Solids	00201L	mg/L	35.	1.
Dissolved Organic Carbon	06104L	mg/L	2.4	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.032	0.003
Total Phosphorus as P	15406L	mg/L	0.320	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.09	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.01	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.04	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.09	0.01

NOTES : Anion-cation balance is higher than our normal limits. Major ions have been checked.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK 7110

Sample Description : ~~OB-1~~ OB-4
Sample Date & Time : 03-07-95 1400
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 04, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01909-OB-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L	<	0.001	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.017	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.007	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L		0.0004	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.039	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.026	0.001

NOTES : Anion-cation balance is higher than our normal limits. Major ions have been checked.

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507007-02 Sample Type:WATER Collected:07/03/95	**OB-4** 14:00							
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/05/95	07/08/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	07/05/95	07/17/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	07/05/95	07/17/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	07/05/95	07/17/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/05/95	07/08/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507007-02 Sample Type:WATER Collected:07/03/95 14:00	**OB-4**							
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	M
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	M
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	M
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT

ENVIRO-TEST QA/QC REPORT

PAH & Alkylated PAH's

Average Surrogate Recovery for E507007	**%**
Nitrobenzene d5	97
2-Fluorobiphenyl	92
p-Terphenyl d14	97

PANH & Alkylated PANH's

Average Surrogate Recovery for E507007	**%**
Quinoline d7	103

Phenolic Compounds in H2O

Average Surrogate Recovery for E507007	**%**
2-Fluorophenol	31
Phenol d5	20
2,4,6-Tribromophenol	90

Volatile Organics (MS):H20

Average Surrogate Recovery for E507007	**%**
1,2-Dichloroethane d4	108
Toluene d8	93
4-Bromofluorobenzene	101

Relative percent difference is expressed as RPD.
Percent Recovery is expressed as %.
THIS IS THE LAST PAGE OF THE QAQC REPORT

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : OB-5
Sample Date & Time : 05-07-95 1540
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-OB-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	53.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	14.4	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	178.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	2.10	0.02
Chloride - Dissolved	17206L	mg/L	9.3	0.5
Sulphate - Dissolved	16306L	mg/L	5.4	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	576.	0.5
pH	10301L	Units	7.45	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	702.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	194.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	7.91	0.02
Fluoride	09105L	mg/L	0.66	0.05
Specific Conductance	02041L	umhos/Cm	1010.	0.02
Turbidity	02074L	NTU	120.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	614.	1.
Dissolved Organic Carbon	06104L	mg/L	9.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.101	0.003
Sulphur - (ICP) - Dissolved		mg/L	2.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.04	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.17	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.42	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.003	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	< 0.01	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : OB-5
Sample Date & Time : 05-07-95 1540
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-OB-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.042	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.573	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.018	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.222	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.007	0.001
Ion Balance		Balance		0.98	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507095-03 Sample Type:WATER Collected:07/05/95 15:30	**OB-5**							
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT

ENVIRO-TEST QA/QC REPORT

PAH & Alkylated PAH's

Average Surrogate Recovery for E507095	%
Nitrobenzene d5	108
2-Fluorobiphenyl	75
p-Terphenyl d14	93

PANH & Alkylated PANH's

Average Surrogate Recovery for E507095	%
Quinoline d7	95

Phenolic Compounds in H2O

Volatile Organics (MS):H20

Average Surrogate Recovery for E507095	%
1,2-Dichloroethane d4	109
Toluene d8	99
4-Bromofluorobenzene	111

Relative percent difference is expressed as RPD.
Percent Recovery is expressed as %.
THIS IS THE LAST PAGE OF THE QAQC REPORT

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK#7110

Sample Description : BRDG-4
Sample Date & Time : 06-07-95 1445
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01967-BRDG-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	17.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	3.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	11.1	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	1.40	0.02
Chloride - Dissolved	17206L	mg/L	4.2	0.5
Sulphate - Dissolved	16306L	mg/L	26.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	51.0	0.5
pH	10301L	Units	6.48	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	62.2	0.5
Total Hardness (as CaCO3)	10602L	mg/L	58.2	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	3.69	0.02
Fluoride	09105L	mg/L	< 0.05	0.05
Specific Conductance	02041L	umhos/Cm	174.	0.02
Turbidity	02074L	NTU	950.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.019	0.001
Total Dissolved Solids	00201L	mg/L	96.	1.
Dissolved Organic Carbon	06104L	mg/L	9.8	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.165	0.003
Total Phosphorus as P	15406L	mg/L	5.10	0.003
Sulphur - (ICP) - Dissolved		mg/L	8.7	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.09	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.03	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	< 0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.013	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.14	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK#7110

Sample Description : BRDG-4
Sample Date & Time : 06-07-95 1445
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01967-BRDG-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.001	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.013	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.011	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.047	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.013	0.001
Ion Balance		Balance		0.99	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 1-BA
Sample Date & Time : 28-06-95 1425
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 1-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		87.3	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		92.6	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		5040.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		36.7	0.02
Chloride - Dissolved	17206L	mg/L		6220.	0.5
Sulphate - Dissolved	16306L	mg/L		0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2150.	0.5
pH	10301L	Units		7.44	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2620.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		599.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.48	0.02
Fluoride	09105L	mg/L		0.78	0.05
Specific Conductance	02041L	umhos/Cm		21500.	0.02
Turbidity	02074L	NTU		6.3	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.025	0.001
Total Dissolved Solids	00201L	mg/L		12800.	1.
Dissolved Organic Carbon	06104L	mg/L		5.5	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.067	0.003
Sulphur - (ICP) - Dissolved		mg/L		6.9	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.02	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.91	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		4.07	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.012	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.70	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 1-BA
Sample Date & Time : 28-06-95 1425
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 1-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		1.14	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.375	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.014	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.005	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		4.81	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.005	0.001
Ion Balance		Balance		1.06	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 2-L
Sample Date & Time : 29-06-95 1205
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

DDW-5

Chemex Worksheet Number : 9501860 2-L
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		27.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		21.6	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		1860.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		24.4	0.02
Chloride - Dissolved	17206L	mg/L		1540.	0.5
Sulphate - Dissolved	16306L	mg/L		0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1830.	0.5
pH	10301L	Units		7.74	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2230.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		158.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.65	0.02
Fluoride	09105L	mg/L		1.49	0.05
Specific Conductance	02041L	umhos/Cm		7860.	0.02
Turbidity	02074L	NTU		50.0	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		4580.	1.
Dissolved Organic Carbon	06104L	mg/L		52.7	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.120	0.003
Sulphur - (ICP) - Dissolved		mg/L		3.7	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.02	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.20	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.68	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.004	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.004	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.69	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 2-L
Sample Date & Time : 29-06-95 1205
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 2-L
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.368	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.082	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.004	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.003	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		1.33	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.014	0.001
Ion Balance		Balance		1.06	0.01

ETL Enviro·Test
LABORATORIES
A DIVISION OF *ETL CHEMSPEC ANALYTICAL LIMITED*

Recycled Paper

9936 - 67th Avenue — Edmonton, Alberta T6E 0P5 Telephone: (403) 434-9509 FAX: (403) 437-2311

CHEMICAL ANALYSIS REPORT

SUNCOR INC.
P.O. BAG 4001
FORT MCMURRAY, ALBERTA
T9H 3E3

DATE: January 26, 1996

ATTN: GARY BILECKI

Lab Work Order #: E506689

Sampled By: DH/GB

Project Reference: NOT SUBMITTED

Date Received: 06/30/95

Project P.O.#: SA# 005718 AMENDMENT C003

Comments:

APPROVED BY:

Doug Johnson
Project Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ACCREDITED BY: (Edmonton)	**CANADIAN ASSOCIATION OF ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL)** - For specific tests registered with the Association **STANDARDS COUNCIL OF CANADA** - Organic & Industrial Hygiene analysis as registered with the Council **AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)** - Industrial Hygiene analysis registered by AIHA **AGRICULTURE CANADA** - Pesticide in Fruits and Vegetables, pesticides and PCP in meat
CERTIFIED BY: (Calgary)	**CANADIAN ASSOCIATION OF ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL)** - For specific tests registered with the Association

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E506689-01 Sample Type:WATER Collected:06/29/95 12:05	**2-L**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/06/95	TT
		PAH & Alkylated PAH's						
		Naphthalene	0.05	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Acenaphthene	0.08	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Fluorene	0.08	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Dibenzothiophene	0.02	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Phenanthrene	0.14	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Pyrene	0.03	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Benzo(a)anthracene/Chrysene	0.04	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl naphthalene	0.04	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd naphthalene	0.06	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C3 sub'd naphthalene	0.53	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C4 sub'd naphthalene	0.35	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl biphenyl	0.04	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd biphenyl	0.11	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl acenaphthene	0.08	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl fluorene	0.17	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd fluorene	0.22	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl phenanthrene/anthracene	0.31	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd phenanthrene/anth.	0.35	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C3 sub'd phenanthrene/anth.	0.29	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C4 sub'd phenanthrene/anth.	0.13	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl dibenzothiophene	0.24	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd dibenzothiophene	0.43	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C3 sub'd dibenzothiophene	0.45	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C4 sub'd dibenzothiophene	0.26	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl fluoranthene/pyrene	0.05	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl B(a)A/chrysene	0.05	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd B(a)A/chrysene	0.06	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/04/95	07/08/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	07/04/95	07/17/95	MBM
		o-Cresol	0.1	0.1	ug/L (ppb)	07/04/95	07/17/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	07/04/95	07/17/95	MBM
		p-Cresol	0.3	0.1	ug/L (ppb)	07/04/95	07/17/95	MBM
		2,4-Dimethylphenol	0.2	0.1	ug/L (ppb)	07/04/95	07/17/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	07/04/95	07/17/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	07/04/95	07/17/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	07/04/95	07/17/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	07/04/95	07/17/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/04/95	07/08/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E506689-01 Sample Type:WATER Collected:06/29/95 12:05	**2-L**							
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

Appendix A Test Methodologies

Hydrocarbons,Recoverable

Preparation Method: Separatory funnel extraction with 80% to 20% Hexane to MTBE; silica gel addition.
Instrumental Method: Gravimetric analysis
Method Reference: H/C ENVIRODAT 6579 APHA 5520F

PAH & Alkylated PAH's

Preparation Method: Liquid/liquid extraction with DCM, methylation

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3540 (modified)
Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H20

Preparation Method: Liquid/liquid extraction with DCM, acetylation

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3510 (modified)
Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method: Automated headspace

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3810 (modified)
Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK #7110

Sample Description : 3-BA
Sample Date & Time : 04-07-95 1310
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 05, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01924-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		52.3	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		53.8	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		3320.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		25.1	0.02
Chloride - Dissolved	17206L	mg/L		4220.	0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		1890.	0.5
pH	10301L	Units		7.40	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2300.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		352.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.49	0.02
Fluoride	09105L	mg/L		0.96	0.05
Specific Conductance	02041L	umhos/Cm		14000.	0.02
Turbidity	02074L	NTU		70.0	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.030	0.001
Total Dissolved Solids	00201L	mg/L		8820.	1.
Dissolved Organic Carbon	06104L	mg/L		12.3	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.009	0.003
Total Phosphorus as P	15406L	mg/L		0.122	0.003
Sulphur - (ICP) - Dissolved		mg/L		2.0	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.07	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.52	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L		0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		4.32	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.014	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.005	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.59	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004
TASK #7110

Sample Description : 3-BA
Sample Date & Time : 04-07-95 1310
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 05, 1995
Sample Station Code :

Chemex Worksheet Number : 95-01924-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.709	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.146	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.004	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		2.65	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.008	0.001
Ion Balance		Balance		0.97	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK #

Sample Description : 6-BA
Sample Date & Time : 10-07-95 1330
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 11, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02013-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	193.	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	209.	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	9140.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	85.3	0.02
Chloride - Dissolved	17206L	mg/L	12800.	0.5
Sulphate - Dissolved	16306L	mg/L	11.3	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2010.	0.5
pH	10301L	Units	7.15	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2450.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	1340.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	3.72	0.02
Fluoride	09105L	mg/L	0.41	0.05
Specific Conductance	02041L	umhos/Cm	39200.	0.02
Turbidity	02074L	NTU	23.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	< 0.01	0.01
Total Dissolved Solids	00201L	mg/L	23700.	1.
Dissolved Organic Carbon	06104L	mg/L	4.8	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.038	0.003
Sulphur - (ICP) - Dissolved		mg/L	1.9	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	2.85	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.40	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	0.031	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.005	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.04	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK #

Sample Description : 6-BA
Sample Date & Time : 10-07-95 1330
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 11, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02013-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		1.79	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		4.02	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.004	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.113	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		13.0	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L		0.004	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		1.06	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507149-01 Sample Type:WATER Collected:07/10/95 13:30	**6-BA**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/19/95	AH
		PAH & Alkylated PAH's						
		Naphthalene	0.03	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Acenaphthene	0.04	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Fluorene	0.06	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Phenanthrene	0.07	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl naphthalene	0.06	0.02	ug/L (ppb)	06/19/95	07/19/95	M
		C2 sub'd naphthalene	0.32	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C3 sub'd naphthalene	0.82	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C4 sub'd naphthalene	0.50	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		Methyl acenaphthene	0.06	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		Methyl fluorene	0.14	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd fluorene	0.13	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl phenanthrene/anthracene	0.13	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd phenanthrene/anth.	0.09	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C3 sub'd phenanthrene/anth.	0.05	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl dibenzothiophene	0.16	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd dibenzothiophene	0.13	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C3 sub'd dibenzothiophene	0.09	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Phenolic Compounds in H2O						
		Phenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		m-Cresol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		p-Cresol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		2,4-Dimethylphenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		2-Nitrophenol	N.D.	4	ug/L (ppb)	07/12/95	07/27/95	MJL
		4-Nitrophenol	N.D.	40	ug/L (ppb)	07/12/95	07/27/95	MJL
		2,4-Dinitrophenol	N.D.	40	ug/L (ppb)	07/12/95	07/27/95	MJ
		4,6-Dinitro-2-methylphenol	N.D.	40	ug/L (ppb)	07/12/95	07/27/95	MJ
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRH
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd quinolines	0.32	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR..
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507149-01 Sample Type:WATER Collected:07/10/95 13:30	**6-BA**							
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
E507149-02 Sample Type:WATER Collected:07/10/95 14:30	**RO-Z**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/19/95	AH
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 8-BA
Sample Date & Time : 28-06-95 1115
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 8-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	16.0	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	8.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1080.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	28.6	0.02
Chloride - Dissolved	17206L	mg/L	599.	0.5
Sulphate - Dissolved	16306L	mg/L	6.9	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1450.	0.5
pH	10301L	Units	7.76	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	1760.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	74.6	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.51	0.02
Fluoride	09105L	mg/L	1.22	0.05
Specific Conductance	02041L	umhos/Cm	4240.	0.02
Turbidity	02074L	NTU	1700.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.055	0.001
Total Dissolved Solids	00201L	mg/L	2620.	1.
Dissolved Organic Carbon	06104L	mg/L	46.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.750	0.003
Sulphur - (ICP) - Dissolved		mg/L	10.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.04	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.19	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.61	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.005	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.26	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : KEN MANLY
SA-5709-A004
TASK #7110

Sample Description : 8-BA
Sample Date & Time : 28-06-95 1115
Sampled By : DH
Sample Type : GRAB
Sample Station Code :

Chemex Worksheet Number : 9501860 8-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : July 17, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.355	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.083	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.006	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.487	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L		0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L	<	0.001	0.001
Ion Balance		Balance		1.07	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 05-07-95 1145
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-13-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	89.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	80.5	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	3150.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	26.2	0.02
Chloride - Dissolved	17206L	mg/L	3920.	0.5
Sulphate - Dissolved	16306L	mg/L	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2100.	0.5
pH	10301L	Units	7.19	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2560.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	554.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.70	0.02
Fluoride	09105L	mg/L	0.57	0.05
Specific Conductance	02041L	umhos/Cm	13700.	0.02
Turbidity	02074L	NTU	55.0	0.1
Cyanide (Available)	06608L	mg/L	0.002	0.001
Phenols	06537L	mg/L	0.060	0.001
Total Dissolved Solids	00201L	mg/L	8550.	1.
Dissolved Organic Carbon	06104L	mg/L	5.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.099	0.003
Sulphur - (ICP) - Dissolved		mg/L	5.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.05	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.76	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.70	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.006	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	0.010	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.007	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	4.11	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 05-07-95 1145
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-13-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.737	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.696	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.013	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.004	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		4.14	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.002	0.001
Ion Balance		Balance		0.98	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	F
E507095-01	**13-BA**							
Sample Type:WATER								
Collected:07/05/95	11:45							
		Hydrocarbons,Recoverable	5	1	mg/L		07/19/95	AH
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Acenaphthene	0.03	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Phenanthrene	0.03	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl naphthalene	0.04	0.02	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd naphthalene	0.10	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C3 sub'd naphthalene	0.12	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C4 sub'd naphthalene	0.09	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl fluorene	0.04	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd fluorene	0.07	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl phenanthrene/anthracene	0.10	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd phenanthrene/anth.	0.21	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C3 sub'd phenanthrene/anth.	0.18	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C4 sub'd phenanthrene/anth.	0.16	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl dibenzothiophene	0.07	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd dibenzothiophene	0.08	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C3 sub'd dibenzothiophene	0.17	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C4 sub'd dibenzothiophene	0.06	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl fluoranthene/pyrene	0.05	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl B(a)A/chrysene	0.05	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene	0.04	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJ
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		m-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		p-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		2,4-Dimethylphenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		2-Nitrophenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		4-Nitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJL
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJ
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJ
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507095-01 Sample Type:WATER Collected:07/05/95 11:45	13-BA							
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
E507095-02 Sample Type:WATER Collected:07/05/95 11:55	13-BA-D1							
		Hydrocarbons,Recoverable	3	1	mg/L		07/19/95	AH
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Acenaphthene	0.03	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Fluorene	0.02	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Phenanthrene	0.03	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(a)anthracene/Chrysene	0.02	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl naphthalene	0.03	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd naphthalene	0.09	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C3 sub'd naphthalene	0.12	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C4 sub'd naphthalene	0.13	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl fluorene	0.05	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd fluorene	0.08	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl phenanthrene/anthracene	0.11	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd phenanthrene/anth.	0.23	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C3 sub'd phenanthrene/anth.	0.21	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C4 sub'd phenanthrene/anth.	0.16	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : 13-BA-DI
Sample Date & Time : 05-07-95 1155
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-13-BA-DI
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		89.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		81.2	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		3080.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		26.4	0.02
Chloride - Dissolved	17206L	mg/L		3880.	0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2100.	0.5
pH	10301L	Units		7.22	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2560.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		557.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		2.72	0.02
Fluoride	09105L	mg/L		0.57	0.05
Specific Conductance	02041L	umhos/Cm		13700.	0.02
Turbidity	02074L	NTU		50.0	0.1
Cyanide (Available)	06608L	mg/L		0.002	0.001
Phenols	06537L	mg/L		0.070	0.001
Total Dissolved Solids	00201L	mg/L		8440.	1.
Dissolved Organic Carbon	06104L	mg/L		4.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.114	0.003
Sulphur - (ICP) - Dissolved		mg/L		2.1	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.75	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.63	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.005	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.008	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		4.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

Sample Description : 13-BA-DI
Sample Date & Time : 05-07-95 1155
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 07, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02005-13-BA-DI
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L		0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.719	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.689	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L		0.09	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.005	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		4.07	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L		0.003	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.003	0.001
Ion Balance		Balance		0.96	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	E
E507095-02 Sample Type:WATER Collected:07/05/95 11:55	13-BA-D1							
		Methyl dibenzothiophene	0.06	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		C2 sub'd dibenzothiophene	0.12	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		C3 sub'd dibenzothiophene	0.24	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl fluoranthene/pyrene	0.06	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		C2 sub'd B(a)A/chrysene	0.05	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJ
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		m-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		p-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJ
		2,4-Dimethylphenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		2-Nitrophenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		4-Nitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJ
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJ
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJ
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/07/95	07/08/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/07/95	07/08/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Ethylbenzene	N.D	1	ug/L (ppb)	07/07/95	07/08/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507095-02 Sample Type:WATER Collected:07/05/95 11:55	**13-BA-D1**							
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/07/95	07/08/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/07/95	07/08/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA
E507095-03 Sample Type:WATER Collected:07/05/95 15:30	**OB-5**							
		Hydrocarbons,Recoverable	<1	1	mg/L		07/19/95	AH
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Pyrene	0.02	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C3 sub'd naphthalene	0.17	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C4 sub'd naphthalene	0.20	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl fluorene	0.04	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd fluorene	0.06	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd phenanthrene/anth.	0.05	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C3 sub'd phenanthrene/anth.	0.06	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd dibenzothiophene	0.04	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C3 sub'd dibenzothiophene	0.06	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	07/12/95	07/19/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		m-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		p-Cresol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		2,4-Dimethylphenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		2-Nitrophenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJL
		4-Nitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJL
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJL
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	07/12/95	07/27/95	MJL
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/07/95	07/08/95	MA

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK #

Sample Description : RO-2
Sample Date & Time : 10-07-95 1430
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 11, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02013-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		0.08	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		0.03	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		1.10	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		0.28	0.02
Chloride - Dissolved	17206L	mg/L	<	0.5	0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2.7	0.5
pH	10301L	Units		5.94	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		3.3	0.5
Total Hardness (as CaCO3)	10602L	mg/L	<	0.5	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L	<	0.02	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		1.00	0.02
Turbidity	02074L	NTU		0.4	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		4.	1.
Dissolved Organic Carbon	06104L	mg/L	<	0.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L	<	0.003	0.003
Sulphur - (ICP) - Dissolved		mg/L	<	0.2	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	<	0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	<	0.01	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.011	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	<	0.01	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

KLOHN-CRIPPEN CONSULTING LTD.
ATTENTION : DAVID THOMSON
SA-5709-A004

TASK #

Sample Description : RO-2
Sample Date & Time : 10-07-95 1430
Sampled By : GB
Sample Type : GRAB
Sample Recieved Date: July 11, 1995
Sample Station Code :

Chemex Worksheet Number : 95-02013-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : August 11, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L	<	0.001	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L	<	0.001	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L	<	0.002	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.008	0.001
Ion Balance		Balance		0.94	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507149-02 Sample Type:WATER Collected:07/10/95 14:30	**RO-Z**							
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	06/19/95	07/19/95	M
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	07/12/95	07/27/95	MJL
		o-Cresol	N.D.	0.1	ug/L (ppb)	07/12/95	07/27/95	M
		m-Cresol	N.D.	0.1	ug/L (ppb)	07/12/95	07/27/95	M
		p-Cresol	N.D.	0.1	ug/L (ppb)	07/12/95	07/27/95	M
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	07/12/95	07/27/95	MJL
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	07/12/95	07/27/95	MJL
		4-Nitrophenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	07/12/95	07/27/95	MJ
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl acridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Phenanthridine	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RRR
		Carbazole	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	07/12/95	07/20/95	RR
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Acetone	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	07/11/95	07/12/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Benzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Dibromomethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Toluene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	07/11/95	07/12/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Chlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Ethylbenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		o-Xylene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		Styrene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	07/11/95	07/12/95	MA
		Bromoform	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E507149-02 Sample Type:WATER Collected:07/10/95 14:30	**RO-Z**							
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	07/11/95	07/12/95	MA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	07/11/95	07/12/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	07/11/95	07/12/95	MA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : 1-BA
Sample Date & Time : 12-09-95 1500
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14. 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-1-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28. 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	85.4	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	102.	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	5030.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	34.8	0.02
Chloride - Dissolved	17206L	mg/L	6690.	0.5
Sulphate - Dissolved	16306L	mg/L	1.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2160.	0.5
pH	10301L	Units	7.19	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2630.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	633.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.64	0.02
Fluoride	09105L	mg/L	0.77	0.05
Specific Conductance	02041L	umhos/Cm	21500.	0.02
Turbidity	02074L	NTU	14.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.060	0.001
Total Dissolved Solids	00201L	mg/L	13300.	1.
Dissolved Organic Carbon	06104L	mg/L	11.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.008	0.003
Total Phosphorus as P	15406L	mg/L	0.060	0.003
Sulphur - (ICP) - Dissolved		mg/L	2.9	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.91	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	4.32	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.013	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	1.35	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : 1-BA
Sample Date & Time : 12-09-95 1500
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-1-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	< 0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L	1.08	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L	0.335	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	0.006	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	0.018	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	< 0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	0.003	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L	5.19	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	< 0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	< 0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	0.009	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L	0.005	0.001
Ion Balance		Balance	1.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 14-09-95 1100
Sampled By : DH
Sample Type : GRAB .
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-2-L
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	24.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	20.5	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1850.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	21.0	0.02
Chloride - Dissolved	17206L	mg/L	1860.	0.5
Sulphate - Dissolved	16306L	mg/L	< 0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1900.	0.5
pH	10301L	Units	7.56	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2320.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	145.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.51	0.02
Fluoride	09105L	mg/L	1.57	0.05
Specific Conductance	02041L	umhos/Cm	8260.	0.02
Turbidity	02074L	NTU	22.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.027	0.001
Total Dissolved Solids	00201L	mg/L	4930.	1.
Dissolved Organic Carbon	06104L	mg/L	27.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.011	0.003
Total Phosphorus as P	15406L	mg/L	0.075	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.3	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.21	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.79	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.82	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 14-09-95 1100
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-2-L
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.363	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.085	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L		0.23	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.006	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		1.43	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		0.93	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-02 Sample Type:WATER Collected:09/14/95 15:40	OB-5							
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MA
E509368-03 Sample Type:WATER Collected:09/14/95 11:00	2-L							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthene	0.04	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluorene	0.07	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthrene	0.11	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd naphthalene	0.31	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd naphthalene	0.19	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluorene	0.08	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd fluorene	0.09	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	0.22	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	0.15	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	0.11	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	0.04	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl dibenzothiophene	0.12	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	0.15	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd dibenzothiophene	0.19	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		o-Cresol	0.1	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		p-Cresol	0.3	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dimethylphenol	0.1	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2-Nitrophenol	N.D.	2	ug/L (ppb)	09/25/95	10/05/95	MBM
		4-Nitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-03 Sample Type:WATER Collected:09/14/95 11:00	2-L							
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509368-04 Sample Type:WATER Collected:09/14/95 11:00	2-LD1							
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 2-L-D1
Sample Date & Time : 14-09-95 1100
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-2-L-D1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	26.3	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	24.7	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1870.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	24.1	0.02
Chloride - Dissolved	17206L	mg/L	1690.	0.5
Sulphate - Dissolved	16306L	mg/L	16.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1910.	0.5
pH	10301L	Units	7.65	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2330.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	167.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	3.02	0.02
Fluoride	09105L	mg/L	1.62	0.05
Specific Conductance	02041L	umhos/Cm	8230.	0.02
Turbidity	02074L	NTU	17.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.029	0.001
Total Dissolved Solids	00201L	mg/L	4820.	1.
Dissolved Organic Carbon	06104L	mg/L	28.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.085	0.003
Sulphur - (ICP) - Dissolved		mg/L	2.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.02	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.24	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	4.00	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.81	0.01

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 2-L-D1
Sample Date & Time : 14-09-95 1100
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-2-L-D1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.387	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.099	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L		0.10	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.009	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.007	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		1.49	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		0.99	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-03 Sample Type:WATER Collected:09/14/95 11:00	2-L							
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509368-04 Sample Type:WATER Collected:09/14/95 11:00	2-LD1							
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-04 Sample Type:WATER Collected:09/14/95 11:00	2-LD1							
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

ENVIRO-TEST QA/QC REPORT

PAH & Alkylated PAH's

Average Surrogate Recovery for E509368	%
Nitrobenzene d5	96
2-Fluorobiphenyl	86
p-Terphenyl d14	91

PANH & Alkylated PANH's

Average Surrogate Recovery for E509368	%
Quinoline d7	102

Phenolic Compounds in H2O

Average Surrogate Recovery for E509368	%
2-Fluorophenol	32
Phenol d5	19
2,4,6-Tribromophenol	80

Volatile Organics (MS):H20

Average Surrogate Recovery for E509368	%
1,2-Dichloroethane d4	109
Toluene d8	103
4-Bromofluorobenzene	104

Relative percent difference is expressed as RPD.
Percent Recovery is expressed as %.
THIS IS THE LAST PAGE OF THE QAQC REPORT

Appendix A Test Methodologies

PAH & Alkylated PAH's

Preparation Method:	Liquid/liquid extraction with DCM, methylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3540 (modified) Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H2O

Preparation Method:	Liquid/liquid extraction with DCM, acetylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3510 (modified) Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method:	Automated headspace
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3810 (modified) Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : 3-BA
Sample Date & Time : 13-09-95 1545
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-3-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	47.1	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	43.3	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	3140.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	17.8	0.02
Chloride - Dissolved	17206L	mg/L	4090.	0.5
Sulphate - Dissolved	16306L	mg/L	30.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1890.	0.5
pH	10301L	Units	7.33	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2300.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	296.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.14	0.02
Fluoride	09105L	mg/L	1.09	0.05
Specific Conductance	02041L	umhos/Cm	14300.	0.02
Turbidity	02074L	NTU	17.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.080	0.001
Total Dissolved Solids	00201L	mg/L	8520.	1.
Dissolved Organic Carbon	06104L	mg/L	5.4	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.121	0.003
Sulphur - (ICP) - Dissolved		mg/L	2.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.51	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	4.45	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.007	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.84	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : 3-BA
Sample Date & Time : 13-09-95 1545
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-3-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L		0.04	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.662	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.126	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.3	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		2.83	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.006	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.007	0.001
Ion Balance		Balance		0.93	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : 6-BA
Sample Date & Time : 15-09-95 1400
Sampled By :
Sample Type : GRAB
Sample Received Date: September 16, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03258-6-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		198.	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		223.	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		10700.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		62.0	0.02
Chloride - Dissolved	17206L	mg/L		16900.	0.5
Sulphate - Dissolved	16306L	mg/L		80.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2080.	0.5
pH	10301L	Units		7.12	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		2540.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		1410.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		3.22	0.02
Fluoride	09105L	mg/L		0.45	0.05
Specific Conductance	02041L	umhos/Cm		43400.	0.02
Turbidity	02074L	NTU		60.0	0.1
Cyanide (Available)	06608L	mg/L	<	0.001	0.001
Phenols	06537L	mg/L		0.020	0.001
Total Dissolved Solids	00201L	mg/L		29400.	1.
Dissolved Organic Carbon	06104L	mg/L		3.0	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L		0.007	0.003
Total Phosphorus as P	15406L	mg/L		0.080	0.003
Sulphur - (ICP) - Dissolved		mg/L		1.4	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.02	0.01
Arsenic - Dissolved (AA)	33109L	mg/L		0.0014	0.0002
Barium - Dissolved (ICP-AES)	56109L	mg/L		2.66	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L		0.002	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		3.70	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L		0.015	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.022	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : 6-BA
Sample Date & Time : 15-09-95 1400
Sampled By :
Sample Type : GRAB
Sample Received Date: September 16, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03258-6-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Iron - Dissolved (ICP-AES)	26109L	mg/L		4.63	0.01
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		1.55	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		2.59	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L		1.60	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.012	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.079	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		14.7	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.005	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L		0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.007	0.001
Ion Balance		Balance		0.95	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509363-01 Sample Type:WATER Collected:09/15/95 14:00	6-BA							
		PAH & Alkylated PAH's						
		Naphthalene	0.05	0.02	ug/L (ppb)	09/22/95	10/02/95	M
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	M
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	0.02	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	0.05	0.02	ug/L (ppb)	09/22/95	10/02/95	M
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	M
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	M
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJ
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJ
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJ
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	0.07	0.02	ug/L (ppb)	09/22/95	10/02/95	MJ
		C2 sub'd naphthalene	0.09	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		C3 sub'd naphthalene	0.29	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		C4 sub'd naphthalene	0.07	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	0.09	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJ
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJI
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJI
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	0.06	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJI
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJI
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJl
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJl
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJl
		Phenolic Compounds in H2O						
		Phenol	N.D.	1	ug/L (ppb)	09/22/95	10/05/95	MBM
		o-Cresol	N.D.	1	ug/L (ppb)	09/22/95	10/05/95	MBM
		m-Cresol	N.D.	1	ug/L (ppb)	09/22/95	10/05/95	MBM
		p-Cresol	N.D.	1	ug/L (ppb)	09/22/95	10/05/95	MBI
		2,4-Dimethylphenol	N.D.	1	ug/L (ppb)	09/22/95	10/05/95	MBI
		2-Nitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/05/95	MBI
		4-Nitrophenol	N.D,	20	ug/L (ppb)	09/22/95	10/05/95	MBM
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	09/22/95	10/05/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	09/22/95	10/05/95	MBI
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		7-Methyl quinoline	4.0	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509363-01 Sample Type:WATER Collected:09/15/95 14:00	**6-BA**							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509363-02 Sample Type:WATER Collected:09/15/95 15:10	**RO-1**							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : 8-BA
Sample Date & Time : 13-09-95 1145
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-8-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	13.7	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	7.80	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	1180.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	20.0	0.02
Chloride - Dissolved	17206L	mg/L	678.	0.5
Sulphate - Dissolved	16306L	mg/L	13.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	1800.	0.5
pH	10301L	Units	7.45	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2190.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	66.4	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.09	0.02
Fluoride	09105L	mg/L	1.33	0.05
Specific Conductance	02041L	umhos/Cm	4950.	0.02
Turbidity	02074L	NTU	600.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.033	0.001
Total Dissolved Solids	00201L	mg/L	3010.	1.
Dissolved Organic Carbon	06104L	mg/L	29.2	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.240	0.003
Sulphur - (ICP) - Dissolved		mg/L	25.7	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.06	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.16	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.93	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.018	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	0.009	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.74	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : 8-BA
Sample Date & Time : 13-09-95 1145
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-8-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L		0.04	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.355	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.075	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L		0.007	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.7	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.573	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.012	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.003	0.001
Ion Balance		Balance		0.96	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 14-09-95 1615
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-13-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	90.6	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	82.7	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	3050.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	24.1	0.02
Chloride - Dissolved	17206L	mg/L	4090.	0.5
Sulphate - Dissolved	16306L	mg/L	0.6	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	2070.	0.5
pH	10301L	Units	7.21	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	2530.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	567.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	2.74	0.02
Fluoride	09105L	mg/L	0.58	0.05
Specific Conductance	02041L	umhos/Cm	14500.	0.02
Turbidity	02074L	NTU	50.0	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.093	0.001
Total Dissolved Solids	00201L	mg/L	8600.	1.
Dissolved Organic Carbon	06104L	mg/L	4.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	< 0.003	0.003
Total Phosphorus as P	15406L	mg/L	0.086	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.80	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	3.87	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	5.63	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : 13-BA
Sample Date & Time : 14-09-95 1615
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-13-BA
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	0.03	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L	0.825	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L	0.600	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	0.13	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	< 0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	< 0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	< 0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	< 0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L	4.73	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	< 0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	< 0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	< 0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L	0.002	0.001
Ion Balance		Balance	0.92	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-01 Sample Type:WATER Collected:09/14/95 16:45	13-BA							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Fluorene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthrene	0.02	0.02	ug/L (ppb)	09/25/95	10/02/95	MJI
		Anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	M.
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJ
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJ
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJ
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJI
		C3 sub'd naphthalene	0.04	0.04	ug/L (ppb)	09/25/95	10/02/95	MJ
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJ
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJI
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJI
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJI
		Methyl phenanthrene/anthracene	0.05	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	0.05	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJI
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBI
		o-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		p-Cresol	0.2	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBI
		2-Nitrophenol	N.D.	2	ug/L (ppb)	09/25/95	10/05/95	MBI
		4-Nitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-01 Sample Type:WATER Collected:09/14/95 16:45	13-BA							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509368-02 Sample Type:WATER Collected:09/14/95 15:40	OB-5							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd naphthalene	0.05	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : BRDG-4
Sample Date & Time : 13-09-95 1145
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-BRDG-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	20.5	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	3.50	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	6.20	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	1.50	0.02
Chloride - Dissolved	17206L	mg/L	4.3	0.5
Sulphate - Dissolved	16306L	mg/L	25.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	48.0	0.5
pH	10301L	Units	6.60	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	58.5	0.5
Total Hardness (as CaCO3)	10602L	mg/L	65.7	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.06	0.02
Fluoride	09105L	mg/L	0.12	0.05
Specific Conductance	02041L	umhos/Cm	175.	0.02
Turbidity	02074L	NTU	1900.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	0.003	0.001
Total Dissolved Solids	00201L	mg/L	92.	1.
Dissolved Organic Carbon	06104L	mg/L	10.0	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.204	0.003
Total Phosphorus as P	15406L	mg/L	4.00	0.003
Sulphur - (ICP) - Dissolved		mg/L	10.0	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.06	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.03	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.20	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.002	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.17	0.01

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : BRDG-4
Sample Date & Time : 13-09-95 1145
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-BRDG-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.002	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.014	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.012	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.053	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.018	0.001
Ion Balance		Balance		1.00	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-1
Sample Date & Time : 12-09-95 1430
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	71.9	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	18.7	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	9.80	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	2.60	0.02
Chloride - Dissolved	17206L	mg/L	0.7	0.5
Sulphate - Dissolved	16306L	mg/L	16.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	245.	0.5
pH	10301L	Units	7.49	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	299.	0.5
Total Hardness (as CaCO3)	10602L	mg/L	257.	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	4.45	0.02
Fluoride	09105L	mg/L	0.18	0.05
Specific Conductance	02041L	umhos/Cm	478.	0.02
Turbidity	02074L	NTU	150.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	270.	1.
Dissolved Organic Carbon	06104L	mg/L	3.1	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.183	0.003
Total Phosphorus as P	15406L	mg/L	0.213	0.003
Sulphur - (ICP) - Dissolved		mg/L	5.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	< 0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.09	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	0.02	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	0.005	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.04	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2, Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-1
Sample Date & Time : 12-09-95 1430
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.008	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.306	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L		0.10	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.149	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.004	0.001
Ion Balance		Balance		1.07	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509289-01 Sample Type:WATER Collected:09/12/95 14:30	OB-1							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509289-01 Sample Type:WATER Collected:09/12/95 14:30	OB-1							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509289-02 Sample Type:WATER Collected:09/12/95 15:40	OB-4							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : OB-2
Sample Date & Time : 13-09-95 1510
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-OB-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS		RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		21.4	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		6.10	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		195.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		3.10	0.02
Chloride - Dissolved	17206L	mg/L		10.0	0.5
Sulphate - Dissolved	16306L	mg/L		0.8	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		481.	0.5
pH	10301L	Units		7.75	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		586.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		78.6	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		8.96	0.02
Fluoride	09105L	mg/L		0.53	0.05
Specific Conductance	02041L	umhos/Cm		885.	0.02
Turbidity	02074L	NTU		2.7	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.002	0.001
Total Dissolved Solids	00201L	mg/L		530.	1.
Dissolved Organic Carbon	06104L	mg/L		11.4	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.118	0.003
Sulphur - (ICP) - Dissolved		mg/L		1.5	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.16	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.79	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L		0.004	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.02	0.01

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
#A005

Sample Description : OB-2
Sample Date & Time : 13-09-95 1510
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03273-OB-2
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 29, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.055	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.121	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.009	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.4	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.209	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.005	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.028	0.001
Ion Balance		Balance		1.02	0.01

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-3
Sample Date & Time : 12-09-95 1415
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14. 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28. 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	3.80	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	1.10	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	4.60	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	1.20	0.02
Chloride - Dissolved	17206L	mg/L	9.7	0.5
Sulphate - Dissolved	16306L	mg/L	9.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	8.0	0.5
pH	10301L	Units	5.61	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	9.8	0.5
Total Hardness (as CaCO3)	10602L	mg/L	14.0	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	5.33	0.02
Fluoride	09105L	mg/L	< 0.05	0.05
Specific Conductance	02041L	umhos/Cm	39.0	0.02
Turbidity	02074L	NTU	850.	0.1
Cyanide (Available)	06608L	mg/L	< 0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	34.	1.
Dissolved Organic Carbon	06104L	mg/L	3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.023	0.003
Total Phosphorus as P	15406L	mg/L	0.750	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.2	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.16	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.02	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	< 0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	< 0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.36	0.01

NOTES : Anion-cation balance is lower than our normal limit. Possibly due to low level of major ions.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-3
Sample Date & Time : 12-09-95 1415
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-3
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.002	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.019	0.001
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.006	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.035	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.020	0.001

NOTES : Anion-cation balance is lower than our normal limit. Possibly due to low level of major ions.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-4
Sample Date & Time : 12-09-95 1415
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS	DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L	4.60	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	1.40	0.01
Sodium - (ICP) Dissolved	11111L	mg/L	5.20	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	1.10	0.02
Chloride - Dissolved	17206L	mg/L	2.2	0.5
Sulphate - Dissolved	16306L	mg/L	10.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	< 0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L	8.0	0.5
pH	10301L	Units	5.76	0.01
Carbonate	06301L	mg/L	< 0.5	0.5
Bicarbonate	06201L	mg/L	9.8	0.5
Total Hardness (as CaCO3)	10602L	mg/L	17.3	0.5
Hydroxide	08501L	mg/L	< 0.5	0.5
Silicon - Dissolved (ICP)		mg/L	5.36	0.02
Fluoride	09105L	mg/L	< 0.05	0.05
Specific Conductance	02041L	umhos/Cm	50.3	0.02
Turbidity	02074L	NTU	575.	0.1
Cyanide (Available)	06608L	mg/L	0.001	0.001
Phenols	06537L	mg/L	< 0.001	0.001
Total Dissolved Solids	00201L	mg/L	30.	1.
Dissolved Organic Carbon	06104L	mg/L	3.6	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	0.065	0.003
Total Phosphorus as P	15406L	mg/L	0.215	0.003
Sulphur - (ICP) - Dissolved		mg/L	3.6	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	0.03	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L	0.01	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	< 0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	< 0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	< 0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	< 0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	< 0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L	0.05	0.01

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : OB-4
Sample Date & Time : 12-09-95 1415
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 14, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03214-OB-4
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : September 28, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.003	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.015	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.010	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L		0.003	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.038	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.017	0.001

NOTES : Anion-cation balance is higher than our normal limits. Possibly due to the low level of major ions.

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509289-01	**OB-1**							
Sample Type:WATER								
Collected:09/12/95	14:30							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509289-02	**OB-4**							
Sample Type:WATER								
Collected:09/12/95	15:40							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509289-02 Sample Type:WATER Collected:09/12/95 15:40	**OB-4**							
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509289-02 Sample Type:WATER Collected:09/12/95 15:40	**OB-4**							
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	M
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	M
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	M

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

ENVIRO-TEST QA/QC REPORT

PAH & Alkylated PAH's

Average Surrogate Recovery for E509289	%
Nitrobenzene d5	97
2-Fluorobiphenyl	84
p-Terphenyl d14	90

PANH & Alkylated PANH's

Average Surrogate Recovery for E509289	%
Quinoline d7	96

Phenolic Compounds in H2O

Average Surrogate Recovery for E509289	%
2-Fluorophenol	21
Phenol d5	15
2,4,6-Tribromophenol	64

Volatile Organics (MS):H20

Average Surrogate Recovery for E509289	%
1,2-Dichloroethane d4	108
Toluene d8	106
4-Bromofluorobenzene	98

Relative percent difference is expressed as RPD.
Percent Recovery is expressed as %.
THIS IS THE LAST PAGE OF THE QAQC REPORT

Appendix A Test Methodologies

PAH & Alkylated PAH's

Preparation Method:	Liquid/liquid extraction with DCM, methylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3540 (modified) Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H2O

Preparation Method:	Liquid/liquid extraction with DCM, acetylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3510 (modified) Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H2O

Preparation Method:	Automated headspace
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3810 (modified) Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

Sample Description : OB-5
Sample Date & Time : 14-09-95 1540
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-OB-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		52.0	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L		14.0	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		190.	0.01
Potassium -(ICP) Dissolved	19111L	mg/L		2.40	0.02
Chloride - Dissolved	17206L	mg/L		10.2	0.5
Sulphate - Dissolved	16306L	mg/L		5.0	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		573.	0.5
pH	10301L	Units		7.44	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		698.	0.5
Total Hardness (as CaCO3)	10602L	mg/L		188.	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L		9.24	0.02
Fluoride	09105L	mg/L		0.80	0.05
Specific Conductance	02041L	umhos/Cm		1050.	0.02
Turbidity	02074L	NTU		4.0	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L		0.003	0.001
Total Dissolved Solids	00201L	mg/L		623.	1.
Dissolved Organic Carbon	06104L	mg/L		9.8	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.047	0.003
Sulphur - (ICP) - Dissolved		mg/L		2.8	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L		0.01	0.01
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.17	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L		0.64	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L		0.001	0.001
Iron - Dissolved (ICP-AES)	26109L	mg/L		0.12	0.01

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A004

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

Sample Description : OB-5
Sample Date & Time : 14-09-95 1540
Sampled By : DH
Sample Type : GRAB
Sample Received Date: September 18, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03274-OB-5
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 3, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L		0.053	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L		0.365	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L		0.014	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L		0.1	0.1
Selenium - Dissolved (AA)	34105L	mg/L	<	0.0002	0.0002
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L		0.240	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L		0.004	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.009	0.001
Ion Balance		Balance		1.02	0.01

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-01	13-BA							
Sample Type:WATER								
Collected:09/14/95	16:45							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509368-02	OB-5							
Sample Type:WATER								
Collected:09/14/95	15:40							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd naphthalene	0.05	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-02 Sample Type:WATER Collected:09/14/95 15:40	OB-5							
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2-Nitrophenol	N.D.	2	ug/L (ppb)	09/25/95	10/05/95	MBM
		4-Nitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/22/95	09/22/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/22/95	09/22/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/22/95	09/22/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/22/95	09/22/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/22/95	09/22/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/22/95	09/22/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/22/95	09/22/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/22/95	09/22/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/22/95	09/22/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/22/95	09/22/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509368-02 Sample Type:WATER Collected:09/14/95 15:40	**OB-5**							
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/22/95	09/22/95	MAA
E509368-03 Sample Type:WATER Collected:09/14/95 11:00	**2-L**							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acenaphthene	0.04	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluorene	0.07	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthrene	0.11	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd naphthalene	0.31	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd naphthalene	0.19	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluorene	0.08	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd fluorene	0.09	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	0.22	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	0.15	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	0.11	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	0.04	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl dibenzothiophene	0.12	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	0.15	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 sub'd dibenzothiophene	0.19	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		o-Cresol	0.1	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		p-Cresol	0.3	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dimethylphenol	0.1	0.1	ug/L (ppb)	09/25/95	10/05/95	MBM
		2-Nitrophenol	N.D.	2	ug/L (ppb)	09/25/95	10/05/95	MBM
		4-Nitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		2,4-Dinitrophenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	20	ug/L (ppb)	09/25/95	10/05/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Carbazole	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/25/95	10/02/95	MJL
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : RO-1
Sample Date & Time : 15-09-95 1510
Sampled By :
Sample Type : GRAB
Sample Received Date: September 16, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03258-RO-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	RESULTS		DETECTION LIMIT
Calcium - (ICP) Dissolved	20111L	mg/L		0.07	0.01
Magnesium - (ICP) Dissolved	12111L	mg/L	<	0.01	0.01
Sodium - (ICP) Dissolved	11111L	mg/L		0.27	0.01
Potassium -(ICP) Dissolved	19111L	mg/L	<	0.02	0.02
Chloride - Dissolved	17206L	mg/L		4.4	0.5
Sulphate - Dissolved	16306L	mg/L	<	0.5	0.5
PP Alkalinity (as CaCO3)	10151L	mg/L	<	0.1	0.1
Total Alkalinity (as CaCO3)	10111L	mg/L		2.7	0.5
pH	10301L	Units		5.56	0.01
Carbonate	06301L	mg/L	<	0.5	0.5
Bicarbonate	06201L	mg/L		3.3	0.5
Total Hardness (as CaCO3)	10602L	mg/L	<	0.5	0.5
Hydroxide	08501L	mg/L	<	0.5	0.5
Silicon - Dissolved (ICP)		mg/L	<	0.02	0.02
Fluoride	09105L	mg/L	<	0.05	0.05
Specific Conductance	02041L	umhos/Cm		12.3	0.02
Turbidity	02074L	NTU		0.2	0.1
Cyanide (Available)	06608L	mg/L		0.001	0.001
Phenols	06537L	mg/L	<	0.001	0.001
Total Dissolved Solids	00201L	mg/L		7.	1.
Dissolved Organic Carbon	06104L	mg/L		0.5	0.2
Nitrite plus Nitrate Nitrogen as N	07110L	mg/L	<	0.003	0.003
Total Phosphorus as P	15406L	mg/L		0.003	0.003
Sulphur - (ICP) - Dissolved		mg/L	<	0.2	0.2
Aluminum - Dissolved (ICP-AES)	13109L	mg/L	<	0.01	0.01
Arsenic - Dissolved (AA)	33109L	mg/L	<	0.0002	0.0002
Barium - Dissolved (ICP-AES)	56109L	mg/L		0.01	0.01
Beryllium - Dissolved (ICP-AES)	04103L	mg/L	<	0.001	0.001
Boron - Dissolved (ICP-AES)	05111L	mg/L	<	0.01	0.01
Cadmium - Dissolved (ICP-AES)	48501L	mg/L	<	0.003	0.003
Chromium - Dissolved (ICP-AES)	24360L	mg/L	<	0.002	0.002
Cobalt - Dissolved (ICP-AES)	27360L	mg/L	<	0.003	0.003
Copper - Dissolved (ICP-AES)	29109L	mg/L	<	0.001	0.001

CHEMEX Labs Alberta Inc.

Calgary : 2021 - 41st Avenue N.E., T2E 6P2. Telephone (403) 291-3077, FAX (403) 291-9468
Edmonton : 9331 - 48th Street, T6B 2R4, Telephone (403) 465-9877, FAX (403) 466-3332

SUNCOR INC. OIL SANDS GROUP
ATTENTION : JOHN GULLEY
SA-5709-A005

Sample Description : RO-1
Sample Date & Time : 15-09-95 1510
Sampled By :
Sample Type : GRAB
Sample Received Date: September 16, 1995
Sample Station Code :

Chemex Worksheet Number : 95-03258-RO-1
Chemex Project Number : SUNC178-0501
Sample Access :
Sample Matrix : WATER
Report Date : October 2, 1995

PARAMETER DESCRIPTION	NAQUADAT CODE	UNITS	R E S U L T S		DETECTION LIMIT
Iron - Dissolved (ICP-AES)	26109L	mg/L	<	0.01	0.01
Lead - Dissolved (ICP-AES)	82111L	mg/L	<	0.02	0.02
Lithium - Dissolved (ICP-AES)	03109L	mg/L	<	0.001	0.001
Manganese - Dissolved (ICP-AES)	25109L	mg/L	<	0.001	0.001
Mercury - Dissolved (CVAA)	80101L	ug/L	<	0.05	0.05
Molybdenum - Dissolved (ICP-AES)	42330L	mg/L	<	0.003	0.003
Nickel - Dissolved (ICP-AES)	28350L	mg/L	<	0.005	0.005
Phosphorus - Dissolved (ICP-AES)	15450L	mg/L	<	0.1	0.1
Silver - Dissolved (ICP-AES)	47450L	mg/L	<	0.002	0.002
Strontium - Dissolved (ICP-AES)	38111L	mg/L	<	0.002	0.002
Titanium - Dissolved (ICP-AES)	22111D	mg/L	<	0.003	0.003
Uranium - Dissolved (ICP-AES)		mg/L	<	0.5	0.5
Vanadium - Dissolved (ICP-AES)	23330D	mg/L	<	0.002	0.002
Zinc - Dissolved (ICP-AES)	30501D	mg/L		0.016	0.001

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	B
E509363-01 Sample Type:WATER Collected:09/15/95 14:00	**6-BA**							
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
E509363-02 Sample Type:WATER Collected:09/15/95 15:10	**RO-1**							
		PAH & Alkylated PAH's						
		Naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Acenaphthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluorene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzothiophene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenanthrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)anthracene/Chrysene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(b&k)fluoranthene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(a)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Indeno(c,d-123)pyrene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Dibenzo(a,h)anthracene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Benzo(ghi)perylene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl naphthalene	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd naphthalene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd biphenyl	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl acenaphthene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd fluorene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl phenanthrene/anthracene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C3 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd phenanthrene/anth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		1-Methyl-7-isopropylphenanth.	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509363-02 Sample Type:WATER Collected:09/15/95 15:10	**RO-1**							
		C3 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C4 sub'd dibenzothiophene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl fluoranthene/pyrene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(a)A/chrysene	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Methyl B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		C2 sub'd B(b&k)F/B(a)P	N.D.	0.04	ug/L (ppb)	09/22/95	10/02/95	MJL
		Phenolic Compounds in H2O						
		Phenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		o-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		m-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		p-Cresol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dimethylphenol	N.D.	0.1	ug/L (ppb)	09/22/95	10/02/95	MBM
		2-Nitrophenol	N.D.	0.2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4-Nitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		2,4-Dinitrophenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		4,6-Dinitro-2-methylphenol	N.D.	2	ug/L (ppb)	09/22/95	10/02/95	MBM
		PANH & Alkylated PANH's						
		Quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		7-Methyl quinoline	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		C2 Alkyl subst'd quinolines	0.03	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		C3 Alkyl subst'd quinolines	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Methyl acridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Phenanthridine	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Carbazole	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Methyl carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		C2 Alkyl subst'd carbazoles	N.D.	0.02	ug/L (ppb)	09/22/95	10/02/95	mjl
		Volatile Organics (MS):H20						
		Dichlorodifluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloromethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl chloride	N.D.	20	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromomethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroethane	N.D.	10	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethanol	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichlorofluoromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrolein	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acetone	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Iodomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon disulfide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Methylene chloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Acrylonitrile	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,2-Dichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Vinyl acetate	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Butanone (MEK)	N.D.	100	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chloroform	14	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,1-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Carbon tetrachloride	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Benzene	1	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Trichloroethene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2-Dichloropropane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromodichloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromomethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Chloroethylvinylether	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		4-Methyl-2-pentanone (MIBK)	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Toluene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethyl methacrylate	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		trans-1,3-Dichloropropene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		2-Hexanone	N.D.	200	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2-Trichloroethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Tetrachloroethylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Dibromochloromethane	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylene dibromide	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Chlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Ethylbenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		m+p-Xylenes	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		o-Xylene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		Styrene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		cis-1,4-Dichloro-2-butene	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA
		Bromoform	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,1,2,2-Tetrachloroethane	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MAA
		1,2,3-Trichloropropane	N.D.	2	ug/L (ppb)	09/19/95	09/20/95	MAA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E509363-02 Sample Type:WATER Collected:09/15/95	**RO-1** 15:10							
		trans-1,4-Dichloro-2-butene	N.D.	5	ug/L (ppb)	09/19/95	09/20/95	MA
		1,3-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		1,4-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA
		1,2-Dichlorobenzene	N.D.	1	ug/L (ppb)	09/19/95	09/20/95	MA

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

ENVIRO-TEST QA/QC REPORT

PAH & Alkylated PAH's

Average Surrogate Recovery for E509363	**%**
Nitrobenzene d5	94
2-Fluorobiphenyl	86
p-Terphenyl d14	87

PANH & Alkylated PANH's

Average Surrogate Recovery for E509363	**%**
Quinoline d7	88

Phenolic Compounds in H2O

Average Surrogate Recovery for E509363	**%**
2-Fluorophenol	34
Phenol d5	20
2,4,6-Tribromophenol	99

Volatile Organics (MS):H20

Average Surrogate Recovery for E509363	**%**
1,2-Dichloroethane d4	108
Toluene d8	100
4-Bromofluorobenzene	105

Relative percent difference is expressed as RPD.
Percent Recovery is expressed as %.
THIS IS THE LAST PAGE OF THE QAQC REPORT

Appendix A Test Methodologies

PAH & Alkylated PAH's

Preparation Method:	Liquid/liquid extraction with DCM, methylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3540 (modified) Analytical Method: EPA 8270 (modified)

Phenolic Compounds in H2O

Preparation Method:	Liquid/liquid extraction with DCM, acetylation
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3510 (modified) Analytical Method: EPA 8270 (modified)

PANH & Alkylated PANH's

Volatile Organics (MS):H20

Preparation Method:	Automated headspace
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3810 (modified) Analytical Method: EPA 8240 (modified)

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

MUNIR JIVRAJ

SUNCOR GROUNDWATER STUDY

May - Oct '95

Sample	Sample		Project	Analysis				MTOX @ 15 MIN				
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	IC40	IC30	IC20	NAPHTHENIC ACID (PPM)****
950628	1-BA	N/A	GW	950706	21500	7.18		100	100	100	100	22
950912	1-BA	N/A	GW	950918	20700	7.41		100	100	100	100	21
950705	13-BA	N/A	GW	950712	12280	6.71		100	100	100	100	13
950914	13-BA	N/A	GW	950918	14030	7.08		100	100	100	100	12
950705	13-BA-D1	N/A	GW	950712	12010	6.66		100	100	100	100	12
950629	2-L	N/A	GW	950706	7770	7.68		100	100	100	59	47
950914	2-L	N/A	GW	950918	8150	7.55		100	100	100	49	57
950912	2-L-D1	N/A	GW	950918	7620	7.55		100	100	100	75	52
950704	3-BA	N/A	GW	950706	14210	6.17	7	100	100	100	100	31
950913	3-BA	N/A	GW	950918	14100	7.28		100	100	100	71	29
950710	6-BA	N/A	GW	950712	38400	6.51		100	100	100	100	8
950915	6-BA	N/A	GW	950918	43500	6.96		100	100	100	100	9
950628	8-BA	N/A	GW	950706	3820	8.03		100	100	100	80*	31
950913	8-BA	N/A	GW	950918	4710	7.5		100	100	91	34	36
950710	BRDG-4	N/A	GW	950712	487	8.46		100	100	100	100	2
950913	BRDG-4	N/A	GW	950918	181	7.55		100	100	100	100	1
950602	DUP1	N/A	GW	950606	3850	6.85		100	100	100	100	5
950602	DUP2	N/A	GW	950606	3950	6.81		100	100	100	100	4
950607	DW-1	N/A	GW	950609	6	7.33		100	100	100	100	<1
950607	DW-2	N/A	GW	950609	6	7.11		100	100	100	100	<1
950607	DW-3	N/A	GW	950609	6	6.54		100	100	100	100	<1
950524	EXPT-BLANK	N/A	GW	950524	5	6.69		100	100	100	100	<1
950717	EXPT-BLANK	N/A	GW	950717	8	6.93		100	100	100	100	<1
950815	EXPT-BLANK	N/A	GW	950815	7	6.97		100	100	100	100	<1
950913	EXPT-BLANK	N/A	GW	950913	10	6.99		100	100	100	100	<1
950926	EXPT-BLANK	N/A	GW	950926	6	5.69		100	100	100	100	<1
951023	EXPT-BLANK	N/A	GW	951023	12	7.12		100	100	100	100	<1
950526	ME-i	N/A	GW	950529	367	6.83		20	15	11	8*	<1*
950703	OB-1	N/A	GW	950706	515	7.81		100	100	100	100	<4
950912	OB-1	N/A	GW	950918	450	7.71		100	100	100	100	5
950629	OB-2	N/A	GW	950706	939	8.07		100	100	100	100	6
950913	OB-2	N/A	GW	950918	841	8.05		100	100	100	100	5
950704	OB-3	N/A	GW	950706	?	5.93	7.02	100	100	100	100	<3
950912	OB-3	N/A	GW	950918	4290	5.95	6.72	100	100	100	100	4
950703	OB-4	N/A	GW	950706	69	7.16		100	100	100	100	<3
950912	OB-4	N/A	GW	950918	47	6.34	7.15	100	100	100	100	4
950705	OB-5	N/A	GW	950712	855	7.16		100	100	100	100	6
950914	OB-5	N/A	GW	950918	968	7.48		100	100	100	100	7
950518	OW84-PP1	N/A	GW	950523	3100	6.48		100	100	100	100	14
950518	MANNIX	RG 003	GW	950523	216	7.83		100	100	100	100	<1
950523	ENV89-1A	RG 005	GW	950525	16860	6.83		100	100	100	100	11
950919	ENV89-1A	RG 005	GW	950926	19030	8.08		100	100	100	100	18
950523	ENV89-1B	RG 006	GW	950525	4610	7.09		100	100	100	100	5
950925	ENV89-1B	RG 006	GW	951006	5280	8.13		100	100	100	100	6
950523	ENV89-1BD1	RG 006	GW	950525	4640	7.11		100	100	100	100	7
950925	ENV89-1B	RG 006-D1	GW	951006	5360	7.56		100	100	100	100	6
950523	ENV89-1C	RG 007	GW	950525	1385	6.95		100	100	100	100	25
950920	ENV89-1C	RG 007	GW	950922	1437	7.36		100	100	100	100	31

C. Fordham/ J. Gulley

MUNIR JIVRAJ SUNCOR GROUNDWATER STUDY May - Oct '95

Sample	Sample		Project	Analysis				MTOX @ 15 MIN				
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	IC40	IC30	IC20	NAPHTHEN ACID (PPM)
950523	ENV89-1D	RG 008	GW	950525	1353	6.85		100	100	71	32*	31
950919	ENV89-1D	RG 008	GW	950926	1352	7.83		100	100	100	100	33
950525	ENV89-2A	RG 009	GW	950529	1162	6.64		100	100	100	100	3
950920	ENV89-2A	RG 009	GW	950922	1181	7.29		100	100	100	100	5
950525	ENV89-2B	RG 010	GW	950529	1339	6.43		100	100	100	100	20
950920	ENV89-2B	RG 010	GW	950922	1510	7.18		100	90	44	22*	34
950530	ENV89-3A	RG 011	GW	950602	1580	7.13		100	100	100	100	10
951002	ENV89-3A	RG 011	GW	951006	1564	7.73		100	100	100	100	13
950530	ENV89-3AD1	RG 011	GW	950602	1510	7.07		100	100	100	100	10
951002	ENV89-3A	RG 011-D1	GW	951006	1536	7.83		100	100	100	100	12
950601	ENV89-3B	RG 012	GW	950602	1369	7.19		100	100	100	100	20
951002	ENV89-3B	RG 012	GW	951006	1359	7.84		100	100	100	100	19
950525	ENV89-4A	RG 013	GW	950529	2810	6.35	7	100	100	100	100	6
950921	ENV89-4A	RG 013	GW	950926	2340	7		100	100	100	100	7
950525	ENV89-4B	RG 014	GW	950529	1562	6.54		100	100	100	49	43
950921	ENV89-4B	RG 014	GW	950922	1708	7.05		100	91	44	21*	40
950529	ENV91-1A	RG 015	GW	950602	1912	6.85		100	100	100	100	4
950926	ENV91-1A	RG 015	GW	951006	2070	7.34		100	100	100	100	3
950529	ENV91-1B	RG 016	GW	950602	1950	6.69		100	100	100	100	31
950926	ENV91-1B	RG 016	GW	951006	2050	7.34		100	100	100	100	34
950531	ENV91-2B	RG 019	GW	950602	9990	6.67		100	100	100	100	12
950926	ENV91-2B	RG 019	GW	951006	10600	7.08		100	100	100	100	13
950518	ENV91-3A	RG 020	GW	950523	6250	6.3	7.3	100	100	100	100	8
951010	ENV91-3A	RG 020	GW	951019	5370	6.64		100	100	100	100	8
950615	ENV91-3B	RG 021	GW	950619	N/A	7.01		100	100	100	100	12
950615	ENV91-3B	RG 021-D1	GW	950619	3770	6.38	7.2	100	100	100	100	9
951010	ENV91-3B	RG 021	GW	951017	2940	7		100	100	100	100	11
951010	ENV91-3B	RG 021-D1	GW	951019	2410	7.76		100	100	100	100	11
950622	ENV91-5	RG 022	GW	950623	9570	7.13		80	42	23	12	48
950524	ENV91-7A	RG 024	GW	950525	1456	8.31		49	28	16	9	52
950927	ENV91-7A	RG 024	GW	951006	1774	8.84	7	32	21	14	9	62
950524	ENV91-7B	RG 025	GW	950525	1621	6.76		100	100	100	94	23
951024	ENV91-7B	RG 025	GW	951030	1546	7.13		100	100	100	50*	27
950606	ENV91-8	RG 026	GW	950607	1419	6.67		13	10	7	5	19
951018	ENV91-8	RG 026	GW	951020	1604	7.04		26	19	14	10	21
950606	ENV91-8D1	RG 026	GW	950607	1427	6.77		15	11	9	6	19
951018	ENV91-8	RG 026-D1	GW	951020	1595	7.13		30	21	15	11	17
950607	ENV92-1	RG 027	GW	950609	4350	6.42		100	100	100	100	6
950920	ENV92-1	RG 027	GW	950922	4670	6.86		100	100	100	100	7
950602	ENV92-2C	RG 028	GW	950606	4060	6.77		100	100	100	100	5
951019	ENV92-2C	RG 028	GW	951030	4330	7.53		100	100	100	95	4
950608	ENV92-3	RG 029	GW	950609	6880	6.52		100	100	100	100	9
951019	ENV92-3	RG 029	GW	951020	6380	6.95		100	100	59	29*	8
950606	ENV92--4A	RG 030	GW	950609	2040	6.3	6.74	100	100	100	100	<
950926	ENV92--4A	RG 030	GW	951006	2030	6.63	7	100	100	100	100	4
950602	ENV92-4B	RG 031	GW	950606	1713	7.28		100	100	100	100	14
951019	ENV92-4B	RG 031	GW	951020	1972	7.34		100	100	100	70*	1
950614	ENV92-6	RG 032	GW	950619	33300	7.38		100	100	100	100	2
951012	ENV92-6	RG 032	GW	951017	42300	7.31		100	100	100	100	24
951012	ENV92-6	RG 032-R	GW	951019	41500	7.67		100	100	100	100	N/A
950614	ENV92-6	RG 032D1	GW	950619	34800	6.44	7	100	100	100	100	2

C. Fordham/ J. Gulley

MUNIR JIVRAJ

SUNCOR GROUNDWATER STUDY

May - Oct '95

Sample	Sample		Project	Analysis				MTOX @ 15 MIN				
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	IC40	IC30	IC20	NAPHTHENIC ACID (PPM)****
950530	ENV92-8	RG 033	GW	950602	26900	6.73		100	100	100	100	15
950614	ENV92-8	RG 033	GW	950619	38000	6.46	7.5	100	100	71	41	24
950928	ENV92-8	RG 033	GW	951006	29000	7.54		100	100	100	100	17
950524	ENV92-9	RG 034	GW	950526	1224	7.76		100	92	47	24	46
950927	ENV92-9	RG 034	GW	951006	1226	8.2		100	100	70	31	54
950518	ENV92-10A	RG 035	GW	950523	1453	6.76		100	100	68	31	N/A
950518	ENV92-10A-R	RG 035	GW	950525	1350	6.85		100	100	100	55	28
951024	ENV92-10A	RG 035	GW	951030	N/A	N/A		100	100	100	57	30
950524	ENV92-10B	RG 036	GW	950526	1436	7.04		100	100	100	70	30
950612	ENV93-1	RG 037	GW	950615	7220	7.13		40	25	16	10	47
950526	ENV93-2A	RG 038	GW	950529	1422	6.98		100	100	100	100	31
950601	ENV93-3A	RG 040	GW	950602	1376	7.29		100	56	32	18	58
950601	ENV93-4	RG 042	GW	950602	1526	6.83		100	100	100	100	10
950605	ENV93-5	RG 043	GW	950607	1139	7.29		69	41	24	14	57
950518	ENV93-8	RG 046	GW	950523	3110	6.68		100	100	100	89	N/A
950928	ENV93-8	RG 046	GW	951006	2690	6.94		100	100	100	100	12
950518	ENV93-8-R	RG 046	GW	950525	2670	6.76		100	100	100	100	8
950605	ENV93-10A	RG 048	GW	950607	1257	7.05		100	100	100	100	29
950925	ENV93-10A	RG 048	GW	951006	1218	8.18		100	100	100	100	29
950605	ENV93-10B	RG 049	GW	950607	1156	7.34		54	34	21	13	53
950926	ENV93-10B	RG 049	GW	951006	1373	8.74	6.96	58	34	20	11	52
950518	ENV93-11A	RG 050	GW	950523	1458	7.24		100	100	100	42	31
950518	ENV93-11A-R	RG 050	GW	950525	1379	7.58		100	100	70	30	N/A
950530	ENV93-11B	RG 051	GW	950602	1461	7.61		57	36	22	14	67
950602	ENV93-11B	RG 051	GW	950606	1475	7.87		51	31	19	11	N/A
950605	ENV93-12	RG 052	GW	950607	1712	6.54		100	100	100	54	14
950616	ENV94-1	RG 053	GW	950619	1091	6.71		24	16	10	7	<3
951023	ENV94-1	RG 053	GW	951030	1325	7.15		90	61	41	28	8
950615	ENV94-2	RG 054	GW	950619	1547	7.06		100	100	100	100	10
951023	ENV94-2	RG 054	GW	951030	1387	7.75		100	100	100	100	9
950622	ENV94-3A	RG 055	GW	950623	2340	7.74		N/A	N/A	N/A	N/A	55
950518	ENV94-3B	RG 056	GW	950523	?	?		100	100	100	46	N/A
950927	ENV94-3B	RG 056	GW	951006	1192	7.11		100	100	100	100	26
950518	ENV94-3B-R	RG 056	GW	950525	994	6.72		100	100	100	65	23
950622	ENV94-5	RG 058	GW	950623	26300	6.71		100	100	100	100	24
951025	ENV94-5	RG 058	GW	951030	29600	7.84		100	100	100	83*	17
950607	ENV94-6	RG 059	GW	950609	2760	6.62		100	100	100	100	5
950925	ENV94-6	RG 059	GW	951006	3110	7.41		100	100	100	100	8
950606	ENV94-7	RG 060	GW	950609	6440	6.5		100	100	100	100	9
950925	ENV94-7	RG 060	GW	951006	7410	6.89		100	100	100	100	8
950621	ENV94-9A	RG 063	GW	950623	N/A	7.35		100	100	100	100	8
950620	ENV94-9B	RG 064	GW	950623	N/A	7.46		100	100	100	100	11
951003	ENV94-9B	RG 064	GW	951006	5760	7.66		100	100	100	100	7
950621	ENV94-10A	RG 065	GW	950623	N/A	7.16		100	100	100	100	3
951003	ENV94-10A	RG 065	GW	951006	9290	7.04		100	100	100	100	5
950621	ENV94-10B	RG 066	GW	950623	4730	6.8		100	100	100	100	4
951003	ENV94-10B	RG 066	GW	951006	5040	7.13		100	100	100	100	7
950621	ENV94-11	RG 067	GW	950623	3360	6.4	6.93	100	100	100	100	6
951003	ENV94-11	RG 067	GW	951006	3180	6.72	7.01	100	100	100	100	[illegible]

Sample	Sample		Project	Analysis				MTOX @ 15 MIN				
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC60	IC40	IC30	IC20	NAPHTHENI ACID (PPM)**
950619	ENV94-12	RG 068	GW	950621	3010	6.09	7.15	100	100	100	100	30
951004	ENV94-12	RG 068	GW	951006	2750	6.79	7.21	59	36	22	13	21
950619	ENV94-13	RG 069	GW	950621	1345	6.43	7.2	100	100	100	100	9
951004	ENV94-13	RG 069	GW	951006	2110	6.93		100	100	100	100	12
951004	ENV94-14	RG 070	GW	951006	2040	7.11		100	100	100	100	11
950621	L94-D8-33	RG 072	GW	950623	12660	6.93		100	100	100	100	34
951004	L94-D8-33	RG 072	GW	951006	15450	7.28		100	100	100	54*	38
951017	L94-D8-30A	RG 072?	GW	951020	17670	7.61		100	100	100	69	32
951026	L94-D8-31	N/A	GW	951030	1584	7.51		100	100	100	41	34
950608	RIVER S.	RG 073	GW	950609	249	7.85		100	100	100	94	<2
951024	RIVER S.	RG 073	GW	951030	306	8.28		100	100	100	100	<1
950608	RIVER M.	RG 074	GW	950609	241	7.85		100	100	100	100	<2
951024	RIVER M.	RG 074	GW	951030	290	8.15		100	100	100	100	<1
950608	RIVER N.	RG 075	GW	950609	240	7.87		100	100	100	100	<1
951024	RIVER N.	RG 075	GW	951030	299	8.24		100	100	100	100	<2
950525	POND-1	RG 076	GW	950526	1452	8.28		39	24	15	9	82
951016	POND-1	RG 076	GW	951020	1168	8.32		14	9	5	3	76
950525	POND-1A	RG 077	GW	950526	1414	8.1		32	21	13	8	84
951016	POND-1A	RG 077	GW	951020	1267	8.26		37	23	14	9	95
950613	POND 2/3	RG 078	GW	950615	1405	7.84		40	25	16	10	86
951016	POND 2/3	RG 078	GW	951020	1192	8.32		34	21	13	8	92
950613	POND 4	RG 079	GW	950615	1418	8.02		25	16	11	7	86
951017	POND 4	RG 079	GW	951020	1502	8.35		31	19	12	8	90
950613	POND 5	RG 080	GW	950615	1541	8.14		100	79	49	31	43
951018	POND 5	RG 080	GW	951030	2170	8.55	8.16	100	100	100	67	35
950524	COKE-DRAIN	RG 081	GW	950526	4210	6.88		100	100	100	100	11
951012	COKE-DRAIN	RG 081	GW	951017	3570	7.23		100	100	100	100	9
951012	COKE-DRAIN	RG 081	GW	951019	3560	7.77		100	100	100	100	9
950525	TID-DITCH	RG 082	GW	950526	1241	7.48		70	40	23	13	48
951018	TID-DITCH	RG 082	GW	951020	1412	7.52		26	17	11	7	49
950518	TID-DRAIN	RG 083	GW	950523	1356	7.79		41	26	16	10	57
950928	TID-DRAIN	RG 083	GW	951006	1396	8.09		49	31	20	13	68
950523	TID-DRAIN-R	RG 083	GW	950525	1340	7.82		100	100	100	42	N/A
950518	FROG LAKE	RG 084	GW	950523	792	6.88		100	100	100	100	<3
951018	FROG LAKE	RG 084	GW	951030	710	8.65	8.5	100	100	100	100	<3
950518	MILD AQUIFIR	RG 085	GW	950523	482	7.08		100	100	100	100	<1
951018	MILD AQUIFIR	RG 085	GW	951020	444	7.54		100	100	100	100	<1
951017	SPECIAL	RG 086	GW	951020	670	6.8		100	100	100	100	<1
951011	SPECIAL	RG 087	GW	951017	190	7.98		100	100	100	100	<1
951012	-	RG 088	GW	951017	1736	7.76		54	34	21	13	74
951011	-	RG 089	GW	951017	1875	8.23		100	62	34	19	63
951011	-	RG 089-R	GW	951019	1843	8.32		100	53	27	13	-
951025	N/A	RG 090	GW	951030	1531	7.44		100	100	100	100	29
951025	N/A	RG 091	GW	951030	1293	7.02		100	71	45	28*	6
951017	-	RG 092	GW	951020	40400	7.04		9	7	5	3	31
950915	N/A	RO-1	GW	950918	6	7.2		100	100	100	100	<1
950710	N/A	RO-2	GW	950712	53	7.2		100	100	100	100	<2

ample	Sample		Project	Analysis				MTOX @ 15 MIN				
Date	SUNCOR ID	EIA ID	Name	Date	COND.	pH AS REC.	pH ADJ.	IC50	IC40	IC30	IC20	NAPHTHENIC ACID (PPM)****

SPECT DATA POINT(S). ****50 g of sample was utilized for extraction and was then concentrated with 8 g of Methlene Chloride.

ESULTS NOT AVAILABLE

OTES:

ases the Microtox Analysis shows acute toxicity while the Nephthenic acid concentration is low.
e of the reason for this anomaly is amount of iron in the sample. Apparently, the bacteria in the Microtox analysis is affected by large (iron)

THE UNIVERSITY OF CALGARY
2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4

Faculty of SCIENCE
Department of PHYSICS AND ASTRONOMY

Telephone (403) 220-5385
Facsimile (403) 289-3331
Telex 03-821545

TO: Mr. D. Thompson

FROM: Dr. H.R. Krouse

FAX # OF RECEIVER: 274-5349

CITY/TOWN: Calgary

NUMBER OF PAGES: 2

COUNTRY:

DATE: Dec. 7, 1995

File:
PA 2779.204
PA 2705.204

Results of Stable Isotope Analyses on water samples for Suncor & Steepbank Mine Areas. (^{18}O & Deuterium)

SAMPLE	DEL D	DEL O18(H_2O)
Suncor 3214-1BA (15:00,Sept.12/95)	-164.5	-20.67
Suncor 3273-8-BA(11:45,Sept.13/95	-155.4	-20.37
Suncor RG006 (14:20,Sept.25/95)	-150.9	-19.03
Suncor RG010 (14:25,Sept.20/95	-137.5	-16.89
Suncor RG009 (13:40,Sept.20/95	-146	-18.75
Suncor 6-BA (Sept.15/95) R/NC-1	-169.3	-22.22
Suncor OB#2 (15:10,Sept.13/95)R/NC-2	-153.8	-20.35
Suncor 3273-3-BA(15:45,Sept.13/95)R/NC-3	-161.6	-20.82
Suncor 3274-2-2DI(11:15,Sept.14/95)R/NC-4	-154.9	-20.65
Suncor 3274-OB-5(15:40,Sept.14/95)R/NC-5	-149.2	-19.97
Suncor 3214 OB-4(15:40,Sept.12/95)R/NC-6	-137.4	-18.13
Suncor 3214-OB-3(14:15,Sept.12/95)R/NC-7	-145.2	-18.9
Suncor 3214-OB-1(14:30,Sept.12/95)R/NC-8	-149.3	-19.99
Suncor 3274-2-L(11:00,Sept.14/95)R/NC-9	-158	-20.81
Suncor 3273-BRDG-4(11:45,Sept.13/95)R/NC-10	-137.4	-18.32
Suncor 3274-=13-BA(16:15,Sept.14/95)R/NC-12	-165.3	-21.91
Suncor 3595-RG066(9:40,)Oct.3/95)R/NC-9	-134	-17.42
Suncor 3861-RG026(9:40,Oct.18/95)R/NC-18	-137	-16.91
Suncor 3861-RG02601(10:11,Oct.18/95)Routine	-137.8	-17.03
R20 Steepbeak R	-131.9	-17.56
R21 Ref. Wetland	-128.9	-15.66
Golder Assoc. AW018-C001(Saline Lake)	-122.6	-14.5